**Leading Magnetics R&D in Academia**

When I joined Carnegie Mellon University (CMU) in September, 1978 after having been a first level manager at the IBM T. J. Watson Research Center, CMU was one of the few universities in the US still involved in research on magnetic materials. On the other hand Japan had strong university efforts and Japanese companies were gaining market share relative to US companies. In April, 1982, Professors S. Charap, J. Artman, L. Berger, Z. Cendes and I were actively working on magnetics in CMU, while others such as Prof. D. Laughlin were pursuing related topics, and I organized a workshop to address the question of what an academic center could do to further research in magnetic materials and devices. A dozen technical leaders from industry attended, and in two days time we developed a list of 30 PhD thesis topics that were judged to be of interest to industry, but not likely to be done in industry. Based upon those topics, I wrote a proposal to industrial firms asking each of them for a $750,000 commitment over a three-year timeframe in order to begin a Magnetics Technology Center. With the assistance of then Dean of Engineering, Angel Jordan, and then President, Richard Cyert, I was successful in May, 1983 in getting both IBM and 3M to commit to funding the Center. Within the following year numerous other companies also joined. Then, in 1989 we applied to the NSF to become an ERC, and the Data Storage Systems Center was awarded in 1990.

It has been said that the overall impact of the DSSC was to keep the data storage industry based in the US and not allow it to migrate abroad as occurred with TV sets, DRAM and many other technologies. Both the research carried out in the Center as well as the many graduates it produced contributed to this outcome.

Research carried out in the Center led to patents on disk media that enabled laptop drives and early iPods. It also resulted in a patented signal processing algorithm valued at over $750 million that helped to enable Perpendicular Magnetic Recording (PMR), which has been used in disk drives since 2005 to increase the areal density of recording from 100 gigabits/in2 to 2 terabits/in2. It also led to the development of Heat Assisted Magnetic Recording (HAMR), which many expect to replace PMR in the near future.

By the late 90’s, over ten new PhD’s were being graduated from the center every year and most of them either went to work and became technical leaders in the data storage industry or faculty who began magnetics and data storage programs at other universities. Moreover, other universities, seeing the success of the DSSC, decided to start their own centers in the field, and the industrial sponsors of the DSSC formed the National Storage Industry Consortium to coordinate the many university efforts that had started.

In retrospect, I was fortunate to be in the right place at the right time. When I joined CMU in 1978, the only university in the US with a significant program in magnetic recording was the University of Minnesota where Prof. Jack Judy was working. However the disk drive industry was exploding, and by 1985, there were 85 companies involved, and as indicated above, the US industry felt threatened by foreign competition. I was fortunate to recognize the opportunity and seize upon it.

Being Director of the DSSC provided me the opportunity to considerably broaden my knowledge of data storage technology. At IBM Research I had been in charge of the design and testing of magnetic bubble memory devices, but being the Director of the DSSC provided the opportunity to become involved not only in design and testing, but in micro-fabrication and to learn much more about controls, signal processing and mechanical issues affecting tribology at the head-disk interface. Leading a team of people to bring out new technologies like PMR and HAMR that required all those disciplines to work together was both technically challenging and rewarding. As I think most successful technical leaders will attest, however, it is not the technical challenges, which are the most difficult. It is the challenge of getting everyone working as a team. Therefore in my view the most rewarding aspect of the job was to identify and get faculty and students with little or no prior technical knowledge of disk drives, but with the necessary skills to apply them to disk drive technology and work together with others from other disciplines to bring out new technologies like PMR and HAMR. Certainly there were times when I did not enjoy having to confront faculty, staff and/or students to resolve interpersonal or administrative issues, but in the end, having done so in order to successfully deliver the technologies and the students that the industry required was highly rewarding.

Thus, I think that what I learned more than anything else from being Director of the DSSC is the importance of leadership. To provide leadership in a technical organization requires not only technical knowledge, but also a vision of what can be done both technically and organizationally, as well as interpersonal and managerial skills. To that end, after I stepped down as Director of the DSSC to become Senior Vice President of Research and Chief Technical Officer at Seagate Technology in 1998, and then nine years later in 2007 retired from Seagate and returned to CMU, I was asked to teach a new course entitled “Leading and Managing R&D”.