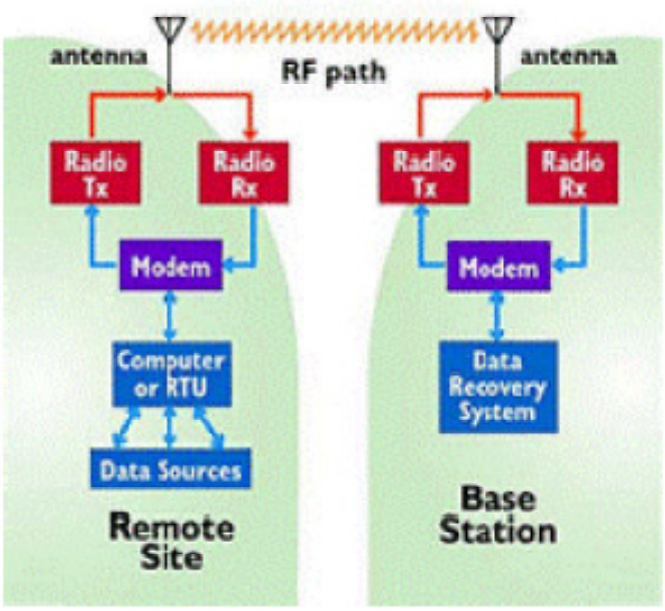
Wireless Telemetry

COMPONENTS OF A TYPICAL WIRELESS TELEMETRY SYSTEM



At the remote site, a sensor or sensors are typically the data source. The output of the sensor(s) is converted to digital data by a small computer device or RTU (Remote Terminal Unit). The RTU is interfaced to a modem device that converts the digital data into an analog signal that can be transmitted over the air. The radio transmitter then transmits the signal to the host site radio receiver. Now the process is reversed. The modem takes the analog signal received and converts it back to a digital form that can be processed by the data recovery equipment.

In a typical application, the base or host site requests data from the remote site(s). The base transmits a request to the remote unit telling it to send its data. The base reverts to a receive mode and awaits the transmission from the remote site. After

the remote sends its data, it goes back to a receive mode waiting for further instructions to come from the base. Once the base receives the remote site information, it may send additional instructions to that site or continue on to request data from the next remote site. This polling process continues until all the remotes in the system have sent their data.

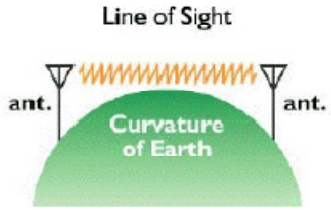
PART 2: RADIO PROPAGATION - SENDING DATA THROUGH THE AIR

Radio waves are propagated when the electrical energy produced by the radio transmitter is converted into magnetic energy by the antenna. Magnetic waves can then travel through space. The receiving antenna then intercepts a very small amount of this magnetic energy and converts it back into electrical energy that is amplified by the radio receiver. Thus, sending information through the air.

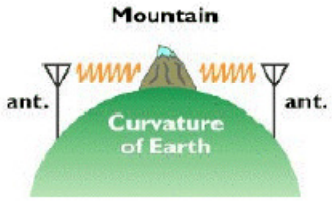
HOW FAR CAN DATA BE TRANSMITTED?

Propagation characteristics of radio waves are subject to many variables that affect the range and performance of a radio system. The main consideration is the loss in the transmission path between the transmitter and receiver. Factors effecting this loss are obstacles and power loss.

The most reliable system will employ a "line-of-sight" design where the radio wave travels directly from the transmitting antenna to the receiving antenna without obstructions as shown below left. However, the curvature of the earth limits the line-of-sight distance. If the transmitting and receiving antennas are too far apart, the earth will block the radio wave. The maximum line-of-sight transmission distance is determined by antenna height and may be limited by other obstacles as shown below.



Line-of-sight transmission



Line-of-sight obstacle

Once a transmission path is determined, signal power comes in to play. In general, signal power decreases in proportion to the square of the distance. For example, if the distance doubles, power decreases by four times. However, in actual practice, power drops off much faster because of attenuation caused by obstructions, trees, foliage, and other factors. This results in the power typically dropping off at a rate to the fourth power of the distance.

Predictions of radio range can be made using a free space isotropic nondirective antenna model where the path loss is 22 dB for one wavelength of separation between antennas and increases 6 dB every time the distance is doubled. However, this model holds true only in free space. Under actual conditions, other factors must be considered. Those other factors will be discussed in detail later on.