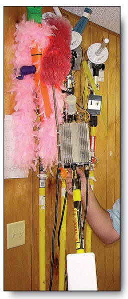

Figure 2.101 *Microwave on a stick. Along with the cameraman and talent, a third member of a roving camera squad would be a grip who points the microwave antenna at the top of the pole toward the microwave receiver. The microwave transmitter, the box with cooling fins (above the hand gripping the pole), takes audio and video in from the camera and feeds very high frequency RF to the antenna. The multicolored "feather dusters" and streamers on each pole allow the operators at the microwave receive sites to spot a particular camera down in the pits and point the receive antenna toward the camera's transmitter.*

Wireless

Diverse Sources

When technology had mastered the art of making RF transmitters and receivers small enough, power-efficient, and sophisticated in the ways of signal recovery, the use of wireless connectivity exploded. Talent could wander around with a mic and not be tethered to a VTR or a larger production facility. Microwave transmitters became small and lightweight enough to be installed in planes and helicopters. Not only could audio and video be delivered back to the truck, but control signals could also be sent out to the sources, along with data in both directions.

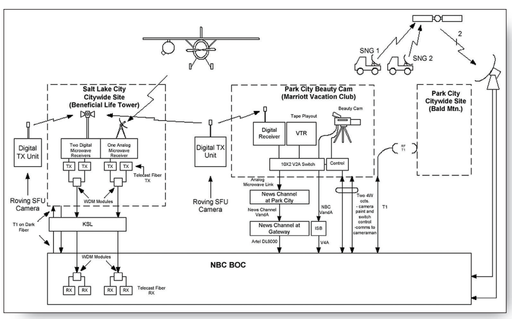

Figure 2.102 *Small part of the RF plan for the Salt Lake City Winter Olympics. RF linked roving cameras and talent, both on the ground and up in the air, via satellite and microwave. The signals were picked up by a number of diverse receive sites, which then forwarded them back to NBC's BOC. (Source: NBC)*

Figure 2.103 *High atop a racetrack's grandstands, a microwave "catcher," who keeps the microwave receivers pointed toward their respective microwave transmit pole (Figure 2.101). The globe hanging underneath the roof transmits program video back to the roving talent's video monitors.*

Figure 2.104 The RF effort is often large enough to be a remote in itself. As such, there are companies that specialize in providing those services. These "flight cases" are from Broadcast Sports Television (BST). Video from the "catcher" microwave receivers is fed into this office trailer where it can be monitored and distributed to the production trucks.

Being wireless requires RF spectrum, or bandwidth, which becomes more precious and harder to come by with each passing year. But as cameras and other electronics shrink in size, television remote production is sticking sources in mobile situations more and more often. Increasingly efficient use and coordination of use of the available spectrum will increase in importance. In these last two sections we've looked at lashing all the pieces and parts, via cable and RF spectrum, into a cohesive entity. Next we will look at the setup required to turn all of this into a television production system. ■

Figure 2.106 Here is a small part of the RF equipment used at the Indianapolis 500. At the bottom of the photo is one of the many wireless cameras that wandered the pit area. The box comprising the rear third of the camera, with the whip antenna, controlled camera operating parameters via telemetry received by the antenna. Behind the camera are a number of "talent packages" that included a wireless mic and IFB. Un-tethered, free-ranging cameras need power, so as we walk down the table past the mics we come to a pile of batteries that clip onto the back of the camera. At the far end are a slew of handheld radios in their chargers.

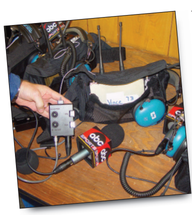

Figure 2.105 Here's the talent audio package for the Indianapolis 500. Microphone transmitter is at the right end of the fanny pack. Everything else in this package is for the reporter to receive directions, and hear program audio or racer radio traffic via a local handheld scanner. All that activity is facilitated by the BST box in the fanny pack. The toggle switch on the top of the control box being held allows the talent to remotely direct where their audio goes when it gets back to the compound: either to the audio mixer, or to a technician so they can request that adjustments be made to what they are hearing from the compound. This is accomplished via an embedded signal in the RF, which is decoded by equipment shown in Figure 2.104.

Wireless Mics

***Figure 2.107** "Bat ear" receive antennas for wireless mics. High quality wireless mics can have a range over 1000 feet. Often interference and reflections will limit that distance. The dilemma for this receive site, a cherry picker at a golf tournament, is that height increases the distance that can be between receiver and transmitter, but also increases the chance of interference. Most wireless systems are frequency agile over a band of frequencies. Wireless mics are always considered secondary users of any frequency they're on. This means that they can be interfered with, but can't interfere with primary users. When a remote production comes to town they often must contact the local "frequency coordinator," a member of SBE and usually a technician or engineering manager at a local television or radio station, to determine what frequencies are available. Wireless mics use frequencies throughout the VHF and UHF spectrum that aren't in use locally. Sometimes, if the topology of the remote is such that there are reflections, multiple antennas are used for a single wireless mic, which is known as receive "diversity." Reflections cause multiple paths from transmitter to receiver. Paths arriving at the same antenna, but having traveled different distances could arrive out of phase, thus canceling each other out. If antennas are placed apart from one another, statistically there's a much better chance of at least one antenna receiving a useable signal. Separation distance is based on the band of frequencies used, with higher frequencies allowing antennas to be placed closer together. These antennas are simply summed together in lower-end systems. High-end systems determine in the receiver which antenna's signal will be used.*

Figure 2.108 In-car cameras provided by BST. BST brings its own trailer, housing camera control and RF electronics, to the venue. The operators shown at top can pan and tilt the camera, and control camera attributes such as iris and black level, as well as "paint" the camera. These operators can also control what frequency each car's transmitter is using, and advance the clear screen in front of the camera lens that is continuously peppered with track debris. Each car, up to eight, transmits up to a helicopter that hovers overhead and relays the signal down to redundant receive antennas on top of the trailer (bottom center). The raised mast, also on top of the trailer (bottom left), is for telemetry between the trailer and the cars.

Figure 2.109 This BST flight case has IFB interfaces with the compound's IFB/intercom (top), which emanates from the main production truck. Program audio is also fed in and processed to the talent's preferences and handed off to the radios at the bottom.

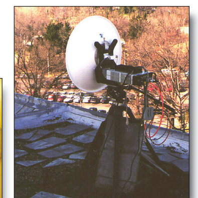

Figure 2.110 Today's microwave transmitter mounted directly on the back of a dish. (Source: Tim Stoffel)

Figure 2.111 UHF antennas used for audio, data or telemetry transmission and reception, like this one at Indianapolis, can be found scattered around large venues.

Figure 2.112 At this boat race in the late 1960s, it took a fair-sized truck to house a half dozen microwave transmitters and receivers. Each transmitter would occupy almost a full height rack (almost seven feet tall) and receivers about half a rack. The equipment was quite heavy and produced a large amount of heat.

Figure 2.113 *Flat-panel display that served as program monitor for the roving talent at the Indy 500 race. This display is part of a "roving" kit shown in Figures 2.101 and 2.103.*

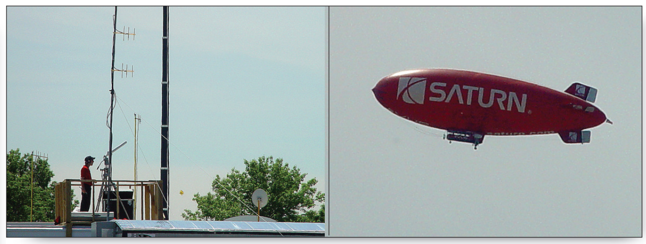

Figure 2.114 *A common sight above large events. The blimp usually has an omnidirectional antenna to transmit its camera signal back to the ground. The receive site on the ground often has a steerable antenna, this one under manual control.*

Figure 2.115 *Microwave "rod" type antennas. Inside the white protective cover are antennas that look like a series of large washers, separated by one-inch spacers. This arrangement has less gain than a dish (hence the two rods) but also much less wind resistance. These are often found on ENG trucks and under the belly of helicopters, where they have the nickname of "launchers" because of their missilelike appearance. If mounted on a helicopter, there are usually two sets — one set points forward and the other aft. That means that the helicopter will either have to be flying towards or away from the receive site to establish a link, but the gain is much higher than an omnidirectional antenna; thus the path can be much longer with these. (Source: Tim Stoffel)*