IN THIS CHAPTER

- Meeting hams around the world
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- Making contact via ham radio
- Contributing to science with ham radio

Chapter 1
Getting Acquainted with Ham Radio

Ham radio invokes a wide range of visions. Ham radio operators (or *hams)* are a varied lot — from go-getter emergency communicators and radiosport competitors to casual chatters to workshop tinkerers. Everyone has a place, and you do too.

Hams employ all sorts of radios and antennas using a wide variety of signals to communicate with other hams across town and around the world. They use ham radio for personal enjoyment, for keeping in touch with friends and family, for public service, and for experimenting with radios and radio equipment. They communicate by using microphones, computers, cameras, lasers, Morse keys, and even their own satellites.

Hams meet on the air, online, and in person, in groups devoted to every conceivable purpose. Hams run special flea markets and host conventions large and small. Some hams are as young as 6 years old; others are centenarians. Some have a technical background, but most do not; it's not necessary to enjoy ham radio. One thing that all these diverse people share, however, is an interest in radio that can express itself in many ways.

This chapter gives you an overview of the world of ham radio and shows you how to become part of it.

HAM: NOT JUST FOR SANDWICHES ANYMORE

Everyone wants to know the meaning of the word *ham,* but as with many slang words, the origin is murky. Theories abound, ranging from the initials of an early radio club's operators to the use of a meat tin as a natural sound amplifier. Of the many possibilities, the following theory seems to be the most believable.

"*Ham:* a poor operator" was used in telegraphy even before radio. The first wireless operators were landline telegraphers who brought with them their language and the traditions of their much older profession. Government stations, ships, coastal stations, and the increasingly numerous amateur operators all competed for signal supremacy in one another's receivers. Many of the amateur stations were very powerful and could effectively jam all the other operators in the area. When this logjam happened, frustrated commercial operators would send the message "THOSE HAMS ARE JAMMING YOU." Amateurs, possibly unfamiliar with the real meaning of the term, picked it up and wore it with pride. As the years advanced, the original meaning completely disappeared.

Exploring Ham Radio around the World

Although the United States has a large population of hams, the amateur population in Europe is growing by leaps and bounds, and Japan has an even larger amateur population. With more than 3 million hams worldwide, very few countries are without an amateur (see the nearby sidebar "Where the hams are"). Ham radio is alive and well around the world. Listen to the ham radio frequency bands on a busy weekend and you'll see what I mean!

Hams are required to have licenses, no matter where they operate. (I cover all things licensing in Part 2 of this book.) The international agency that manages radio activity is the International Telecommunication Union (ITU; `www.itu.int/en`). Each member country is required to have its own government agency in charge of licensing inside its borders. In the United States, hams are part of the Amateur Radio Service (`www.fcc.gov/wireless/bureau-divisions/mobility-division/amateur-radio-service`), which is regulated and licensed by the Federal Communications Commission (FCC). Outside the United States, amateur radio is governed by similar rules and regulations.

REMEMBER

Amateur radio licenses in America are granted by the FCC, but the licensing exams are administered by other hams acting as volunteer examiners (VEs). (I discuss VEs in detail in Chapter 4.) Classes and testing programs are often available through local clubs (see the section "Clubs and online groups," later in this chapter).

WHERE THE HAMS ARE

The International Amateur Radio Union (IARU; www.iaru.org) counts about 160 countries with a national radio society. Counting all the hams in all those countries is difficult, because in some countries, amateur stations and operators have separate licenses. The United States alone had more than 760,000 hams as of 2020 — the most ever. You may not be surprised to hear that China has the fastest-growing amateur population; Thailand and India aren't far behind.

Because radio signals know no boundaries, hams have always been in touch across political borders. Even during the Cold War, U.S. and Soviet hams made regular contact, fostering long personal friendships and international goodwill. Although the Internet makes global communications easy, chatting over the airwaves with someone in another country or participating in a planet-wide competition is exciting and creates a unique personal connection.

Since the adoption of international licensing regulations, hams have operated in many countries with minimal paperwork. For example, CEPT, the international treaty that enables countries to recognize one another's amateur licenses, allows hams licensed in their home countries to operate within any other CEPT country. The ARRL provides a lot of useful material about international operating at www.arrl.org/international-regulatory.

Tuning into Ham Radio

Your interest in ham radio may be technical, you may want to use ham radio for public service or personal communications, or you may just want to join the fun. These are all perfectly valid reasons for getting a ham radio license.

THE RADIO IN YOUR POCKET

You already use a radio to transmit all the time, although you probably don't think of it that way. Your mobile phone is actually a very sophisticated, low-power portable radio! You don't have to have a license to use it, of course; the phone company takes care of that. Nevertheless, your phone is really a radio, transmitting and receiving radio waves that are very similar to some of the radio waves that hams use. As you find out more about ham radio, you'll also find out more about radio waves in general, and you'll begin to look at your mobile phone in a whole new light.

Using electronics and technology

Ham radio lets you work closely with electronics and technology (see Chapter 2). Transmitting and receiving radio signals can be as much of an electronics-intensive endeavor as you like. By digging into the technology of ham radio, you're gaining experience with everything from basic electronics to cutting-edge wireless techniques. Everything from analog electronics to the latest in digital signal processing and computing technology is applied in ham radio. Whatever part of electronic and computing technology you enjoy most, it's all used in ham radio somewhere . . . and sometimes, all at the same time!

In this section, I give you a quick look at what you can do with technology.


REMEMBER

You don't have to know everything that there is to know. I've been a ham for almost 50 years, and I've never met anyone who's an expert on everything. A ham radio license is a license to learn!

Design and build

Just as an audiophile might, you can design and build your own equipment or assemble a station from factory-built components. All the components you need are widely available. Some of the original do-it-yourself (DIY) makers, hams delight in *homebrewing,* helping one another build and maintain stations. In software-defined radio (SDR) equipment, computer code is the new component, and I encourage you to experiment as much as you wish.

Experiment with radio waves

Besides being students of equipment and computers, hams are students of *propagation,* which is the means by which radio signals bounce around from place to place. Hams take an interest in solar cycles and sunspots and in the ways they affect the Earth's *ionosphere,* that uppermost region of the atmosphere that reflects shortwave radio signals back to Earth. For hams, weather takes on new importance, too — microwave radio signals can travel long distances along storm fronts or reflect from rain or snow.

Create your own antennas

Antenna experimentation and computer modeling is a hotbed of activity in ham radio. New designs are created every day, and hams have contributed many advances and refinements to the antenna designer's art. Antenna systems range from small patches of printed circuit-board material to multiple towers festooned with large rotating arrays. All you need to start growing your own antenna farm are some wire or tubing, a feed line, and some basic tools. I give you the full picture in Chapter 12.

Invent networks and signals

You can write software to create brand-new types of signals. Hams also develop systems that are novel hybrids of radio and the Internet. Hams developed packet radio, for example, by adapting data communication protocols used in computer networks to operate over amateur radio links. Packet radio is now part of many commercial applications, including your mobile phone.

The combination of GPS technology with the web and amateur mobile radios resulted in the Automatic Packet Reporting System (APRS), which is now used around the world. For more information about these neat systems, see Parts 3 and 4 of this book.

Code yourself a radio

Modern radios are based on software-defined radio (SDR) technology, which allows the radio to adapt to new conditions or perform new functions, as I discuss in Part 4. Hams using design tools like *GNU Radio* (`www.gnuradio.org`) can experiment with all sorts of techniques to improve and customize their equipment. Digital signal processing (DSP) is a big part of ham radio and has created some very innovative designs, such as the FlexRadio Systems Maestro operating console shown in Figure 1-1.

FIGURE 1-1: The FlexRadio Systems Maestro combines traditional operating controls with the latest in software defined radio (SDR) design and display techniques.

Digitize your radio

Voice communication is still the most popular way that hams use to talk to one another, but computer-based digital operation is gaining fast. New modes (methods of communication) enable world-wide contacts without requiring high power signals. The most common home station today is a combination of computer and radio. Hams also repurpose commercial network equipment to create their own microwave data networks.

Operate wherever you are

You can operate a remote-controlled station via a tablet or phone from anywhere in the world. All it takes is access to the Internet and some hosting software at the station. Most new radios are designed to support operation over an Internet connection. You can operate your home station while you're away or, if you can't have a station at home, use the Internet to access a station and keep on having fun!

Enhance other hobbies

Hams use radio technology in support of hobbies such as flying drones, model rocketry, and high-altitude ballooning. Hams have special frequencies for radio-controlled (R/C) model operation in their "6 meter" band, away from the crowded unlicensed R/C frequencies. Miniature ham radio video transmitters (described in Chapter 11) can beam back pictures and location information from robots, model craft, or portable stations carried by operators. Ham radio data links are also used in support of astronomy, aviation, auto racing and rallies, and many other pastimes.

Joining the ham radio community

Hams like to meet in person and online as well as on the radio. This section discusses a few ways to get involved.

Clubs and online groups

Participating in at least one radio club or group is part of nearly every ham's life. In fact, in some countries, you're required to be a member of a club before you can even get a license. There are hundreds of online groups with a variety of interests in ham radio, ranging from hiking to public service to technical specialties.

TIP

Chapter 3 shows you how to find and participate in ham radio groups, which are great sources of information, training, and assistance for new hams.

THE HAM RADIO BUSINESS CARD

A ham radio tradition is to exchange postcards called *QSLs* (ham shorthand for *received and understood*) with their call signs, information about their stations, and (often) colorful graphics or photos. If you are a stamp collector, you can exchange QSLs directly with the other station. There are online equivalents, too. Whether you prefer paper or electronic form, your QSL is your "ham radio business card" just like Ria N2RJ's in the figure below. You can find more sample QSL cards and information about the practice of QSLing in Chapter 14.

Hamfests and conventions

Two other popular types of gatherings are hamfests and conventions. The traditional *hamfest* is a ham radio flea market where hams bring their electronic treasures for sale or trade. Today's hamfests often include training or instruction opportunities along with commercial vendors for a complete "one-stop shop." Some hamfests are small get-togethers held in parking lots on Saturday mornings; others attract thousands of hams from all over the world and last for days, an in-person complement to eBay and Amazon.

Hams also hold conventions with a variety of themes, ranging from public service to DX (see "Radiosport — Competing with Ham Radio," later in this chapter) to technical interests. An increasingly popular feature is the all-day "university"

format focused on a certain type of operating, a technical specialty, operating training — or all three combined!

Hams travel all over the world to attend conventions where they might meet friends formerly known only as voices and call signs over the radio. There is no better way to enjoy travel than being assisted by local hospitality!

Emergency teams

Hams don't need a lot of infrastructure to communicate. As a result, they bounce back quickly when a natural disaster or other emergency makes communications over normal channels impossible. Hams organize as local and regional teams that practice responding to a variety of emergency needs. They support relief organizations such as the American Red Cross and the Salvation Army, as well as police and fire departments.

TIP

Summer and fall are hurricane and wildfire seasons in North America so ham emergency teams gear up for these potentially devastating events. Hams staff an amateur station at the National Hurricane Center in Florida (w4ehw.fiu.edu) and keep The Hurricane Watch Net (an on-the-air response group) busy on 14.325 MHz (`www.hwn.org`) when storms are active. During wildfire season, hams deploy in support of fire crews across the West. They staff camp communications and set up radio gear in the field, often in remote and difficult locations. Many hams also act as NOAA SKYWARN (`www.weather.gov/skywarn`) severe weather spotters in their local communities, assisting the National Weather Service.

After disasters of all types, hams are some of the first volunteers to help out, on the job providing communications at emergency operations centers and in the field. Hams trained as emergency response teams help government agencies by handling health-and-welfare messages, performing damage assessments, and providing point-to-point communications until normal systems come back to life. Ham radio also provides the hams themselves with personal communications in and out of the affected area. To find out more about providing emergency communications and public service, see Chapter 10.

Community events

Hams provide assistance for more than just emergencies. Wherever you find a parade, festival, marathon, or other opportunity to provide communications services, you may find ham radio operators helping out. In fact, volunteering for community events is great training for emergencies!

FIELD DAY — HAM RADIO'S OPEN HOUSE

On the last full weekend of June, hams across the United States engage in an annual emergency-operations exercise called Field Day, which allows hams to practice operating away from their regular stations. You can find Field Day setups in parks, at schools, near athletics venues, even in fields! An amateur emergency team or station probably operates in your town or county; go visit them! The American Radio Relay League (ARRL), the national association for amateur radio, provides a Field Day Station Locator web page (`www.arrl.org/field-day-locator`) that shows you how to find the team or station nearest you.

Radiosport — Competing with Ham Radio

Just like playing a sport or exercising, hams like engaging in challenging activities to build their skills and station capabilities. Called *radiosport*, these encourage continuous improvement of both the operator and the station. Competition provides training and that pays off for public service or in emergencies! Here are a few of the most popular radiosport activities:

- **DX:** In the world of ham radio, *DX* stands for *distance,* and the allure of making contacts ever more distant from one's home station has always been part of ham radio. Hams compete on the shortwave bands to contact faraway stations and to log contacts with every country. They especially enjoy the thrill of contacting exotic locations, such as "DXpeditions" to uninhabited islands and remote territories. On higher frequencies, even the microwave bands, hams guide their signals along weather systems and ionospheric features, even bouncing signals off the moon, to make contacts far beyond the "radio horizon." When conditions are right and the band is full of faraway stations, succumbing to the lure of DX is easy.
- **Contests:** Contests are ham radio's version of a contact sport. The point is to make as many contacts as possible during the contest period— sometimes thousands — by exchanging short messages. These exchanges are related to the purpose of the contest: to contact a specific area, use a certain band, find a special station, or just contact the most stations.
- **Awards:** Thousands of awards are available for various operating accomplishments, such as contacting different countries or states. There are award programs for contacting islands, summits, parks and trails, counties — almost any type of station or location. Awards are great incentives for improving your station and your operating skills.

» **Special-event stations:** These temporary stations are on the air for a short time to commemorate or celebrate an event or location, often with a special or collectible call sign. Each December, for example, the Marconi Cape Cod Radio Club sets up a special temporary station at the location of Marconi's Wellfleet transatlantic operations. Find out more on the club's Facebook page, *KM1CC - Marconi Cape Cod Radio Club* (`www.facebook.com/KM1CC`).

If you enjoy the thrill of the chase and the feel of a good workout, go to Chapter 11 to find out more about all these activities.

Communicating through Ham Radio Contacts

If you were to tune a radio across the ham bands, what would you hear hams doing? They're talking to other hams, of course. These chats, called *contacts*, consist of everything from simple conversations to on-the-air meetings to contesting (discussed later in this chapter). I discuss contacts in depth in Chapter 8.

Though you make contacts for different purposes, most contacts follow the same structure:

1. You make a call to someone or respond to someone else's call by transmitting your call sign over the air.
2. You and the other operator exchange names, information about where you're located, and the quality of your signals for an understanding of conditions between your stations.
3. If the purpose of the contact is to chat, proceed to chat.

   You might talk about how you constructed your station, what you do for a living, your family, and your job, for example.

REMEMBER

A *call sign*, often shortened to just *call*, is a ham's "radio name." (The term *call letters* is only used by broadcast radio and TV stations.) Call signs have two parts; a *prefix* of letters and a number, such as KE7 or W5, and a *suffix*, which is all letters. The prefix tells you what country licensed the ham and the suffix tells you which ham it is. My call, NØAX, says "N" (so I'm American), "Ø" (so I was licensed in the tenth call district), and "AX" (that's me!). Chapter 7 covers call signs in detail.

Except for the fact that you and the other ham take turns transmitting, and except that this information is converted to radio waves that bounce off the ionosphere or are retransmitted by powerful relay stations, making a contact is just like

talking to someone you meet at a party or convention. You can hold the conversation by voice, by keyboard (using a computer connected to the radios), or by Morse code. The average contact satisfies a desire to meet another ham and see where your radio signal can be heard.

REMEMBER

A question that I'm frequently asked about ham radio is "How do you know where to tune for a certain station?" Usually, my answer is "You don't!" Ham radio operators don't have specific frequency assignments or channel numbers. This situation is a good news/bad news situation. The good news is that ham radio gives you unparalleled flexibility to make and maintain communications under continually changing circumstances. The bad news is that making contact with one specific station requires you to know when and on what frequency to call. As you see in Chapter 11, hams have found many ways to solve this problem, however; the result is an extraordinarily powerful and adaptive communications service.

Ragchews

By far the most common type of activity for hams is casual conversation, called *chewing the rag.* Such contacts are *ragchews.* Ragchews take place via voice or keyboards or Morse code across continents or across town. You don't have to know another ham to have a great ragchew; ham radio is a friendly hobby with little class snobbery or distinctions. Just make contact, and start talking! Find out more about ragchews in Chapters 8 and 9.

TIP

The origins of the word *ragchew* are fairly clear. The phrase *chewing the rag* was well known even in the late Middle Ages. *Chew* was slang for *talk,* and *rag,* derived from *fat,* was a reference to the tongue. Thus, people began to use *chewing the rag* to describe conversations, frequently those that took place during meals. Later, telegraph operators picked up that use, and hams picked it up from telegraphers. Because most of ham radio is in fact conversation, ragchewing has been part of radio since its earliest days.

Nets

Nets (an abbreviation of *networks*) are organized on-the-air meetings scheduled for hams who have a shared interest or purpose. Your club or public service team probably has a regular net on a weekly basis. These are great practice for new hams! Here are some of the types of nets you can find:

- **Public service:** Under normal circumstances, these nets meet for training and practice. When disasters or other emergencies strike, hams organize using these nets to provide crucial communications into and around the stricken

areas until normal services are restored. The nets are also used to provide non-emergency assistance to public events, like parades or foot races.

- **Technical specialties:** These nets are like radio call-in programs; stations call in with specific questions or problems. The net control station may help, but more frequently, one of the listening stations contributes the answer. Many technical-assistance nets are designed specifically to assist new hams.
- **Mobile and boating:** Hams operate while on the road or on the water, fresh or salt. They like to stay in touch during their travels and other hams like to contact them as they visit unusual locations. If there are mechanical problems, the station has a ready group of helpers. When there's no phone service or Internet, such as at sea or in remote locations, the net can relay messages and status reports.
- **Digital networks:**
  - *Messaging:* Ham radio was the original "text messaging" system and we're still pretty good at it! Not only do hams exchange messages directly between stations, they have built relay networks, such as APRS (discussed earlier in this chapter), D-RATS, WSPR, and many more.
  - *Email:* If you could listen to Internet systems make contact and exchange data, a "mailbox" station might be what they'd sound like. Mailbox stations monitor a single frequency all the time so that others can connect to it and send or retrieve messages via the ham radio Winlink system (`www.winlink.org`).
  - *High-speed data:* Hams share access to frequencies used by WiFi and similar services. By reprogramming common routers and other network equipment, hams have created their own high-speed networks, such as *HSMM-MESH* and the Amateur Radio Emergency Data Network (AREDN). The repurposed routers listen for other routers nearby and connect to them, forming an "ad hoc" network. These flexible network can also connect to the Internet and are a valuable public service tool, especially in remote areas without reliable mobile phone service.

Citizen Science and HamSCI

Hams have supported "real science" since the earliest days of wireless when *everyone* was an experimenter. One of the best examples is the series of "listening tests" conducted during the early 1920s, in which hams supplied many observations that helped establish the existence of the ionosphere. Amateur radio and science have gone hand-in-hand ever since. The ARRL publication *A History of QST*,

Volume 1: Amateur Radio Technology describes the 100-year story of collaboration between hams and scientists, discovering and inventing technologies at the foundation of our present-day wireless world. Ham radio is also a great activity for STEM (science, technology, engineering, and math) students in secondary or university-level education. The hands-on nature of ham radio makes the equations and graphs "real." Ham radio provides practical experience with all sorts of know-how that is offered by few other activities.

Today, there are opportunities for hams to participate in scientific research. These are just a few of the opportunities hams have to make real contributions:

- **High-altitude ballooning:** Student teams and individuals launch weather balloons with APRS equipment (described earlier in this chapter) to track the balloon position and altitude. Data and images are either transmitted back to the ground or stored on a memory card and recovered along with the balloon. Find out more about amateur high-altitude ballooning at `www.arhab.org`.
- **CubeSats:** Working with universities and government space programs, teams of students and researchers build micro-scale satellites (`www.cubesat.org`) that beam telemetry data from on-board experiments back to Earth. Some satellites also have simple repeater or translator stations on-board that hams can use for point-to-point communication.
- **Society of Amateur Radio Astronomers (SARA):** If keeping an eye on the sky sounds interesting, check out the SARA website (`radio–astronomy.org`). It can help you build your own equipment, find kits, or purchase preassembled gear.
- **WSPRnet:** A special digital protocol, WSPR was designed to make measurements of propagation using extremely low power. To collect the observations, WSPRnet was created (`wsprnet.org`) with stations reporting in world-wide, 24 hours a day. The data is used for modeling the ionosphere, examining the effect of solar activity, and making propagation predictions.

In August of 2017, the United States was treated to a coast-to-coast total solar eclipse. Hams realized this would have a big effect on the ionosphere as the solar shadow traveled west to east. Because the ionosphere reflects shortwave signals, those signals could be used to measure the effect of the eclipse. HamSCI (`www.hamsci.org`) was created to conduct the experiment, inviting hams to participate in a large-scale experiment to characterize the ionosphere's response to the eclipse and other open scientific questions. Hundreds of hams helped out by getting on the air during the Solar Eclipse QSO Party (SEQP — see Figure 1-2), a contest-like operating event designed to generate data for studying the eclipse.

FIGURE 1-2: Students from the New Jersey Institute of Technology club (K2MFF) operating during the eclipse.

[Ann Marie Rogalcheck-Frissell, KC2KRQ, photo]

The success of the SEQP both in the number of observations and their high quality, led the group to create today's forum for academic and other professional researchers to engage the ham radio community. Today's HamSCI features a wide range of researchers and interested amateurs. Check out the group's projects and events if you're interested in using ham radio to advance science — any interested person is welcome. And there's another total solar eclipse traversing the United States from south to north in 2024!