The intention of the cosmic ray research was to get high schools into the interesting research and understanding of cosmic ray. In order to do this there were some conditions that had to be met: to have Data Acquisition Systems in different schools that could digitize and hold data of about 100 bits per record, a system that gave the users the possibility of looking back in time to determine the shower direction of the cosmic rays, a system that enhanced proper time resolution for possible coincidences in the signals from separated schools, and a system that was very affordable for the high schools. The cosmic ray group presently has a CAMAC system that does these things, but is quite expensive, ranging from about $5000 to $10000; therefore, the plan to incorporate a cheaper method of achieving the goals listed above was develop, this is why I have studied the waveform digitizer and its usefulness in this area.

The waveform digitizer is a dual channel digitizer that allows sampling of an analog signal up to 10 Million Samples per second. It allows the user to perform several functions: capturing and viewing of slow signals, capturing and viewing of one-time events, it allows hard copying of display by using the plot function, it also gives the user memory capacity of 2000 samples X 8 bits per sample/channel. In order to achieve the objective of the project, there was a serial port circuitry added to the waveform digitizer. The circuitry shows the UART receiving 8 bits of data from the parallel in the digitizer and put data out through serial port, with a 9600 baud rate (bits per second).

In order to use the waveform digitizer effectively, I had to understand the design of the device, and this had to be done with some comprehension of digital logic and logic chips. I studied flip-flops, with focus on the D flip-flop and how it is used to design a shift-register. A D flip-flop mainly serves as a delay device, transferring its input state to the output at after the positive edge trigger of the clock. A shift register constructed with D flip-flops, at each clock pulse, shift its patterns of 0's and 1's to the right, with the data at the first D input entering from the left. This property makes the shift-register useful for parallel to serial data conversion and vice versa. I also studied some new logic devices that I had no prior experience with, for example, pulse duration control chips, counters, etc. A better understanding of these digital logic chips helped me in understanding the design of the waveform digitizer.

Understanding the waveform digitizer became possible after some comprehension of digital logic. The main thing after the comprehension of the digital logic was to understand how this logic worked together to enhance the performance of the waveform digitizer. I had to study the functions of these devices, and know what they were being used for in each case; I had to understand what was going on in the waveform digitizer box. The waveform digitizer schematic shows the digitizer having two inputs, channels 1 and 2. These inputs are connected to the AD and DA converters for needed signal conversion, in this case, we are more concerned with the AD converter. The AD converter is connected to a driver that drives the RAM, where the digitized information from the AD converter is stored in 2048 different addresses. The RAM is also connected to the DA converter for the purpose of getting digitized signal from the RAM and converting it to an analog signal for viewing on the oscilloscope. In the design, one can