

## Foreword

This NASA Reference Publication has been prepared through the joint efforts of Dr. Julius Goldhirsh of The Johns Hopkins University Applied Physics Laboratory and Dr. Wolfhard J. Vogel of The University of Texas Electrical Engineering Research Laboratory . It was developed under NASA's Radio Science and Support Studies Program, which with its predecessor programs, has been involved for two decades in the study of radiowave propagation over earth-space paths.

Much work has been carried out during the last 10 years to measure and model the impairments to which communications via land-mobile satellites are subjected due to propagation effects. This topic was given the highest priority for NASA supported propagation studies in the United States for several years. Significant contributions have also been made by researchers in a number of other countries. International cooperation has facilitated the acquisition of propagation measurements using actual satellite paths. The authors' Australian campaign, for example, relied on the use of Japan's ETS-V satellite, INMARSAT's Pacific satellite, and the participation of the AUSSAT organization. Measurements taken in Maryland were achieved through the cooperation of INMARSAT, this time through use of the MARECS B-2 satellite.

The objective of this document is to distill the important results pertaining to the measurements and analyses of propagation as relevant to land-mobile satellite systems and to present them in a single reference. Beyond this objective, a need was perceived to present the information in a form that would be most useful for engineers concerned with the design of land-mobile satellite systems.

This publication takes its place along side of the two NASA handbooks on propagation, Propagation Effects on Satellite Systems at Frequencies Below 10 GHz - A Handbook for Satellite Systems Design, NASA Reference Publication 1108 (02), 1987 and Propagation Effects Handbook for Satellite Systems Design - A Summary of Propagation Impairments on 10 to 100 GHz Satellite Links With Techniques for System Design, NASA Reference Publication 1082 (04), 1989. As in the case of the handbooks, comments regarding this document are welcome.

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