CHAPTER ONE

1.1 Changing Communications Needs

Antenna sites have been around for over seventy-five (75) years. In the early days, AM radio stations required many acres of land to install multi-element vertical and sometimes guyed towers. With the introduction of FM radio and television, *hill top* locations were employed because of the *line-of-sight* characteristics common to this broadcasting mode. Cellular telephone and PCS services require another antenna configuration still. In fact the development of personal communication technology has changed just about everything previously accepted as being typical for an antenna site.

Monopoles dot the horizon along major highways. Buildings in every metropolitan area are crowned with increasingly familiar side mounted directional antenna structures. These systems provide the expanding infrastructure for the personal communication industry. When cellular service first came on the air, two systems, (the "A" and "B" system) were authorized for each definable population center. The "B" system was to be operated solely by a *wire-line* telephone company (or partnership), while the "A" system could only be operated by a company or association not having telephone industry interests whatsoever. The "A" system generally wound up being a combination or joint venture of several competing non-wire-line applicants.

Fig 1.1
Building with a Cellular Antenna "crown"

This competitive *two-system* requirement by the Federal Communications Commission (FCC) was thought to be necessary because of the high investment capital needed and to insure that cellular service would not be so outrageously expensive so as to keep it out of the hands of the general public. The first systems came on line in the early 1980's. Shortly thereafter the rush was on to get not only the top 30, 60 and 90 cities on the air, but all the areas in between. This *build-out* process involved the need for reliable service along with the ability to serve an ever

increasing number of users. In both cases these factors, expanding territories and increased demand within a given area, have driven the need for additional antenna sites up to the present. Now with the introduction of new services the process is starting all over again.

Coverage problems emerged very quickly. Reliable service in tunnels, under bridges or in below-ground parking facilities had to be provided. It is not uncommon for a typical cellular system to be operating in excess of one hundred antenna locations with as high as 30% of the them dedicated solely to solving specific coverage problems. The key to good coverage is also the ability for a mobile unit to pass from one radio coverage area to another without service interruption. This process is called a *hand off* (the computer transferring of call from one cell site to the next).

1.2 The Impact Of The "No-holes" Vehicle Antenna

Most initial cellular systems were designed to use an automobile installed mobile unit or car phone. These units were comparatively large, were marketed by many manufactures, and contained attractive features such as automatic dialing, *hands free*, message taking and horn alert to name a few. The advantage of the mobile unit was that the highest permissible power could be utilized enabling greater range if the antenna was attached outside of the vehicle clear of obstruction. The vehicle electrical system provided for unlimited use. Permanently mounted antennas on vehicles are a common practice for police and fire vehicles. But it soon became apparent that this was not to be the case with the emerging cellular subscriber. Cellular installers argued until they were blue in the face the advantages of the roof top mounted car antenna. It clearly does provide superior cellular service, range and clarity. But the arguments for the most part fell upon deaf ears. As a result, alternatives were introduced such as the *magnetic mount*, the *trunk lid mount* and a new concept in antenna systems, the *stick-on, no-hole* or *thru glass* antenna.

This glass mounted antenna was the brilliant idea of a reputable antenna company and became an overnight standard in the industry. But the process of coupling RF radio energy through a car window glass (especially if tinted) introduced power loss. In fact about 30 to 50% of the power of a typical mobile unit is lost in the process. It was argued that

this problem would require cellular companies to add additional tower locations to make up for the shorter range encountered. In reality other factors required additional antenna sites including the technical problem introduced by the no holes antenna. The disadvantages encountered with the wide spread use of these antennas actually paved way for another unexpected growth phenomenon, i.e. the low-powered portable unit.

Other objections to the mobile mounted telephone unit were obvious. It could only be used while in or near the vehicle. Peak periods during morning and afternoon drive time reeked havoc upon system loading resulting in circuit busies and delays causing customer dissatisfaction. Off-peak periods of the day had little usage. So systems had to be constructed to accommodate the peak periods with lessor returns on the investment.

1.3 Portable Units Replace Mobile Units

As the technology and system coverages improved, manufacturers were busy developing the hand-held portable telephone. Even though cellular protocols were effectively open, manufacturers closely guarded their implementation techniques to miniaturize their products. Some of the developments have been astounding. What was sought was an "acceptable" size, weight and battery life. Some of the early versions of hand held units (referred to as "bricks" and closely approximating them) are downright funny to look at today.

Few of the early portable units (now referred to as "handsets") were used. But not for long. Surface mounted component technology, multilayer printed circuit boards and the development of specialized multi-function integrated circuits (IC's) coupled with creative plastic housings, and true innovations in battery technology quickly captured the preferences of mobile users to the point that today the portable is the unit of choice.

What is less obvious but very important to you as an antenna site owner is that the portable power level is almost five (5) times less then that of a functioning mobile unit. The significance of this reduced power level requires additional *cell splitting*, thus more antenna sites. But it is a win-win situation because with additional sites, the cellular companies can serve even greater numbers of subscribers using the same channels. The engine driving all this expansion is obviously the increasing subscriber base and the increased ease and convenience of obtaining revenue from usage that is no

longer dependant upon peak periods related to when users were in their vehicles.

1.4 What Happened To The Old IMTS?

In the early days the forerunner of cellular service was called Improved Mobile Telephone System, IMTS, a great name because many generations of improvements were made to the system over the years and the name never changed. IMTS and cellular existed side by side for a time but the real death for IMTS occurred when manufacturers stopped supporting IMTS products. There is a lesson to be learned here. Manufacturers will usually be the first to abandon a market which is not expanding. Attention to this practice can be a valuable prediction of what will be happening in the future.

Site Savvy

> Manufacturers will usually be the first to abandon a technology which is not expanding.

However, the frequencies used in the old IMTS service were not abandoned but reemerged when the Federal Communications Commission (FCC) assigned them for use in one-way paging applications. Many companies who saw their mobile subscriber base dwindling, now had a migration strategy to begin to develop one-way personal paging applications. New networks evolved which were being supported by a different product. Many old mobile service providers also became players or at least agents for the new cellular services. Only those who refused to accept the changes and adapt to them were hurt by the transition.

1.5 New Paging Services

The FCC wasn't finished with paging applications and about the same time released large blocks of new paging channels for licensing by existing and new telecommunications entrepreneurs. New offerings in the 931MHz. band were met with little initial enthusiasm. Not much product was in place to support the new service and there was much speculation that the very high operating frequency would result in serious coverage problems. It wasn't long until transmitters, antenna systems and paging units began to fill the needs of serious investors willing to construct systems in major

metropolitan areas. Today all kinds of products are available for both the operator and the paging user. Cellular type multiple site technology was adopted quickly by the paging industry when it was discovered that it was possible to simultaneously *turn on* several transmitters at the same time. *Simulcasting* pays close attention to the accuracy of the base station frequency of each channel and the phase and timing that audio and digital information has when it leaves the transmitters. If everything is adjusted properly, the rf signals which overlap can actually enhance coverage in an area. The build out of paging has also been accelerated drastically in the last several years with the (precarious?) use of satellite control, making the installation of a *fill-in* station as easy as finding a site, aiming a dish and plugging it in. A typical *fill-in* location usually requires an antenna site which may not particularly be in a great location. For example, you might own an apartment building at the bottom of a hill surrounded by even taller hills. The general area may represent a *knife edge shadow* problem for the paging company. Their signal, emanating from an adjacent hill, glances off the hill overlooking your location resulting in poor or distorted coverage below. Unless your location is right in the middle of a major metropolitan area, in which case it is highly likely the problem has already been solved by the paging company, you might be able to provide a useful and profitable solution to their coverage problem.

Many predicted that as cellular and PCS providers offered value added services such as voice mail, call transfer and numeric messaging etc. the paging industry would dry up and blow away. But paging subscribers continue to increase with no apparent reduction in new starts. Communication analysts and financial investors have been scratching their heads over this one. Perhaps it is the changing nature of paging service itself. First used for business applications, statistics now support a rapid shift to personal use as a whole new generation of teens and family members join the ranks of new subscribers.

Early voice pagers actually broadcast the original calling party's message. But paging companies quickly learned that a typical paging channel could only provide service to about three or four thousand voice subscribers before real time constraints choked the channel with traffic. Talk-time was gradually reduced to just a few seconds barely enough time to convey a telephone number before being disconnected. With increasing demand for units, a numeric technology was proposed which could accommodate roughly fifty to eighty thousand subscribers processed on a

single channel. None of this was possible until the rotary dial telephone was replaced by the *touch-tone* phone. With the move to numeric beepers, alphanumeric paging was not far behind. To encode a text page one either has to dictate the alpha-message to a dispatch operator who encodes it into the paging terminal or use a dedicated computer with special software. Pretty cumbersome at the time but the situation changed rapidly.

The transition from voice to numeric to alphanumeric is almost generational. Early users of real time voice paging preferred that service. New users never really had the opportunity to use voice and thus feel comfortable with numeric paging. Many early variations of numeric paging used two-digit number groups called *data codes* to represent brief text messages similar to *ten-codes* used by police departments. Now that the popularity of the personal computer, the on-line service, the Internet Service Provider (ISP) and of course *e-mail* has invaded the daily routines of most of us, it goes without saying that the linking of alphanumeric paging to e-mail was the next logical progression. *TSR Wireless* and others offer systems that instantly allow e-mail messages to be directed to a text pager as well as to the subscriber's regular on-line service. Also provided are news headlines, sports, weather and stock market data flashed instantly to the text pager on a routine basis. The alphanumeric pager is also capable of receiving numeric pages directly from touch dial phones as well.

I have a friend who has a very sophisticated cellular telephone unit with all the extras, a one hundred (100) number dialing directory, internal voice mail and a host of other value added services. Could it be that this product, even to a technically minded user, may be a bit formidable to use or remember how to use? Perhaps such products are too complicated and less desirable especially if you must add all those extra services to your monthly mobile telephone bill. Paging, on the other hand is very simple.

One paging consultant has predicted that the world paging market might exceed 200 million units early in the century. The impact of this expansion in popularity is more product, cheaper systems and a host of services offered both locally and globally. In other words, services are going to have to get better to survive. Providers who can not expand their systems are likely candidates for acquisition by providers who will. All this means to you is more antenna sites will be required. Product development is fueled by consumer demand and the selection of new pager products and features is staggering. Even the large manufacturers are contributing new

offerings constantly. One significant product release is the *Motorola RSVP* which provides a paging unit cleverly constructed into the battery of a *Motorola MicroTAC* pocket telephone. The pager does the usual numeric job with audio and vibrator alerting. The battery into which it is constructed provides energy for both the beeper and the portable. Truly a unique product which attests to the popularity of separate application services in a *bundled* world.

Technology also fuels changes in the way paging operations are accomplished. *SkyTel Corp.* has been developing a new paging data protocol making two-way paging practical. Initial efforts were met with a few technological challenges but the system is getting better with each new upgrade. An interesting twist to high speed digital transmission paging is the reintroduction of voice paging. This time the voice is digitized, compacted and transmitted digitally to the pager. Much faster than the old analogue method of transmission. Future paging fads might very well be voice service once again.

Other large companies are also providing messaging and acknowledgment services with a high degree of sophistication such as *RAM Mobile Data USA L.P.* and *Ardis*, a leftover venture from IBM's original nationwide maintenance system operating in the 450MHz. band. Systems are proposed, find favor then sometimes are overshadowed by competing technologies such as the *pACT, Personal Air Communications Technology* system derived from an Internet protocol and based upon CDPD technology. Competing with these protocols for two-way paging are many others such as *Motorola's FLEX, InFLEX and ReFLEX* systems. These methods will cost billions to deploy nationwide.

The players in this arena are definitely the "big boys" (see Appendix A) who have the muscle and the marketing base to forge effective nationwide one-way and two-way paging systems quickly and efficiently. When a system of this sophistication is deployed it typically follows the following phases:

1. Major metropolitan areas are first implemented using existing facilities (roof-tops) as much as possible to keep costs down.
2. Next, deployment is made along the major Interstate highways from one population center to another.
3. Finally, *build-out* is every area in between where a reasonable return can be expected with attention to enhancement and solving coverage problems.

Accordingly, it is only necessary to build a portion of a system in order to obtain a market presence and a positive cash flow. But the goal of *total area coverage* and reliability is close behind. If the product and service offerings are on the right track, system development then moves on to rural America picking up site after site until the marketing (coverage) map is "all one color" (showing reliable coverage). The concept of two-way paging in actuality is really *acknowledgment one-way paging*, i.e. the calling party knows the general location of the unit and is assured that the unit has in fact received the message. The real objective of this enhanced service is reliable page delivery. Another advantage of a transponder in a paging unit is that the system can locate the single transmitter to convey the page. Otherwise one must resort to broadcasting the page over the entire nationwide network in the hopes of signaling the unit. If the network can't find you, it saves your message until you show up somewhere and are ready to receive it. The advantage of this system is 100% reliable message delivery. *AT&T Wireless* has projected that about 2000 or more base stations would be necessary to complete a workable system on a nationwide basis. What is not projected but follows from past experience is that between five to ten *receive only* sites would be required to enable the extremely low-powered paging device to relay its acknowledgment. That would imply that for a nationwide system to operate effectively, roughly 20,000 receive sites might be needed. How many companies are going into two-way paging? At last count there were about six so unless these companies work together, we could speculate that over 100,000 receive sites would be needed in the next few years. Granted these sites will not be high quality high profile locations, but understanding what will be needed can assist your evaluation of what you have to offer.

Fig 1.5
A Motorola two-way paging unit

What about the demand for two-way paging? Recent studies have found that better than half of all paging users would like to know if their page has been delivered. There is no doubt that this statistic will drive the product and service offerings if the costs can remain competitive. What is equally significant is that many pager users, better than half of them, say that they always have to make a call back once a page has been received.

These statistics were very different two decades ago when voice paging provided an extended message. It is obvious if all you can do is place a phone number in a pager's memory you're going to have to call that number to get your message. In the old days a voice message might sound like this "Joe, your three o'clock appointment has been postponed until tomorrow at 10 A.M.". It is not really necessary to call back on that kind of message. So what separates the functionality of a two-way pager from a cellular or PCS telephone? Price!

PageNet (Paging Network Inc.) one of the largest nationwide paging companies with a substantial customer base for numeric paging is developing its *VoiceNow* service to provide an alternative to the call back statistic, i.e. more information on the first page. In addition, there is a host of ancillary services that paging subscribers love to love. *ESPNet* provides sports scores and sport news features as regular broadcasting services to existing subscribers. Even more interesting, several FM radio broadcasters are paging on their sub-carrier channels making the lines between the broadcasting service and paging services murkier still.

1.6 Other Communications Services

At the same time that the FCC was creating the cellular industry, another service was catching hold in the 800MHz. band. It was initially referred to as *SMR*, Specialized Mobile Radio but now it is known as *ESMR,*, Enhanced Specialized Mobile Radio. This service uses multiple and trunked radio channels in a manor similar to cellular technology. Blocks of channels were granted for this service to be used primarily for fleet mobile and dispatched mobile applications. Struggling for standards and inter-connectivity, individual system operators hastened to develop dispatch services using telephone interconnection on a secondary basis. The service application was primarily for service or transport vehicles that require a dispatcher to tell them what to do and where to go. There are a lot of packages that need to be picked up or delivered and lots of plumbers, contractors and electricians that need day to day coordination with an office dispatcher. Although it would appear that these applications could be served by cellular telephone systems, SMR's usually invoice by the unit not by the minute. Smaller companies were likely to use cellular services but larger operations found SMR services far more economical. In recent years the basic dispatch aspect of SMR systems have been marked with some truly remarkable technological improvements, resulting in the blurring

of the lines between SMR and Cellular operations. *Nextel Communications* leads the way in this endeavor with some truly creative services and are giving cellular and PCS services a run for their money. It is not uncommon, in any part of the country for former cellular mobile subscribers to be using SMR services to great economic advantage.

TV cable companies with broadband facilities are also in a unique position to provide wireless site services. But this potential has fallen short of expectations. Having an exclusive franchised territory (which is now being challenged by the Direct Satellite Service DSS providers) cable companies have a unique advantage of having a lot of cable hanging on poles, all connected to boxes which have power to them. With a minimum of special equipment it would be a short path to small antennas hanging from poles and attached to micro power bases stations, called *CMI's* or Cable Microcell Integrators. Networking their unique coverage footprint, cable companies are in an excellent position to exploit their embedded base and to provide Personal Communications Services (PCS). The bandwidth that most cable companies have going into buildings and residences is staggering when compared to just a telephone line. But all is not that easy however, as most cable systems are one-way and additional equipment would have to be provided to establish a two-way path to process PCS communication. And of course cable service is not provided to everybody. As exciting as this technological option appears to be, with its potential to make every telephone pole an antenna site, few cable companies have applied for PCS licenses. The primary advantage of cable operators in the PCS build out is that an area could be covered quickly and with much less capital compared to constructing tower sites. But the bottom line is the industry does not seem to want to wait around for cable companies to position themselves to provide the coverage which is needed. But don't feel sorry for the cable companies. They have a lot more service offerings in the wings such as providing basic telephone service, Internet access, high definition TV and home security monitoring along with their ever increasing subscription fees for basic television channels. We don't want them in the antenna site business anyway.

1.7 Services At 220 MHz.

In 1992, the FCC started accepting applications to be issued by lottery (now they use auctions) for several new service offerings and in particular one in the 220MHz. band. During this period "license mills"

emerged using TV *infomercials* on non-prime time television touting get rich quick telecommunications opportunities. Many individuals who had little or no telecommunications experience invested in these applications in the hopes of "cashing in on the burgeoning telecommunications industry". The FCC indicated that there would be about 6000 licenses available for granting with over 4000 issued. It was envisioned by existing communications providers that this new service could have the potential of causing "destructive competition" a concept which the FCC rarely entertains much today like it used to.

Characteristic with any new service offering, are protests and entanglements. Issues were introduced which required clarification and resolution. The result of all these complaints and petitions for reconsideration sometimes causes the FCC to suspend the new services for a time. After the issues are resolved, the FCC releases construction permits to the winning applicants. Whenever a license is granted, the FCC is very serious about the applicant being able to construct its facilities and use it's assigned frequency allocation within a given period of time (usually one year) otherwise the license expires.

As an antenna site provider, knowing about these "hoops" will help you set up an antenna site agreement which initially allows a potential applicant to "lock-in" your site with an availability option. However, you are also entitled to an option payment for this privilege. If the application bogs down at the FCC or is challenged for any number of reasons (which is not your problem but effecting you nevertheless), it may be years before the option is converted to a monthly check. We will delve into this matter in greater detail in Chapter Seven. But for now, keeping abreast of new service offerings by the FCC, which seems to be happening more and more lately, can be a valuable resource in developing your site. Getting back to the above example, had you issued a site option to a prospective licensee in 1992 you wouldn't have started to receive a check for site rental until April of 1996 which was the absolute "drop-dead" date established by the FCC to have these systems completely operational.

In addition, applicant's have some incentive to drag their feet if engaging in a new service offering when investment capital may be at a premium or equipment suppliers are still trying to come up with a working product. Obviously a lot can happen in two years to a site. You don't want to tie up a lucrative position in your building or on your tower without being

compensated.

Because site identification is necessary in an initial FCC license application, it is very likely that the site selected might no longer be available four years later. As a result, many of the construction permits might require modification or even the requirement to substitute other sites. Bad for you if you can't accommodate your original customer. Good for you if you missed out on the original application as you now have a crack at the business. This *Guide* will assist you in developing a resource to serve both sides of the equation.

The FCC addressed this issue when it granted its final *Report and Order*. It allowed antenna site moves within the top 50 cities to be less traumatic to avoid a new application or modification of the original filing. If the licensee was in any of the top 50 cities, the site could be moved up to 5 miles or 8 km. Note: the FCC likes to use the Metric System. If the licensee is in an area not near any of the top 50 markets, the site can be moved approximately 15 ½ miles or 25 km without any re-application for authority.

Keeping current on these twists and turns in the regulatory process insures your capitalizing upon them quickly. For example, all the potential applicants in your area are on file in the FCC Public Notices. In other words, you can easily find out who has applied for these services within 15 ½ miles of your site. If you know things are on hold because you keep abreast of the trade journals or the FCC Web site, you can contact the applicants with your offering and be ready to serve them when they receive their grants. Not all new services are met with such uncertainty at the onset. But it happens. When it does, confidences suffer. Applicants wonder if the application costs or option fees will use up important venture capital. Manufacturers are reluctant to commit to producing equipment which might not be sold for a while. It's a vicious circle. As with all new services, the bureaucracy grinds on and everyone eventually gets what they want at the end of the process. The cellular service, for example, took many years to resolve before the first licenses were issued.

Operations in the 220 MHz. band offer some interesting advantages which have yet to be completely explored. Some speculate that better in-building penetration and less susceptibility to absorption or other phenomena associated with cellular frequencies may be significant to the selection of

this band especially for paging. One of the not so common uses suggested for the new 220 MHz. service includes an in-building robot that delivers mail and office supplies from room to room by computer remote control. Another proposed application includes point-of-sale devices which check credit cards, ATM and check depot services. Other suggestions include point of sale inventory and ordering systems, accounting control, state lottery sales points, sensing devices for toll gates and security applications. These uses are a far cry from the typical dispatch services initially envisioned. The new band is quite capable of supporting all types of services. The important thing is that the resource is a developing one and will no doubt result in many local antenna sites which you may be in a position to provide.

Keeping an eye on this industry should not be that difficult either as management consulting firms have already been providing construction and service advice to licensees in the form of weekly newsletters. In addition, some licenses may be up for grabs in less-populated areas. Industry notables have indicated that the market will indeed explode at least in the top 100 markets as other frequencies are becoming jammed packed with users. In addition the service was created at the cutting edge of data technology and will need little retro-fitting unlike the cellular service which is now in the process of reinventing itself in a digital domain. The important point about this new band is that you know it is out there and developing.

US MobilComm Inc. is a large 220 MHz. operator who is actively rolling out service offerings in the Washington, D.C. and Baltimore, Md. area. The company also operates systems in New York City, Boston, Philadelphia, Houston, Chicago, Milwaukee, Minneapolis, Miami and California. Since this system competes directly with SMR's operating in the 800 MHz. band, it is likely there will be *churn* (customers changing services) from one system to the other if prices for the 220 MHz. system can remain competitive. The company uses exclusive agents and some dealers to sell its present offerings. But remember as these services broaden and improve many additional antenna sites will be needed for expansion.

1.8 Band Selection And Antenna Location

The 220Mhz. band is an unusual band indeed. It has long been known that the major frequency bands used in government and commercial two-way radio exhibit unique coverage characteristics. Operating

compatibility between bands is an important consideration and one for which the licensee is equally concerned. Should you have two tenants at your site, one transmitting a high power paging base station on 158.70 MHz. and the other proposing to use a two-way station with the mobile receive channel on 158.67 MHz., there is going to be an *in-band* problem. The paging channel will completely desensitize the mobile receiver channel when it is on the air because the two frequencies are too close for the receiver to block out the sideband energy from the transmitting station. This is a worse case scenario. However many incompatibilities besides adjacent channel problems can be skillfully managed by the tenants themselves. Let us look at some of the more general band characteristics.

1. Low Band, i.e. 35 to 45 MHz. offers greater over land coverage but has very poor in-building penetration. In addition it is effected by periodic sunspot activity occurring every 11 years or so resulting in *skip* communication. Skip is evidenced by transmissions bouncing down from the ionosphere, winding up about 2300 miles away and sounding just as good as a local transmitter. The band is not being supported by product and many operations are migrating to higher frequencies.

2. High-Band VHF, the 150 MHz. band is a pretty good compromise as it is not effected as much by skip conditions and provides fairly good over land and in-building penetration. The problem with this band is that there are very few frequencies unassigned. Some proposals for splitting VHF frequencies to narrower band widths may add additional channels but unfortunately all the present equipment would require replacement.

3. High-Band VHF, the 220 MHZ. band is about the best compromise between overland and in-building penetration. It is unlikely to be effected by skip conditions. The band has not been used much for personal communications of any type and thus remains to be developed with new data services currently being proposed.

4. High-Band UHF, the 450 MHz. band is an excellent band for in-building penetration. However the over land

characteristics begin to erode showing greater tendencies for line-of-site or point to point communication. Most of these frequencies are also in use with very little room for growth.

5. Super High Frequency, SHF, 800-900 MHz. and above, provide essentially line of sight communications. But one clear advantage of these frequencies is that they are electrically very quiet resulting in much less natural noise interfering with the reception of the desired signal.

Admittedly this is a simplification of the operating characteristics of each of the bands you are likely to see using your antenna site. But it is safe to say that your antenna site can accommodate services in each of the bands without much interaction. It is only when the services are *in-band* that care must be taken to avoid conflicts.

1.9 And Now There Is PCS

Should there ever have been a gold rush of the 1990's it would have to be the introduction, acceptance and construction of the new Personal Communication Service (PCS). With the Federal Communications Commission (FCC) exercising its new auction strategy to allocate frequencies for use in population centers, billions of dollars are being spent by very large companies for the privilege of competing with and cashing in upon the apparent financial success of cellular service.

What is the difference between cellular and PCS? The frequency range is different with PCS winding up in the 1.850 to 1.990 GHz. band. PCS also places a very large block of spectrum, some 120 MHz. in the hands of its operators as opposed to only 50 MHz. for cellular. PCS providers will start with digital systems using signal compression and a host of other computer permissible tricks to increase their capacity from 5 to 8 times over cellular. And by working in micro cells (that means lots of sites) the degree of frequency reuse can be vastly expanded. Cellular providers have a few tricks to maintain their edge for a time none the least of which is that they are already out there and doing a fairly good job of providing service. Many cellular subscribers own their equipment and may not want to purchase new equipment unless its dirt cheap or PCS service rates are significantly less. Remember that most cellular companies now literally give away their portables and mobile units just to have you sign a contract. So

convinced are they that you'll average $75 to $150 month in service, they will get you started by giving you the phone just to get you hooked. But in this industry you are called a *POP* and giving you a free phone has proved to be an effective marketing tool. PCS equipment, at least initially, is going to be a lot more expensive. Many PCS players are already cash starved after surviving the licensing auction and the requirement to build a fully developed system from the onset. It is not likely they will be giving away their handsets initially. But no doubt we will be seeing all sorts of deals that will allow PCS operators to compete with the cellular companies already entrenched in the market?

With cellular annual revenues increasing at a rate of 35% percent or more, a lot of mistakes can be made without much impact. Some analysts project that within the next decade there will be over 120 million cellular/PCS subscribers. They are also projecting a new smaller service market of short range (home) based portable telephones. These phones may only work up to a mile from your house or office. If this was connected to a PCS system, there could be a huge new market for subscribers in a very brief period of time. What might even be happening here is a wholesale replacement of the *POT* or the Plain Old Telephone.

Unfortunately PCS is also beset with initial protocol standard problems. Not all systems will use the same method and interoperability will suffer without compatibility. For example, one popular system proposed for use is CDMA or Code Division Multiple Access. Another is TDMA, or Time Division Multiple Access. Finally GSM, or Global System for Mobile Communications is vying for acceptability. In some cases the protocols are identical but the frequencies are incompatible. So it may take a few years for all the systems to converge. Cellular on the other hand has already established a fairly reliable nation-wide system. Publicly traded corporations have spent unprecedented amounts at auction for a *block* of frequencies tied to a *BTA*, a Basic Trading Area and similar to the MSA mentioned earlier. There are six *blocks* of frequencies (A-thru F and not to be confused with the "A" & "B" cellular systems) covering the top US cities down to highly rural areas. Each *block* was awarded to the highest bidder in that market using a bidding process in which applicants wishing to enter the new service or market proposed a dollar amount per person within the population center.

The A and B blocks, already assigned and licensed for the most part,

netted the Government roughly $8 Billion dollars in bids. Block C brought in about $10 Billion. That is a lot of money for just a piece of paper. Now the companies (see Appendix A) must build the networks, antenna systems and marketing mechanisms all capable of competing with not only two existing cellular systems and a few ESMR's already in place, but with other PCS operators as well. Someone described this situation as being similar to placing seven gas stations at a single intersection. Since many of the remaining areas and lesser spectrum blocks have yet to be constructed, there remains room for a lot to go wrong. Companies unable to secure financing for their awards or swap their *blocks* for more desired ones, will no doubt delay many market entries. Eventually the winners will shake out the losers and the systems will be constructed.

Communication companies are constructing facilities at the fastest pace in the history of telecommunications. Antenna systems including towers, shelters and switching equipment are going up in a matter of weeks. And the building process is not always the same between different companies. For example. When a PCS company reports that it has completed **Full** coverage, it means that it is approximately equivalent to cellular voice service. **Core** coverage means that initial construction covers the center city area or other core areas. And **Initial** service means that they are on the air serving "some" customers. **Full Commercial** service includes authentication, published pricing, billing and customer service. **Limited Commercial Service** means some of the above. **Trial** means they are still tweaking the system. These criteria, contributed by the *CDPD Forum*, give you an excellent idea of where the PCS operating company is positioned when they contact you about your sites.

In some instances the site they need may be desired immediately, or as they will specify, *time is of the essence,* in which case your deal is likely to go very fast. In another scenario they may be working a few months to a year ahead in their strategic planning and want to lock up your site for use six months down the road when they plan their transition from **Core** to **Full** service or from **Limited Commercial** to **Full Commercial Service**. In this case they are likely to drag their feet wanting you to commit and reserve the antenna site location but not willing to pay for it until construction is undertaken. Statistics as to where each provider is on this report card is a common reporting function of the various trade publications (see Appendix D).

Site Savvy

PCS providers usually use buildings or existing towers first in order to minimize start up costs.

1.10 Other Services Are On The Horizon

There are far too many new services waiting in the wings or in partial states of regulatory or engineering development to write about in this *Guide.* For even as it is being written, new services are evolving and existing ones are in the midst of change. But the bottom line for you is that every service regardless of its sophisticated technology will still require an ever increasing resource of antenna site locations and a suitable physical environment to house equipment. Changes are occurring in conventional radio, the 220 MHz. trunking system, microcells, in-building cellular sites, wireless PBX systems, PCS facilities, one-way and two-way paging applications, along with a host of new product offerings such as wrist watch pagers, wireless laptops and palm sized Personal Data Assistants (PDA) *all interconnected in some fashion or another* by wireless modems.

Common to all this technology is *low power*. The trade off for these subminiature and low power devices will be to employ additional antenna locations. Rather than focus upon the technical aspects of these telecommunication services it is far more important to understand the physical requirements. You will then be able to match your proposed facilities to present and future building requirements of the communication company you wish to serve. In addition, you may even be able to anticipate facilities which the communication company may not yet have scheduled for improvement. You can do this easily by discovering an area of poor coverage. Essentially you must be a partner in these new ventures.

The *Antenna Site Operating Guide* addresses many different antenna site applications covering a wide range of individual activities or vocations from which you can benefit. You may want to skip to Chapter Ten and review some of these activities in greater detail in order to focus upon a given area as you work through the subjects in this *Guide.* Remember, you do not have to be an engineer. But you must do some research, assemble some information and develop a marketing plan to be

successful. What makes it easy is that the communication companies you serve will welcome your suggestions whether they use them or not.