8.2.2 AN ACCELERATED FORTH DATA-ACQUISITION SYSTEM

S. A. Bowhill and A. D. Rennier

Department ot Electrical and Computer Engineering
University of Illinois
Urbana, Illinois 61801

A new data acquisition system was put into operation at Urbana in August 1984. It uses a standard Apple II microcomputer with 48 k RAM and a standard 5 1/4 inch floppy disk. Design criteria for the system includes the following:

1. Acquire two 8-bit data bytes each 10 microseconds for 60 altitudes, compared with 20, previously.
2. Coherently integrate real and imaginary components for 50 pulses (1/8 sec)
3. Display coherently integrated samples in real time
4. Perform complex autocorrelation each minute
5. Write correlation data to floppy disk each minute
6. Display height profiles of power and Doppler frequency each minute while data are being written to disk
7. Accommodate 1 hour's data on each side of floppy disk.
8. Perform the above for as many altitudes as possible

The system was implemented using fig-FORTH, a threaded interpretive language which permits easy interfacing to machine code. The throughput of this system is better by a factor of 6 than the PDP-15 minicomputer system previously used, and in addition has the real-time display feature and provides the data in much more convenient form. The improved performance is due to the following features:
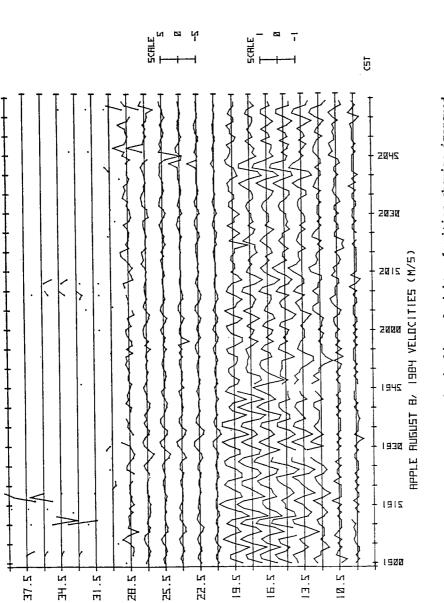
1. FORTH uses a zero-address pseudo-machine with an integer stack and integer arithmetic
2. An accelerator board raises the Apple clock frequency to 3.6 MHz
3. I/O and coherently integration routines were written in machine code and interrupt driven
4. Two A/D converters were used in tandem for the real and imaginary components
5. The Apple II permits direct screen access for the real-time display
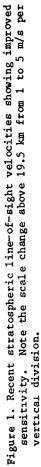6. The quarter-square algorithm was used for multiplication

Figure 1 shows the improved performance obtained from the new system in the stratosphere. Velocity data can be obtained to 28.5 km altitude.

Complete documentation of the software (RENNIER and BOWHILL, 1985) is available from the University of Illinois, together with compiled system disk and complete source code.

REFERENCE

Rennier, A. D., and S. A. Bowhill (1985), FORTH system for coherent-scatter radar data acquisition and processing, Aeron. Rep. 115, Aeron. Lab., Dept. Elec. Computer Eng., Univ. IL, Urbana-Champaign.

Figure 1. Recent stratospheric line-of-sight velocities showing improved sensitivity. Note the scale change above 19.5 km from 1 to 5 m/s per vertical division.