Remote Operating
for Amateur Radio

Ham Radio, the Internet and Remote Station Control

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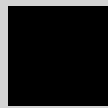
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Foreword

Once upon a time, almost every amateur had the ability to set up a station at his or her home with few, if any, complications. Neighborhoods seemed more tolerant of Amateur Radio antennas, especially before the days when homes were seen as investments rather than simply places to live.

But as our author, Steve Ford, WB8IMY, points out, times have changed. Now a growing number of amateurs are discovering that it has become extremely difficult, if not impossible, to set up home stations. Some home owner associations are banning ham antennas of any sort. Whole communities are attempting to pass ordinances restricting Amateur Radio antennas (the ARRL is opposing these efforts). And to make matters worse, neighborhoods are awash with consumer electronic devices that generate inference and seem overly susceptible to our signals.

Fortunately, the advent of high-speed Internet access has provided a possible solution. Hams who suffer from onerous restrictions can establish remote stations in "friendlier" areas and operate them by Internet remote control. That's what this book is all about.

If you're finding it difficult to enjoy ham radio because of restrictions where you live, *Remote Operating for Amateur Radio* is your guide to freedom. In this book you'll learn how to set up a remote station and operate it just as though you were sitting in front of the radio. You'll also become acquainted with the FCC rules that govern remote operating, as well as the rules that impact your pursuit of contests and awards.

No matter what your living circumstances may be, the full enjoyment of Amateur Radio is still as close as your nearest Internet connection.

David Sumner, K1ZZ
ARRL Executive Vice President
Newington, Connecticut
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The Case
for Internet
Remote Control

Forty-five years before this book was originally written, Bob Dylan released a song (and record album) titled *The Times They Are a-Changin'*. He was singing about social change back then, but the words have since been used to wax poetic about any situation in which large-scale change is taking place – political, cultural, technological, etc.

Amateurs have been witness to many technological changes over the decades. We've watched the evolution from "hollow state" vacuum tubes to solid state components. We have seen the steady progression of microprocessor technology as it shrank our transceivers while adding more features. We've seen Amateur Radio software evolve from crude *BASIC* logging programs to sophisticated digital signal processing.

Throughout history, however, there has been one constant: the Amateur Radio station. By "station" we might mean the traditional depiction of gleaming stacks of hardware in a cozy room with neatly dressed feed lines snaking away to giant outdoor antennas. Of course, a station can just as easily find its place in an automobile, boat or airplane. For many amateurs, a "station" may also be defined as the handheld transceiver they carry in their pockets.

But the times they are indeed a-changin, and for many reasons.

The amateur population is aging. At the time of this writing, the average ham was edging into his or her sixth decade on the planet; many amateurs are older still. Throughout most of their ham careers, the majority took pleasure in their home-based stations. Now, however, an increasing number find themselves "downsizing" their living arrangements, which can mean relocating to apartments or condominiums, or possibly moving to assisted-living environments. Unless they are lucky enough

Many new home developments are governed by Homeowner Associations. These groups tend to enforce strict rules concerning external structures such as Amateur Radio antennas. In fact, most associations prohibit *all* external antennas with the possible exceptions of small parabolic dishes for satellite TV reception. Association restrictions have become serious problems for residents who wish to enjoy Amateur Radio.

to be able to carry on with smaller stations and limited-space antennas, some of these individuals may discover that their enjoyment of Amateur Radio is at an end.

Because of the recent economic crisis, some younger hams have also found themselves "downsized" through job layoffs. These amateurs may have been homeowners, but now they face life as apartment dwellers. Although they may still own station equipment, they lack the necessary space for antennas.
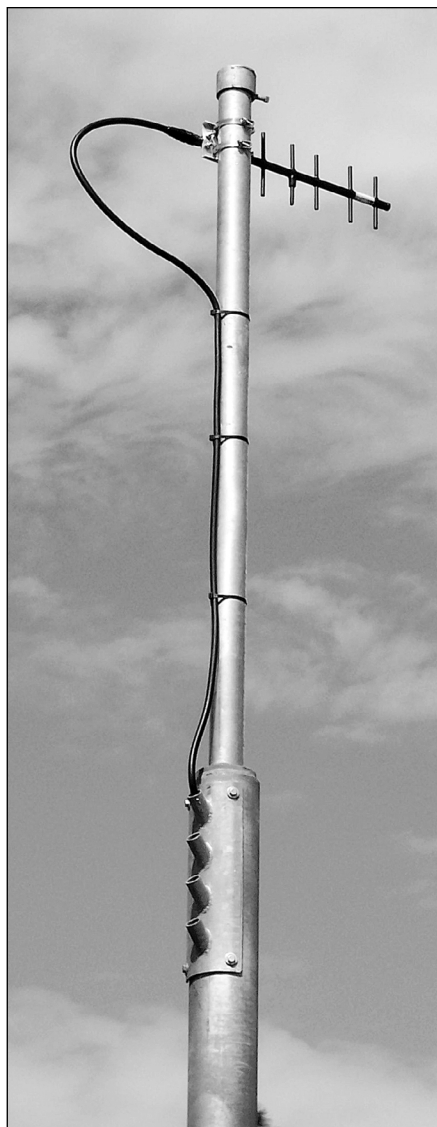
Those fortunate enough to keep their homes and jobs may be living in developments governed by Homeowner Associations that impose restrictions on outdoor antennas (as in *none permitted whatsoever*). These associations are becoming increasingly common.

Other amateurs may simply live on lots that are too small to allow the installation of full-sized antennas, or in homes that were built in exceptionally poor locations (like the budding VHF enthusiast who realizes that living at the bottom of a deep valley is a serious handicap).

If you're already laboring under severe antenna restrictions, even a small Yagi for RF remote control can become a liability. That's where the Internet has its greatest advantage – no antennas are required at the client location!

And then there are amateurs who discover that their home stations are useless because of electronic interference from nearby neighbors or power lines. Or perhaps *they* are the ones causing interference, to the point where they've had to curtail most of their Amateur Radio operating in order to keep the peace.

The Remote Solution

If it isn't possible to establish or operate a ham station in your home, the next best alternative is to set it up somewhere else and operate by remote control. This is not a new concept in Amateur Radio. Hams have been assembling remotely controlled stations for decades.

From the earliest days amateurs have experimented with wired remote control over relatively short distances. In the beginning these experiments consisted of stations controlled by elaborate systems using small electric motors to manipulate the transmitters and receivers. In more recent times the favored approach was RF control, primarily on UHF frequencies as required under FCC Rules at that time (the FCC has since expanded RF remote control to the 2-meter band).

RF remote control is still a viable option for some, but it is technically and legally complicated. For the RF link to function properly, you must have transceivers at both ends of the path along with all the necessary hardware to pass the commands (and audio) to and from the primary radio. The FCC requires that the control link transceivers automatically identify themselves at least every 10 minutes, which also requires dedicated circuitry to make this possible (Morse code identifiers at the very least).

Of course, the strongest objection to an RF link is the fact that it is limited in terms of usable distance. When you're restricted to exercising your control on VHF or UHF frequencies, there is a practical limit to how far the link radios can be from each other and still enjoy reliable signals. The greater the distance, the more power and antenna gain is needed at both ends of the RF path. Someone who already lives under severe antenna restrictions isn't going to be able to erect, say, a

long-boom UHF Yagi antenna to communicate with a distant remote station.

Fortunately, the relentless march of technology has provided a much easier solution for remote control – *the Internet*.

Thanks to the Internet, hams now have the ability to remotely operate any station at any distance – all without the complication and limitation of RF linking. The Internet links computers, which are themselves linked to modern transceivers, and it easily transfers large amounts of data between them – including data that carries digitized audio. This has created a boon in remote station control, making it possible for hams to continue enjoying their hobby regardless of where they live. Even local, state and federal communicators are connecting radios to the Internet and controlling them remotely. Among professionals this is known as *Radio over IP*, or RoIP.

One of the first amateur Internet remote stations was created in 2000 by Bob Arnold, N2JEU and Keith Lamonica, W7DXX. Their pioneering work started a revolution in remote station control that continues to this day. In fact, remote operating is growing in popularity, fueled by the fact that Internet access is now almost universal throughout the industrialized world.

And thanks to the popularity of the Internet, personal computers have become ubiquitous. Most homes have at least one laptop or desktop computer in residence. And how many "mobile" computing devices (netbooks, smart phones, etc) are in the market is anyone's guess. Suffice to say that it is a very large number!

How it Works – the Big Picture

The purpose of this book is to offer practical information that will help you assemble your own Internet-controlled Amateur Radio station. Maybe you have a well-equipped home station and you'd like to share your good fortune with some of your friends. Or, perhaps you are a ham living under onerous restrictions and you'd like to establish a remote station so that you can finally get on the air. Either way, a remote-controlled solution is definitely available. All it takes is a certain monetary investment (depending on how much hardware you already own) along with careful planning and a reasonable amount of perseverance.

But before we dive into specific details, let's look at the big picture. In fact, try looking at the picture in **Figure 1.1**.

The station you wish to control is known as the *host*. It's a host because it "hosts" all the gear necessary to transmit and receive RF signals.

If the remote station is the host, that makes the remote operators "guests," right? Well . . . no. In geek-speak, remote users are known as *clients*. Try to commit these terms to memory as they will appear often in this book.

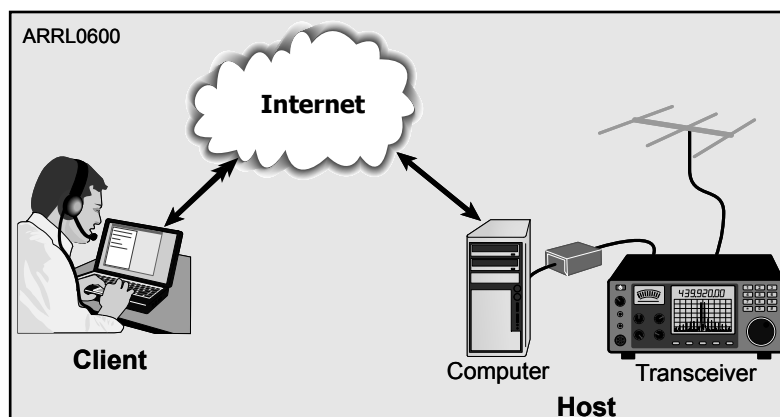At the risk of being overly simplistic, this is the shopping list for a host station:

Figure 1.1 – A simplified diagram illustrating Internet remote control of a distant Amateur Radio station.

◻A transceiver with a computer interface
◻A computer
◻Host software
◻An Internet connection

A client station typically includes:
◻A computer
◻A microphone/headset for voice operation and perhaps a CW key
◻Client software
◻An Internet connection

Host Transceivers and Interfaces

The host transceiver can be almost anything – HF, VHF or whatever. The only requirement is that it has the ability to "talk" to a computer and share it's transmit/receive keying and audio lines.

Fortunately, this capability is found in just about every transceiver manufactured within the last 10 years. Some transceivers offer direct computer interfacing through various ports. Once the transceiver and computer are communicating with each other, the computer can "poll" (query) the rig and obtain information such as the current frequency and band, IF filter selections, RF gain settings and much more. At the same time, the computer can send commands to the transceiver. It can "tell" the radio to switch to a new frequency or mode, increase or decrease output power and so on.

The transceiver control interface usually doesn't transport audio signals. Those are handled separately, typically through a *sound card interface* with cables going between the computer and the transceiver. You will also find devices on the market that combine transceiver control and sound card interfacing in a single package.

The Host Computer

The host computer doesn't have to be anything special or expensive. You're not asking it to store large files or display elaborate graphics. All it needs to do is communicate with the transceiver and the Internet, and run the host software. Technically speaking, the host computer doesn't even need a display monitor. No one at the host station will be looking at it, unless someone needs to access the computer to perform maintenance.

Most amateurs (about 95% at the time of this writing) run computers equipped with various flavors of the *Windows* operating system. Consequently, most host software is written for *Windows*. Be that as it may, you can just as easily use a *Mac OS* or *Linux* computer at the host station. There may even be some security advantages in doing so, which we'll discuss later.

Whichever operating system you choose, a host computer can be remarkably affordable. If you really want to shave costs, you can probably pick up a used desktop PC for a couple of hundred

The Tigertronics SignaLink is typical of the devices known as "sound card interfaces." It allows your computer to switch your transceiver between receive and transmit. It also provides isolation for the audio lines.