My memories of Terry Hsu - by Rusty Nelson March 8,1998

I first met Terry in April of 1979, when I transferred from the Aerospace Division of Control Data Corp. to Digital Image Systems Division (DISD) of Control Data Corp. as it was known then. Terry already had been working at DISD for about 3 years. The design he, Bill Bhend and Rich Kirchner were all working on was nearly complete. Pete Juetten was the technical leader of the design project known as the Advanced Flexible Processor (AFP). All the people above worked for Gale Allen who was the Director of Engineering. The AFP was a very advanced technology high speed processor which had many computational elements of which Terry had designed about half of them. Terry designed the Shift/Boolean, Multiply, File and Data Memory units (4) within the AFP. My first job was to make an interconnect wire list to connect all the units together. I worked with all three designers when generating the wire list. Terry was always very helpful when I had questions concerning his units. After the circuit board panels (4) were built and assembled and my wire list was finished and the wiring that connected the four circuit board panels was installed, it was time to checkout the computer. I was heavily involved in the checkout of the prototype machine. We had a number of problems in the Control section that Bill Bhend designed and the External Memory Interface Unit that Rich Kirchner designed. I cannot remember a single problem in any of Terry's units. I was very impressed with the quality of his designs. Terry also designed a Storage Access Controller (SAC) for the same AFP project. I was not as involved in the checkout of this unit as most of my time was spent working on the AFP itself. The SAC again was an extremely complex device that allowed a number of AFP's to access shared memory. There were a few minor problems with the SAC but for the complexity, I would consider the design very good. I can not remember the date for sure, but Terry was awarded the Technical Excellence award for work on the AFP project in 1983 or 1984. The Technical Excellence award was only given to a few people each year and at the time Control Data was much larger (40,000 to 50,000 people) than it was in more recent times.

In 19841 again worked with Terry closely when it was decided by the top executives at Control Data that the AFP should be made into a product for sale throughout the company due to its extremely high computational capability. The original AFP was made for a special classified customer with a code name Hyberg and was a one of a kind computer. The cluster of AFP computers were used in very important classified work that probably helped end the cold war. It was decided that the original AFP design would be supplemented with a Floating Point Unit. Floating Point arithmetic is used to increase the precision and accuracy of arithmetic in a computer. The design of Floating Point logic is much more complicated than integer logic which was all the original AFP had. Terry was the technical leader on the Floating Point project. I had very little experience with Floating Point arithmetic. Terry designed the most complicated section, the floating point multiply unit. I designed the floating point adder unit and divide/square root unit. The design of the Floating Point add on unit worked almost flawlessly. I had several minor logic problems in my adder unit but as in the previous AFP design, no problems were discovered in Terry's multiply unit. Again I was impressed with the thoroughness of Terry's work.

The next project we worked on was a miniaturized version of the AFP. Whereas the AFP was very large and used very high-powered logic chips, the Micro AFP was to be a little slower but very small. It was to be place on aircraft which was impossible with the AFP due to its weight and high power requirements. The part Terry and I worked on was called the Complex Arithmetic Unit (CAU) which was a new unit that added a new capability for signal processing (radar). The unit still had to perform the old Shift/Boolean, Multiply, File and Add operations of the old AFP. Terry figured out how to implement the complex arithmetic operations necessary to meet the customer requirements. Terry always had the knack of being able to look at and understand an abstract concept and figure a way to implement it in logic (hardware). Not many engineers are capable of doing this and especially doing it well. Terry performed the initial architecture required to allow me to implement the detailed design. Again as in the previous designs, the CAU worked perfectly when the Application Specific Integrated Circuits (ASIC's) were build and checked. As a side note, one of the items I will always remember is one special part of the CAU that produced a term called "potential overflow". Basically in laymen's terms, it indicated before hand when the logic was about to exceed the limits of the hardware. The customer, who had many years of Radar experience instructed us to implement it in a very simple straightforward way. The problem, however, was that potential overflow was signaled very early thus wasting valuable accuracy. Terry studied the problem and found that by implementing a series expansion, the potential overflow would be signal later saving much sought after accuracy. The customer did not believe this could be done, but after analyzing Terry's solution, they were extremely pleased with the new approach. I know that no one in our project could have thought of an approach like this. I never understood exactly how Terry's logic worked but he showed me how to implement it and test it to make sure it worked properly.

The next project that Terry and I worked on was the next generation AFP computer known as the Advanced Parallel Processor (APP). I didn't work as closely with Terry on this processor as he worked mostly on the Cluster Memory section as it was known and I worked on the APP itself. Everything about the APP was bigger, faster and more complex than its predecessor, the AFP. This project lasted for 6 years and although, due to problems unrelated to the logic design, the APP did not perform up to the expected performance, however the APP was successfully shipped and used by a classified customer.

The last project in which I worked with Terry was the design of a High Speed Input/ Output interface (HiPPI) for the Fo6thill project. Again Terry did his usual excellent job of figuring how to implement the interface to meet very stringent (very high speed) requirements from the customer. This project just as the other previous projects was a complete success. In fact, the company (Computing Devices International) received over 2 million dollars in bonus payments (above the contract price) due to the excellent design of both the software and hardware.

I have written a lot of fairly technical information describing my work with Terry. I am sorry if much of it is boring to the nontechnical reader. The just of this summary of my work with Terry is that I was helped many times by Terry on technical problems that were difficult for me to solve. We also discussed other things other than computers such as investments, car problems, and other things like problems with our children. For someone as brilliant as Terry, he never acted in a condescending manner as some other "smart" people I have been associated with have. One of the things I remember that Terry and I talked about many years ago was when he owned an old red Ford Pinto. I remember one day he came to me to discuss what to do about a problem he had with his Pinto. It seems he was backing out of his driveway and because there was another car in or near the driveway, he ended up backed into a fire hydrant at the end of has driveway. He was pretty embarrassed by what had happened. He ask me if I would look at the damage. We went out to the parking lot to inspect the Pinto. The damage wasn't real bad but it didn't look good either. He wanted to know if I thought he could fix it himself or have to take it to a body shop. I said with some 'Bondo' (plastic body filler) he could make it look better, but it would be a lot of work sanding, priming and painting the damaged area. I didn't think much about it after we discussed how it could be fixed. I can't remember how much later, maybe 3 or 4 weeks, he can by my office to tell me that he had fixed it. We went out to look at it in the parking lot again. I've done some body work before so I know a good job from and bad job. The job Terry did on the Pinto was, let's just say, 'was not very professional'. I didn't have the heart to tell him that it looked pretty amateurish since I knew he must have spent a lot of time on the repairs. He drove that Pinto for several more years after the repair was made and I think he had to eventually replace the engine due to severe mechanical problem that ruined the engine. I think he located an engine in a salvage yard and installed the used engine in the Pinto. He must of really loved that Pinto with all the work he put into the car.

Terry and I had a lot of interesting discussions concerning many topics. I'll miss talking to him in the halls at work. I will never forget him and the help he gave me over the 18 plus years I had the privilege to know him.

Rusty Nelson March 1998

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