THE ACTS PROPAGATION PROGRAM

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INTRODUCTION

The success or failure of the ACTS experiment will depend on how accurately the rain-fade statistics and fade dynamics can be predicted in order to derive an appropriate algorithm that will combat weather vagaries, specifically for links with small terminals, such as very small aperture terminals (VSATs) where the power margin is a premium.

This article describes the planning process and hardware development program that will comply with the recommendations of the ACTS propagation study groups.

ACTS Propagation Terminal Development Plan

A plan for the ACTS propagation terminals was initiated at the first ACTS Propagation Studies Workshop, November 28-29, 1989. The workshop's goal was to develop the ACTS Propagation Studies Program. These guidelines specify how the terminal should be configured so that it can record the following propagation and meteorological parameters:

- 20-GHz beacon receive signal level
- 27-GHz beacon receive signal level
- 20-GHz radiometric sky noise temperature
- 27-GHz radiometric sky noise temperature
- Point rain rate near the terminal
- Atmospheric temperature at the Earth's surface
- Atmospheric humidity at the Earth's surface

Prototype Receive Terminal Development

A NASA research grant was awarded to Virginia Polytechnic Institute in early 1991 for the Prototype development. The Prototype ACTS propagation receiver terminal will consist of a common antenna, a dual-channel digital receiver, a dual-channel analog radiometer, and a data acquisition system. The terminal will also be equipped with meteorological recorders for measuring the point rain rate and the atmospheric temperature and humidity.

A simplified block diagram of the receiver terminal is shown in Fig. 1. The salient features of the terminal are as follows:

- 1.2-m common antenna
- Ortho-Mode Transducer (OMT) to split 20-GHz V- and H-Pol (if used)
- 20-/30-GHz diplexer to split 20- and 30- GHz V-Pol signal
- Cost-effective low-noise amplifiers followed by single downconversion to 70-MHz intermediate frequency (IF)
- Total power radiometer with detectable sensitivity of ±1 K
- Data collection - PC/AT-based

The design will be based upon modular form for easier integration and testing. The worst case CONUS coverage link budget is shown below:

Beacon frequency band (GHz)	27.5	20
Common antenna size (m)	1.2	1.2
Antenna Gain (dB)	49	46.4
Nominal CONUS EIRP (dBW)	16	16
Transmission loss (dB)	2.0	1.8
Modulation loss (dB)	-	3.2
Path loss at 30-deg elevation (dB)	215	212
Total loss (dB)	217	217
Low-noise-amplifier noise figure (dB)	7	7
Receive G/T (dB/K)	17.6	15.1
Carrier-to-noise density (C/N), (dB-Hz)	45.2	42.7
C/N over 15 Hz (dB)	33.4	30.9

Schedule

The tentative schedule summary for the ACTS Propagation Studies is shown below:

Completion of Prototype Terminal	July '92
Selection of Experimenters	May '92
Completion of 7 Terminals Productions	March '93
Installation and Calibration of Terminals	April '93
ACTS Launch	Early '93
Start of Data Collection	Early '93

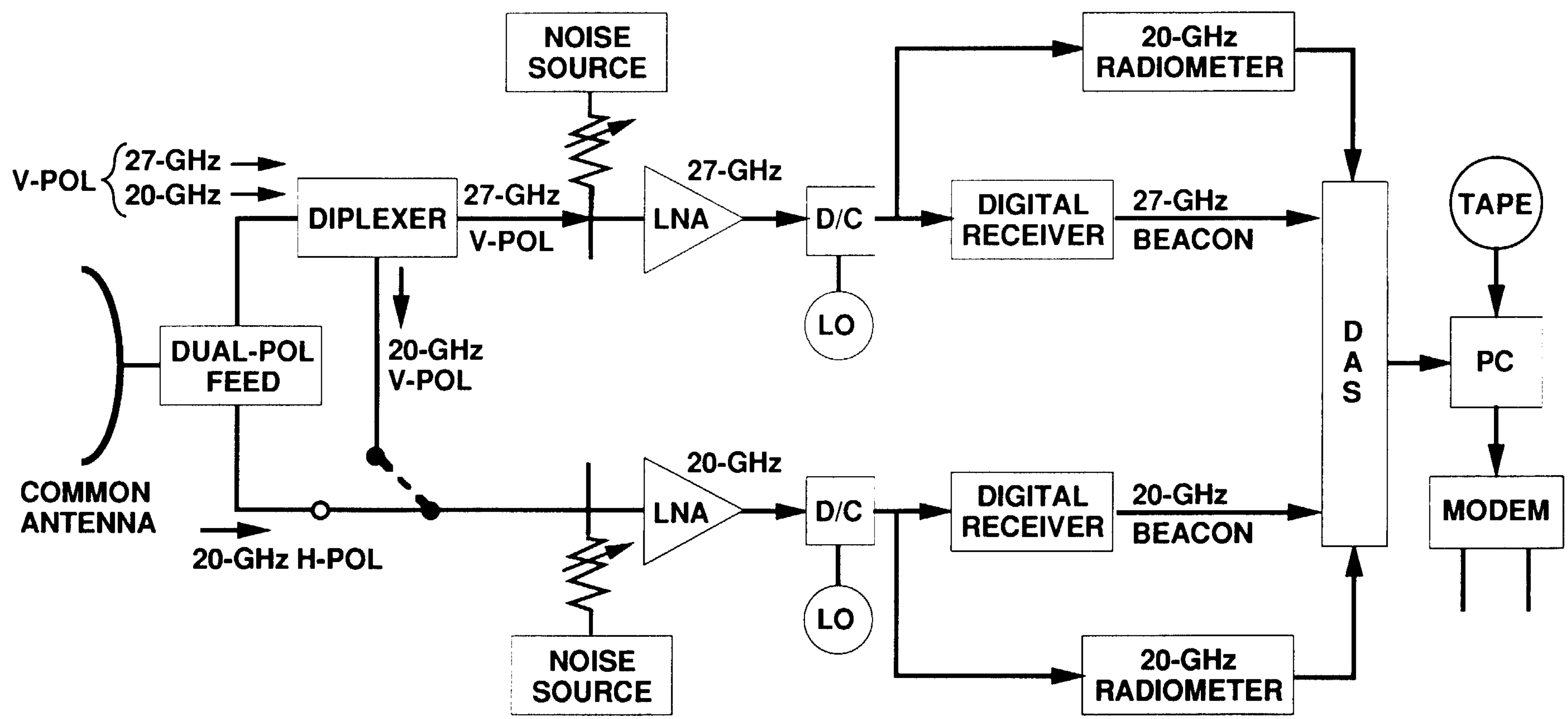
Data Collection Sites

Rain climate zones without prior propagation data will receive special consideration. Sites with an ongoing environmental sensing program employing radiosondes, weather radars, etc., will be given higher priority. Seven such sites have been selected.

Conclusions

The ACTS propagation measurements campaign has been outlined.

FIGURE 1
FUNCTIONAL BLOCK DIAGRAM OF THE ACTS TERMINAL



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