THE UNIVERSITY OF MICHIGAN RADIATION LABORATORY

2455 Hayward Street
Ann Arbor, Michigan 48105

(313) 764-0500

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CONTRACTING OFFICER	George E. Himes
REPORT SUBMITTED BY	Thomas B. A. Senior and Eugene F. Knott

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This is the fourth monthly progress letter on Contract F33615-73-C-1174 and covers the period 15 June - 15 July 1973.

During this reporting period a streamlined edition of program RAM1B was developed and tested, and a copy was sent to AFAL. The program is called RAMD and it requires much less storage than does RAM1B because the source deck itself is less than half as long and the program has fewer arrays. It is also more efficient because a printer plot routine has been discarded, the surface currents are printed out only for the first angle of incidence specified on input and the few subroutines that do remain are more efficient. The program will produce either bistatic or backscattering patterns for either E- or H-polarization.

Program TWOD, which solves the problem of a conducting cylindrical core surrounded by a dielectric shell for E-polarized incidence, is being extended to include magnetic materials as well as H-polarization. The extension introduces additional unknowns, for now we must admit the existence of both electric and magnetic currents on the outer shell in addition to electric (or magnetic) currents on the surface of the inner core. The equations being developed are based upon an impedance boundary condition on the inner surface for E-polarization so that the H-polarization formulation may be trivially obtained via duality.

Two approaches have been taken to obtain the basic equations, one based upon a vector formulation commencing with Hertz potentials and the other based on a scalar formulation. Although the vector approach is the more natural, it ultimately produced integral equations in which a kernal has a second derivative singularity. Our experience with RAM1B has shown that such a singularity should be avoided if at all possible. On the other hand, the scalar formulation has no such kernal and one of our tasks will be to resolve the differences between the two. Although there appear to be errors in the analysis used by Northrop to obtain the basic equation for program TWOD, our scalar formulation reduces to Northrop's results when the permeability of the shell is set to the free space value.

Analyses of data produced by programs REST and RAM1B for a loaded ogival cylinder are continuing. (It will be recalled that the former makes use of resistive sheets strategically placed outside the conducting body while the latter imposes an impedance boundary condition over its surface.) Thus far the results from REST suggest that resistive sheets can produce a quite effective broadband treatment, provided the viewing angles are well away from the specular directions. However, constant or even linear variations in resistivity along the sheet do not always produce the desired results, while a square law variation seems to be consistently beneficial.

Program RAM1B has confirmed what might have been expected for an impedance boundary condition: since the leading edge is the sole contributor to the scattering for E-polarization, a high impedance placed there is effective even when a small fraction of the surface is treated. Moreover, it does not matter if the impedance variation over the treated surface is linear or square law; the performance in the edge-on region is virtually the same in either case. However, a more extensive surface treatment does tend to extend the performance further into the specular region.