APPENDIX A: THE RECOLLECTIONS OF BARRIE GILBERT REGARDING THE READ-OUT EFFORT AND THE 7000 SERIES IN GENERAL

NOTES FROM INTERVIEW WITH BARRIE GILBERT

November 30, 1977

The Read-Out Effort

*Barrie Gilbert joined Tek in 1964. He had previously been working on sampling oscilloscopes in Britain. After only two months of working for Al Zimmerman on sampling scopes, he joined the "New Generation Group" under Wim Velsink.

*A critical issue at the time was a readout system for the New Generation. Fiber optic, mechanical and simple electrical systems were being proposed, but there were problems with each of these approaches. Barrie was convinced from the beginning that the readout should be done electronically, although the cost of prevalent character generators was estimated at about $1,000. Some of the many advantages of electronics readout included the potential for virtually any message content and a same-plane display, which would make it easier to take a picture of the information.

*It was clear from the first that custom ICs were needed to meet most objectives; and, anyway, general purpose ICs were not available. Barrie also decided that the coding should be in the form of analog current levels, which would greatly simplify the plug-in coding circuits. Barrie also adopted several other ground rules: the code organization should be optimized for the major plug-in applications and yet every plug-in should have the potential of being used with a mainframe with the readout; there should be built-in accounting for probe multiplication factors; all alphabetic characters, numerals, mathematical symbols, and some Greek characters should be available; there should be two ten-character words available per plug-in; there should be no restrictions on the message content; a set of preprogrammed instructions to the readout system should be included; future expansion of the coding matrix should be possible; etc., etc.

*One of the concepts that Barrie felt strongly about was "superintegration." Most electronic circuits are built up by inter-connecting discrete elements. The conventional approach to IC design is to continue this approach, except put them on a chip. Barrie felt it desirable to try to achieve the desired electrical functions by merging elements and by relying upon the electrical functions by merging elements and by relying upon the electrical interplay that occurred between the elements themselves (a "juxtaposition of diffusions"). The result of the superintegration approach is a "sort of glob" that does not make sense in any schematic terms. Although to this day superintegration is still an esoteric approach not much used, Barrie's thoughts about superintegration are credited with inspiring IBM's Berger and Weidmann (who developed I^2L) and Barrie used superintegration extensively in the final design of the readout system.

*Barrie's first design generated the analog input signal spatially on the chip itself. This approach took advantage of the two-dimensional nature of an IC chip and drew the characters as a series of vector strokes. Barrie checked out this approach on a 'boot-legged mockup'. . .a prototype fashioned with teledeltos paper and dime store earrings (a prototype made from ICs would have been very expensive). Although the mock-up worked, in practice it would have required fashioning a separate IC chip for each character desired. Also, in Barrie's words, "it was a misapplication of the superintegration concept."

*Since Barrie wanted to put at least ten characters on each chip, he abandoned the two-dimensional replica approach. Each character was conceived of as consisting of eight points with seven vector strokes connecting the points. Barrie then represented the points with an "x," "y," positional scheme which was scanned by a dee-shaped region. There was still a snag with this approach. . .it required separate emitter masks for each set of ten characters, which was undesirable from the point of view of low-cost manufacture.

*Barrie's third design required only one mask to program. It was an "analog read-only memory" which could deliver two waveforms, one for the "x" coordinate, one for the "y." The majority of the circuits involved were designed by Barrie Gilbert with Les Larson also supplying some crucial contributions.

*The read-out effort had been started in mid-1965, and a prototype version that could simulate the performance desired was completed by about September, 1967.

*Barrie Gilbert has recently returned to Tek after a six and one-half year absence, working for Plessey and Analog Devices in Britain. On reflecting of the differences between Tek and Plessey and between Tek and other firms in general, Barrie remarked on two differences that seemed important: 1) at Tek, you were assumed to be able to do things until you failed whereas at Plessey (and in Britain, generally) you were assumed incapable until you proved yourself, and 2) all materials to do a job were readily available at Tek, many on an open-shelf, at Tek, it was assumed that you would make good use of the material. . .if you used them for a hobby project, then that at least improved your technical ability; in Britain, everything had to be ordered, and you had to go to a stock man who would go get things for you; the Tek System is "invigorating" and gives you a feeling that the company is ready to support you; the Tek System also reduces schedule shippage and helps engineers evaluate instrument cost. (Unfortunately, many of these erstwhile advantages under Item 2 are less tangible, as cost accounting procedures in engineering development tighten their self-defeating grip.)

NOTES FROM SECOND INTERVIEW WITH BARRIE GILBERT - JANUARY 17, 1978

BIOGRAPHICAL NOTES

*Barrie Gilber seems always to have been interested in electronics and oscilloscopes. At age nine he became involved with a deaf friend who made his own hearing aids from tubes wired into tobacco tins. This friend helped Barrie to make a three-stage triode amp and taught him how to solder. By age 11 Barrie had made his first oscilloscope using as a display a VCR 97 (Valve Common Receiving Tube. . .six inch green phosphor. . .war surplus). Barrie also built several of his own televisions and vividly remembers watching the Coronation in 1952 on a set he had made. To Barrie this was a "golden age" for a boy learning electronics because of the availability of cheap, ex-government radar tubes and beautifully-built surplus equipment. A small hardship was the refusal of his father to have electricity installed in their home (because he had just redecorated the house throughout), so Barrie had to take his early oscilloscopes to his friend's house about a mile away to try them out. So, while Barrie's engineering experience has centered around circuits and semiconductors, he has always been interested in visual displays and oscilloscopes.

THE 7000 SERIES IN GENERAL

*Soon after Barrie had joined Tek, Lang Hedrick called and Barrie was shifted to the 7000 series. Other people on the team then were Roy Hayes, Les Larson, Bill Peek, Joe Burger, John Horn and Wim Velsink (the leader).

*The ideas for the 7000 Series seemed to come from a variety of sources. . . the 540 and 530 series had been in existence for a long time and a catalog of ideas for improvements had been built up over the years. And, Howard had a lot of ideas. It was clear that with the maturation of transistors and the age of the 500 series, "the time was right for a new line. . ."

*"There was no master architect for the 7000 series. . .no one as an individual planned the features. It was a democratic evolutionary process. There was no awareness or feeling of enforced management. We dealt with matters in a pragmatic way. All the engineers were in this together. We knew the project was important: we were piecing together the Cadillac of Oscilloscopes."

*The preferred form of communication was verbal. There was a lot of common discussions. "We were excited by the project. . .all the technical talent was assembled in Building 50 and there was no sense of diffusion. There was still a small company feeling. And, usually all the materials and components we needed for the job were readily available. . ."

*There was little emphasis then on what it ought to cost in terms of engineering effort to do this project. We knew we had to do it whatever. Today we think (necessarily) in terms of our limited resources and think in terms of costs. Now and again a project comes along that short circuits the long approval process because it is so important."

*"I had the feeling that somebody, somewhere knew what the 7000 development was costing, but guys like Kobbe and Velsink thought as engineers not managers. . .they also were not hierarchical. So I knew that I could always do

what I had to do--there was no need to write proposal documents that would then get approved. I could basically lay out a plan verbally and then do it. Documents were not written as required by a process, but rather they were written to explain with great excitement what now could be done. . ."

*"At the time we knew that not even a founder could stand in the way of a good idea. . .and Howard never would stop a good idea if it was presented to him. . . he was reasonable. I never thought of him as a barrier, even though he doubtless had veto powers. He was more visible then, interested in everything, but still he was not a barrier.

*"Most importantly, from my experience, the very best ideas were bootlegged into existence, often by working through the night."

GENERAL COMMENTS

*"The development of Integrated Circuits has altered the way we now approach instrument design, but not in any inconoclastic way. Rather ICs have opened up new possibilities. The key thought is not whether IC designs are becoming mature, it's that ICs have added a new dynamic to the profession. These days, in the course of the development of a product you never really know what will happen before you are through that will change your basic approach. Before it was easier to decide what to do--and then the struggle was in doing it. Now the struggle is to decide what to do--what will have market appeal. Almost anything is possible. . .there are fewer challenges in which purely physical constraints are the problem."

Growth at H-P is from the inside out, but we seem to need to take our cues from the outsides. . .reaction engineering vs. action engineering."

*"We do have the inclination to pursue high technology in projects where the state-of-the-art is involved. . .But these projects are usually undertaken only when its clear everybody else is going down the same road. We are not a strong research outfit. . .we do not really have a Tek Research Lab in the way H-P does. Tek Lab programs sit squarely on the shoulders of other companies' processes and inventions, in the majority of cases, and they are much more tightly coupled to short-term needs."

*"Maybe we can do more by making clever adaptations of available technologies rather than trying to pioneer new and better technologies. We might be able to cut off all advanced projects and still address our market, but that seems unlikely. Once we were out there all alone, and we were forced to do our own research into basic technologies. . .The 7000 Series was a dazzle, a broad spectrum triumph. There was nothing else on the market like it. When it came out we were good at everything from circuits and CRTs to read-outs, relays and push-buttons. Our human engineering was way ahead. But now the rest of the world has caught up and now we have fewer distinctive abilities."

*"In the 7000 Series development days, engineering was the center of Tek universe. . .the success of the entire company rested on the engineers. I sometimes feel that engineering is becoming almost a service operation. . .there to serve the entity which is 'The Company.' We are no longer primarily a superb engineering company. . .we are now a manufacturing, marketing, money-making machine. I am not saying that it is necessarily bad. . .it pays my

salary. But we need to be aware of these things and make our management decisions in accord with these realities. I liked it better when our slogan was "Committed to Technical Excellence."