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PIFEX DATA AND ARCHIVAL FORMATS

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Introduction

JPL has assembled, as a part of NASA's Mobile Satellite Experiment (MSAT-X), a mobile laboratory for conducting experiments on MSAT-X developed equipment and determining L-band propagation effects. To gather this experimental data, a central data acquisition system (DAS) was built around an IBM PC/AT. A description of the van and the DAS is given in (Emerson, 1987). Up to this point, the mobile laboratory (ML) has been used for three major Pilot Field Experiments (PiFEx): Tower 1, Satellite 1a, and Tower 2 (Berner, 1987, 1988a,b). At least two more are planned: Tower 3 and Satellite 1b. Nearly a gigabyte of data has been collected so far. Each test has introduced new equipment to the ML and new requirements on the DAS. To date, each experiment has resulted in a different file format for storing the raw data, making the subsequent analysis programs experiment dependent. To combat this, JPL has developed an archival format that is experiment independent and expandable for future additions.

Experiment Data File Formats

The starting point for the JPL DAS development was the data acquisition system developed by Dr. Wolfhard Vogel of the University of Texas at Austin (Vogel, 1985). Dr. Vogel's files consist of sixty-three 4120 byte records. Each record consists of a 24 byte header, 1024 samples of the received signal level, and 1024 samples of the signal phase (see Figure 1).

Since MSAT-X was interested in testing equipment along with the propagation investigation, the DAS had to record data from all instruments, not just the receiver. For the first PiFEx experiment, Tower 1, the DAS took data from the antenna subsystem, the MSAT-X receiver, and a reference receiver and stored it in the memory of the IBM. When the memory was full, the DAS stopped taking data and dumped its memory to a Bernoulli Box cartridge disk. This resulted in 2.5 minutes of data taking and 30 seconds of data writing, making the data acquisition non-continuous. Time tagging of the data was provided by the data file's name, MMDDHHMM.DAT (month, date, hour, minute).

The Tower 1 data was written in blocks of like data (see Figure 2). For example, the High Speed Analog group consisted of 150,000 records, with each record consisting of a sample each of the reference receiver inphase channel, the reference quadrature channel, the pilot receiver inphase channel, and the pilot

quadrature channel. These blocks were then stacked sequentially into a named file when the data was written to the cartridge disk (Bernoulli Box). Memory constraints prevent using this method if additional equipment is to be added without decreasing the data acquisition rates of the original equipment.

For Satellite 1a and Tower 2, the data taking method underwent a radical change. First, a Loran receiver was added to the ML configuration. Secondly, the data acquisition became continuous, with the data being written in files containing 75 seconds of data. Each file now consists of 20 blocks, each block containing 3.75 seconds of data (see Figure 3). This removed the memory limitation that prevented expanding the Tower 1 configuration. Each block contains data stacked in a similar manner as the Tower 1 format. Although this method provides continuous data acquisition, the file format now requires an additional block demultiplexing step for data analysis programs.

For the July 1988 Tower 3 experiment, additional equipment has been added to the ML configuration: the JPL terminal processor (adding an additional digital interface) and a data channel signal-to-noise ratio measurement (an HP-IB recording and an analog channel). The overall data format will remain the same, but the absolute location of each data record will change because of the additional data items.

For Satellite 1b this may change again. Thus, we may have at least 4 different file formats. Adding to the problem is the fact that we have run tests on the JPL Antenna Range with the DAS sampling the pilot receiver at a higher rate, resulting in yet another file format to deal with. Obviously, an archival format is required.

Archival Format

The archival format consists of a header, which may list the experiment name and any special conditions; a table of contents, which would list the data set number, the absolute position in the file of the first byte of the set, the number of bytes of data in the set, and a data type description; and finally the data sets (see Figure 4).

The only experiment dependent item required would be a program that translates the data format used for the experiment to the archival format. This translation would be done after the experiment and prior to any data analysis.

The advantages of this method are clear. Using just one byte for the data set numbering provides the ability to store 256 different data sets. Since the table of contents lists the start position and the data length, different sampling rates can be accommodated. Analysis programs would need to read only the table of contents for the location of the data of interest; thus, one version of the program could analyze data for all of the experiments. Specific programs could be written to extract

limited data sets; this would ease the dissemination of data, such as propagation data, to experimenters other than JPL.

Conclusion

A standard archival format has been presented for the JPL MSAT-X PiFEx experiments, which will overcome the deficiencies of the current set-up. This format allows ease of data processing, flexibility for future experiments, and controllable data dissemination to other experimenters.

References:

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Berner, Jeff B. 1988a. "The PiFEx Satellite 1a Experiment," MSAT-X Quarterly, Number 15, June 1988.

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Vogel, Wolfhard J. 1985. Personal Communication to Anil V. Kantak, December 3, 1985.

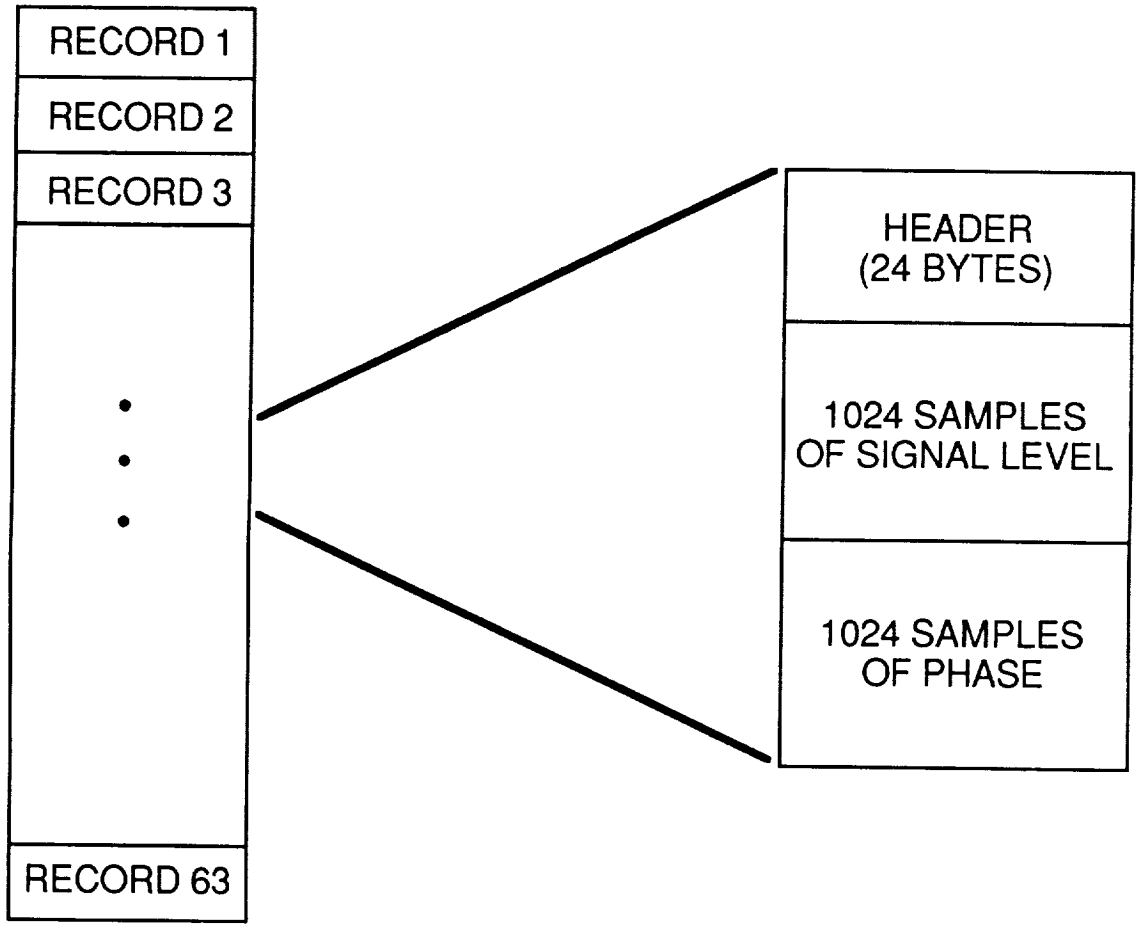

Figure 1
University of Texas Format

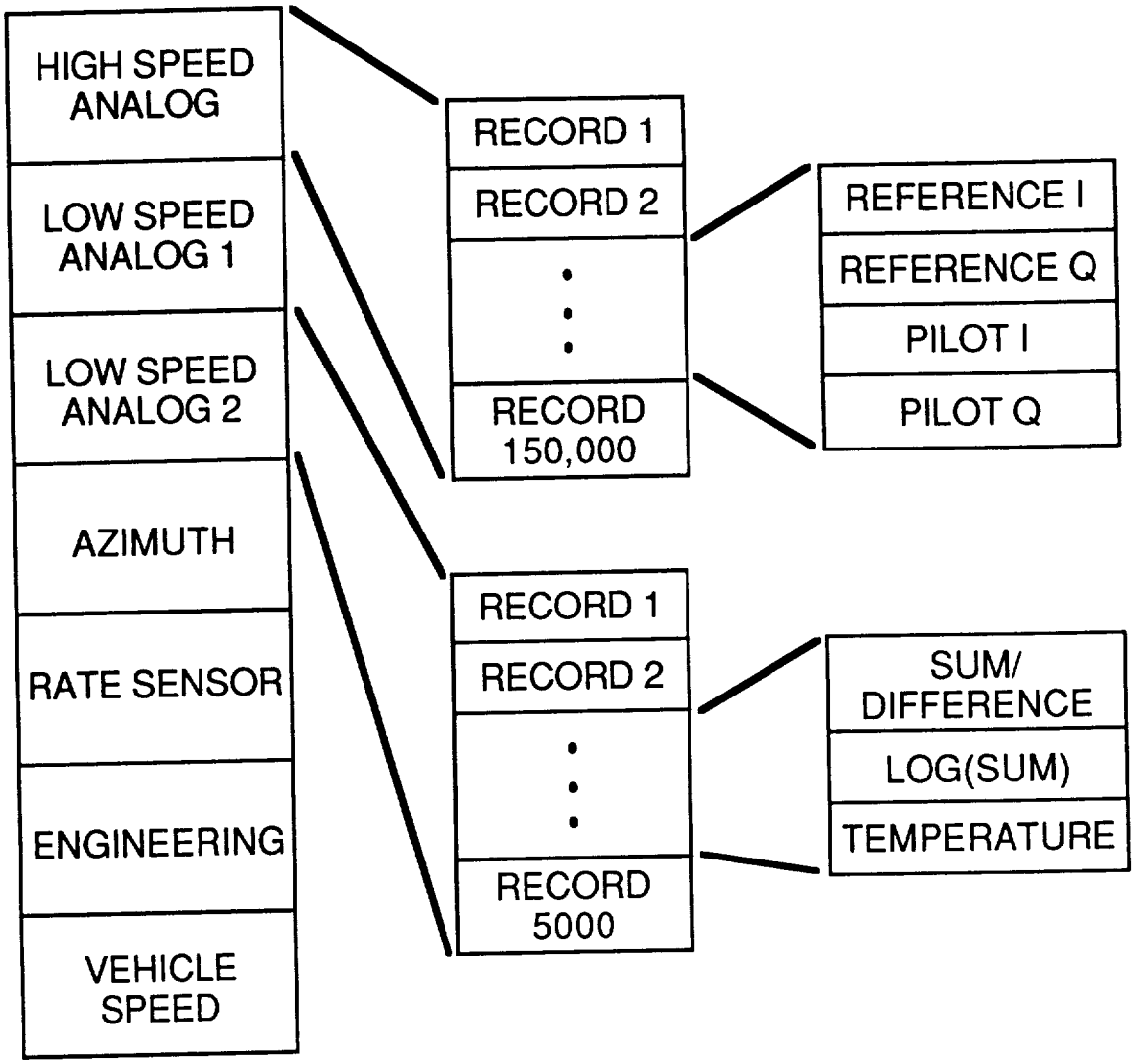

Figure 2
Tower 1 Format

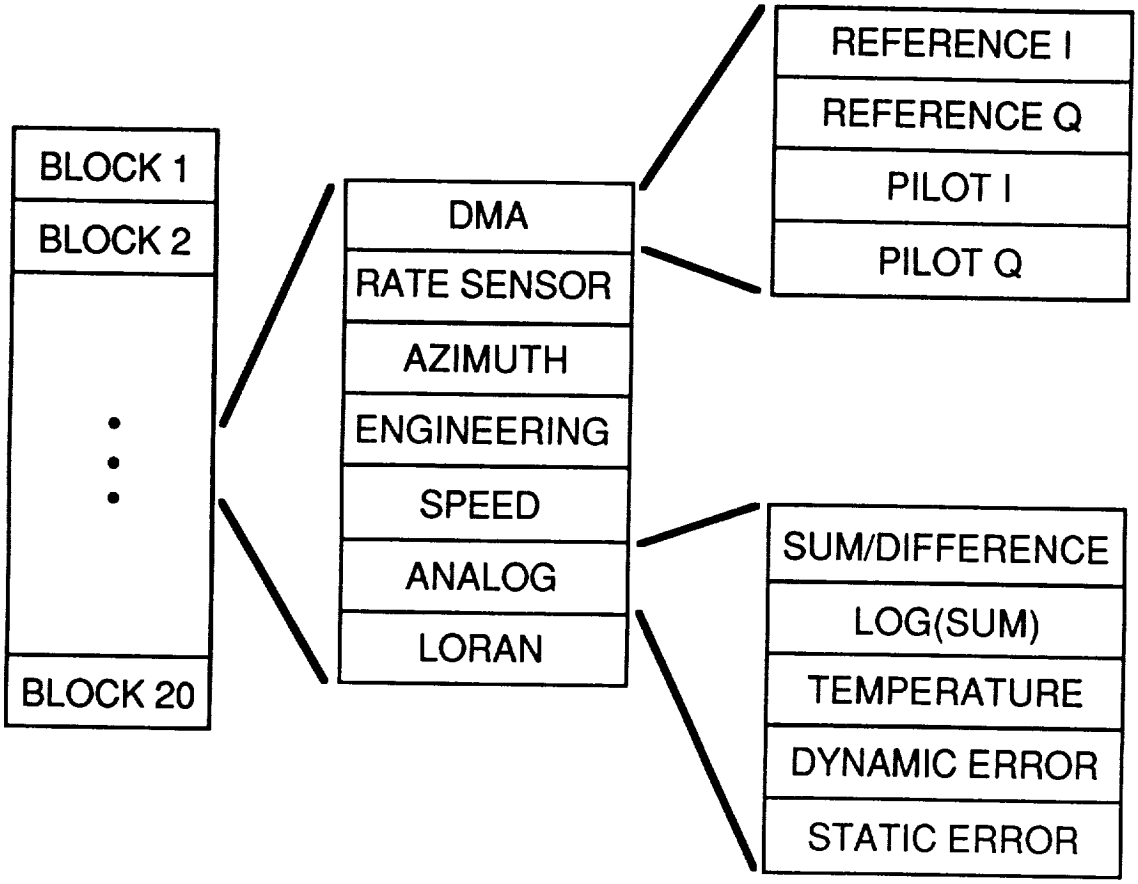

Figure 3
Satellite 1a Format

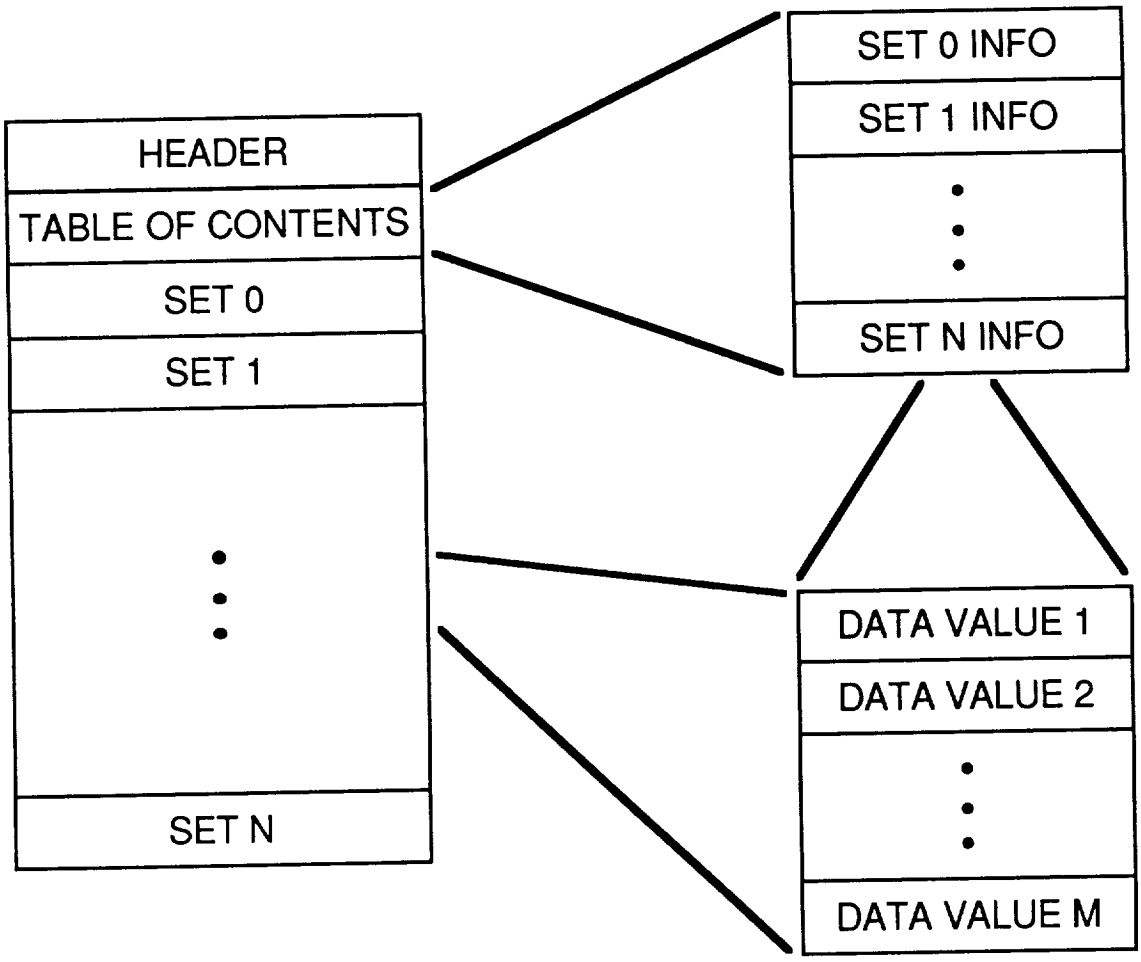

Figure 4
Archival Format