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COMSTAR Experiment:

Notes on the COMSTAR Beacon Experiment

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Definitive empirical characterization of the transmission properties of the atmosphere has long been limited by the lack of appropriate sources radiating from beyond the atmosphere. The COMSTAR beacons provide appropriate radiation to interested experimentors throughout the continental United States.

Government, commercial, and scientific interest in transmission through the atmosphere at frequencies above 10 GHz derives from the potential for employing this portion of the spectrum for satellite communications and is basic to the attention being paid the COMSTAR beacon experiment, both within the U.S. and abroad. This opportunity for improving future generation communication satellites underlies A.T.&T.'s provision for carefully designed millimeter wave beacon sources in several earlier corporate proposals to the FCC.

Soon after the FCC granted permission to proceed with COMSTAR, specifications describing the beacon characteristics were published in technical journals along with an invitation to build and operate equipment for their reception. This announcement was received enthusiastically, and on October 1, 1975, a group of 40 interested experimenters gathered at a first "COMSTAR Experimenter's" meeting at Holmdel, New Jersey. Spacecraft development progress was discussed, along with early characterization results from prototype beacon equipments. Attendees signified their interest in participating in the experiment and outlined tentative plans. It was agreed that coexperimenters would meet from time to time, and that the data resulting from COMSTAR observations would be published in the open literature.

COMSTAR D1 has been in service now for almost two years. Beacon radiations have been observed at Bell Laboratories sites for this entire

period, beginning even before the satellite D1 came on station. Aspects of COMSTAR's behavior have been reported at professional meetings and in journals. Participation in the experiment is gratifying; at the present time observations are in progress at:

University of South Florida, Tampa, Fla.
Virginia Polytechnic Institute, Blacksburg, Va.
Johns Hopkins University, Laurel, Md.
Air Force Cambridge Research Labs, Hanson Field, Mass.
Institute for Telecommunications Science, Boulder, Colo.
COMSAT Laboratories, Clarksburg, Md.
General Telephone and Telegraph, Waltham, Mass.

In addition, several universities and government agencies have programs directed toward equipping facilities receiving the beacons at other locations.

The service lifetime of these beacons has three determinants: the lifetimes of critical devices, particularly the IMPATT amplifiers; the redundancy and fail-safe features provided in the system design; and the power budget of the spacecraft itself. These units have been designed to provide a minimum of two years of useful operation, as such a period is consistent with stable estimates for attenuation behavior. This goal would appear to have been realized in spacecrafts D1 and D2, although the 19-GHz radiation from satellite D1 has a predictable anomalous behavior during portions of the satellite thermal cycle. Long-term beacon availability depends, therefore, on continued access to surplus spacecraft power—a commodity which decreases with increased communications load and decreased solar cell efficiency. Given the staggered launch schedule of the COMSAT vehicles, the pertinent design parameters, and our present experience, it is expected that COMSTAR beacon signals should be available at least until the early 1980s.