Reflective array antenna

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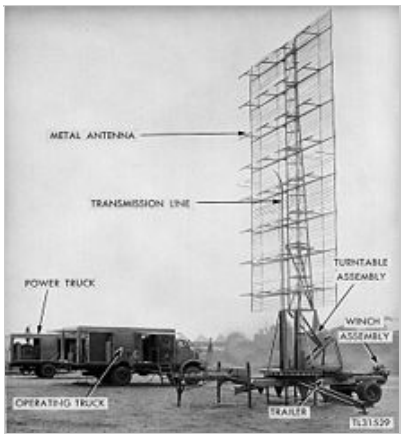
In telecommunication and radar, a **reflective array antenna** is a class of directive antennas in which multiple driven elements are mounted in front of a flat surface designed to reflect the radio waves in a desired direction. They are often used in the VHF frequency band, and these versions often resemble a highway billboard, so they are sometimes called "billboard antennas". The curtain array is a larger version used by shortwave radio stations.



Reflective array 'billboard' antenna of the AN-270 radar, an early radar system used in 1941 at Pearl Harbor. It consists of 32 horizontal half wave dipoles mounted in front of a 55 ft. high screen reflector. With an operating frequency of 106 MHz and a wavelength of 3 meters this large antenna was required to generate a sufficiently narrow beamwidth to locate enemy aircraft.

Reflective array antennas usually have a number of identical driven elements, fed in phase, in front of a flat, electrically large reflecting surface to produce a unidirectional beam, increasing antenna gain and reducing radiation in unwanted directions. The individual elements are most commonly half wave dipoles, although they sometimes contain parasitic elements as well as driven elements. The reflector may be a metal sheet or more commonly a wire screen. A metal screen reflects radio waves as well as a solid metal sheet as long as the holes in the screen are smaller than about one-tenth of a wavelength, so screens are often used to reduce weight and wind loads on the antenna. They usually consist of a grill of parallel wires or rods, oriented parallel to the axis of the dipole elements.

The driven elements are fed by a network of transmission lines, which divide the power from the RF source equally between the elements. This often has the circuit geometry of a tree structure.

Gain limits

The more driven elements that are used, the larger the antenna is compared to a wavelength, and the higher the gain, and the narrower the beamwidth of the antenna's main lobe. However, as the number of driven elements increases, the complexity of the required feed network increases. Ultimately, the rising inherent losses in the feed network become greater than the additional gain achieved with more elements, limiting the maximum gain that can be achieved. The gain of practical array antennas is limited to about 25 - 30 dB. "Active" array antennas, in which groups of elements are driven by separate RF amplifiers, can have much higher gain, but are prohibitively expensive.

Since the 1980s, versions for use at microwave frequencies have been made with patch antenna elements mounted in front of a metal surface.[1]

References

1. ^ Huang, john. *Reflectarray antennas*.

A modern form of reflective array is the "bow tie" UHF television antenna. This example has two dipole driven elements in front of a grill reflector oriented for vertical polarization. The "bow-tie" dipoles, consisting of two V-shaped elements, have a larger bandwidth, allowing the antenna to cover the wide UHF television band.

Enormous reflective array antenna of the Duga-3 or "Steel Yard" over-the-horizon (OTH) radar system, Chernobyl, Ukraine, part of the Soviet early-warning network. It transmits at frequencies between 7 and 19 MHz. The pairs of cylindrical cages at right are the half wave dipole driven elements, fed at their center by vertical feed lines. Behind them is a reflector screen of horizontal wires, just visible in center.

An ALLISS antenna, a modular type of curtain array used by international shortwave stations for broadcasting to distant areas by skywave.