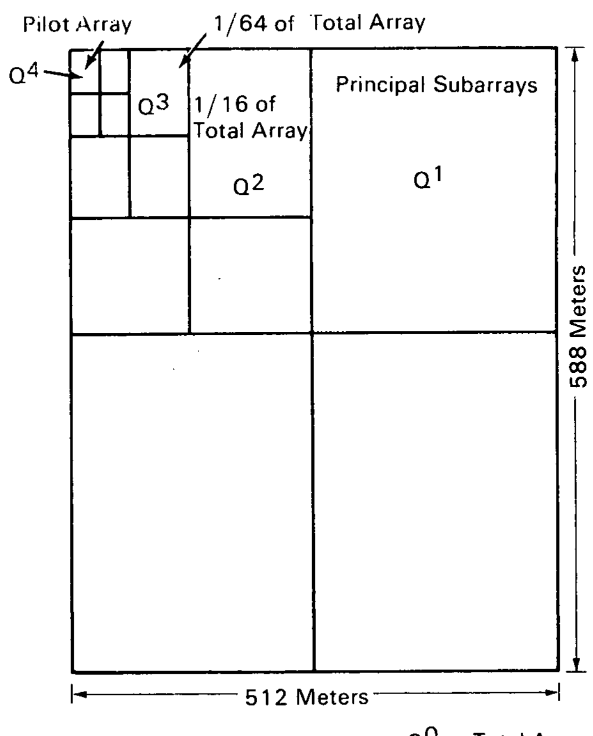
NASA TECH BRIEF

NASA Headquarters

Economical Phased-Array Antenna for Environmental Applications

A minimal cost, computer-controlled large aperture scanning antenna system has been designed. In addition to handling data acquisition and tracking, the antenna can function as a sensitive radio telescope, because of the demanding performance requirements. The phased array antenna can serve as a radiometer in investigations of the Earth's atmosphere. With the addition of power amplifiers at each element, the array could become a radar link to commercial aircraft. Used in solar radar, the antenna's improved sensitivity and resolution would make it possible to resolve quadrants of the solar disk in Doppler radar observations. And as a planetary radar device, the antenna could detect the planet Jupiter and make observations of Venus and Mars at a much lower frequency than has previously been used.



Receiving Antenna Array Layout

The general system layout, with appropriate dimensions, is shown in the figure. The entire array is designated Q^0, while the four principal subarrays are denoted as Q^1. Each of the principal subarrays is subdivided into four parts, called Q^2, which are partitioned in a quadripartite fashion to form the Q^3 level. The lowest subdivision of the array is the Q^4 level (Pilot Array) which contains 16 dipole elements. The general design philosophy of the array organization consists of designing the Q^4 level as a module of the final complete system, and reaching a system compromise between the amount of electronics physically installed in the antenna aperture and the total rf cable.

The modular concept of organization, requiring only 272 rf control boxes in the field, enables each Q^4 level to function as an independent module of the final array. The number of enclosures is modest considering the extent of the system. However, each enclosure is relatively large (0.11 to 0.17 m^3) and must be protected from local weather hazards and rf interference. If future conditions warrant, the complete system could be disassembled and moved from site to site.

The electronics portion of the system includes an amplifier circuit (one for each dipole element) which permits amplitude and phase adjustments in the field. Salient performance specifications are: 13 dB power gain for a frequency range of 69.4 to 80.4 MHz; a noise figure of less than 3 dB; and a departure from linearity of less than 11° for any combination of input signal level and frequency. The main beam scanning and

(continued overleaf)

pointing operation is performed by a computer-operated control system which generates and distributes the phase angle information, as a function of the desired beam pointing position, to the time delay circuits.

Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.95)

Reference:
NASA-CR-101683, (N69-30176), Design Studies of a Large Electronically Steerable Phased Array

Patent status:

No patent action is contemplated by NASA.

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