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## THE CELLULAR TELEPHONE CONCEPT -- AN OVERVIEW

### Background

Conventional mobile telephones have been in use for many years. However, in many major U.S. cities, the limited number of available frequencies assigned to mobile service could not handle the increasing volume of users and telephone traffic. Many potential users had to wait months, sometimes a year to get a phone number.

Once a user had a mobile telephone, he often had to wait for a dial tone or frequency to become available (only one call could be made at a time on one frequency). Also, radio channels couldn't be used again in nearby cities because the powerful transmitting signals from each system's single, high-powered base station would interfere with one another.

Something clearly had to be done.

Bell Laboratories began experimenting with the system we know today as cellular telephone in the 1960s. Results

of this research were revealed in 1971 and, soon after, Bell Laboratories and Motorola, Inc., almost at the same time, announced plans for high-capacity mobile telephone systems based on cellular technology.

In 1968, the Federal Communications Commission opened up the 800MHz band of the radio spectrum for use by this service and, in essence, challenged the cellular telephone industry to develop it for the maximum public benefit.

With the FCC's challenge and the problems of the conventional system in mind, and with years of experience in hand, telecommunications companies like Motorola and AT&T set out to develop a computerized system that would make cellular mobile and portable telephone service available to many more people.

Fifteen years after it issued its challenge and opened up the 800MHz band, the FCC in 1983 authorized in Chicago the first commercial cellular system. Systems are now either operating or being installed in many other major U.S. cities.

Cellular overcomes the limitations of conventional systems by breaking the geographical area into many small subdivisions, called cells, rather than one large one, and by using low-powered transmitters with limited range in each of the smaller subdivisions. This way, each channel can be used simultaneously in the different cells (an analogy is the hundreds of TV stations throughout the U.S. that, be-

cause they're out of each other's ranges, reuse channels 2 through 13 on the VHF band). Taken together, the cells compose the total service area.

### How Does Cellular Work?

In a cellular system, each transmitter is only powerful enough to communicate with the cellular telephones that are within its cell. As a person making a cellular call from a portable or mobile phone on a particular channel moves from one cell to another, the call is automatically "handed off" -- or switched -- to the adjacent cell. Such a transfer takes place without the user's knowledge.

Computer control systems are the keys to efficient operation of a cellular system. Computers at a telephone switching office activate computers in each cell and, through these, the computers in the cellular mobile or portable phones. For example, the heart of Motorola Inc.'s DYNA T-A-C (R) cellular system is called an Electronic Mobile Exchange (EMX). The EMX computerized switching system keeps track of each cellular mobile or portable telephone, selects one of a network of cell sites covering a city and interconnects it into the wire-line telephone network. The cell sites send the conversation to the user's phone, and return the conversation from the user's phone. As a user moves about a cellular system while

talking, the EMX automatically and instantaneously switches the conversation from cell to cell.

Potential interference from portable units operating from tall buildings or the top of a hill is eliminated in a cellular system by a simple technique. Once a portable has made contact, its power is automatically adjusted, again by computer, to the lowest level necessary for effective communications. This guarantees that no excess power will be used, minimizing interference with distant cellular phone users and permitting maximum reuse of the channel. This feature also extends the battery life of the portable unit, further enhancing the utility to the user.

Cellular telephone users, on foot or in their cars, virtually anywhere in a metropolitan area with cellular service, can place or receive calls to or from any other telephone in the world.

#### A Nationwide System

Once cellular systems are installed in more and more cities, and because of cellular's highly sophisticated features, the basis of a nationwide compatible cellular telephone system will exist.

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