How Chris came to the Computer

To start with, my father was a mechanical engineer who was also a graduate of CIT and so becoming an engineer and attending CIT was in my mind from the beginning although I knew little about either.

In the early 1960's I developed several interests. One was in amateur radio and another was in magnetic tape recording. In addition I became involved with my school drama club and after an initial outing in which I proved to myself that I had no future as an actor, I became involved in the design of both lighting and sound for shows, becoming the lighting director for several. I also got a tape recorder and recorded various performances of both the drama club and the school chorus of which I was also a member. Finally, I occasionally hung around the studios of a local low power "community music" FM station chatting with the combo man. All of these activities or interests involved the use of electronics or at least electricity. Further, building simple electrical circuits was easy for a young kid when compared to the construction of mechanical things.

It was a ninth grade English teacher, however, who caused me to hit the nail on the head with an assignment for the class to write an essay on what we were going to do for our careers. With the above background and interests I selected electrical engineering and to complete the essay had to at least study a bit about what being an electrical engineer entailed. This analysis led me, however, to see myself working in some manner in the entertainment industry, either in the broadcasting or recording industries or maybe even working on Broadway.

At that time I knew no more about computers than the average man on the street. One would occasionally see images of them either printed or on film or TV, the usual mainframe with banks of tape drives, reels spinning, along with some text or dialog about "giant brains" and such. However, it didn't dawn on me then to see them as a possible career path.

To any techie minded kid growing up in the late 1950's and 1960's, the big story was the "space race". From the launch of Sputnik I and President Eisenhower's announcement of the International Geophysical Year, both in 1957 (and both of which I clearly remember), the emphasis was on space science and related technologies and I was right there with it in spirit. But my day-to-day activities seemingly had little to do with either. My only real involvement was a vicarious one.

Back then, my family received the weekly news and photo magazine, "Life". In those days, the evening national news lasted only 15 minutes and usually consisted of someone sitting at a desk in front of a bank of clattering teletypewriters reading the news with an occasional still photo thrown in. In comparison, "Life" magazine was kind of a window on the world with its many photos and stories. Further, "Life" had signed an exclusive deal with NASA to document the lives of the astronauts and of course this lead to further coverage of the space program in general. When I got home from school and found that week's issue of "Life" in the daily mail, I would devour it immediately.

So, imagine my pleasure when the issue for September 25, 1964 arrived. The cover was a fold-out artist's conception of what the launch of a Saturn V rocket to the moon would look like, and inside were a number of articles related to technical subjects and a fair amount of prognostication about future developments. It makes an interesting read to this day. You can see this cover here: http://books.google.com/books?id=rUwEAAAAMBAJ&pg=PAFront (if you scroll down to page 2 you will see the fold-out part of the cover image).

There are seminal events in everyone's life and this particular issue was at least two in mine. One article was about a man named Bill Wolf who was one of the "new breed of entrepreneurs" in the space race, selling information rather than "stuff" and using computers to do it. But the thing which really caught my eye was a one page sidebar to this article titled, "His Long Romance with an Aging Chunk of Hardware" which detailed his "love" for his first computer, MIT's "Project Whirlwind" and how he had rescued it from the scrap heap, restoring it to operation, because, "it was one of a kind" and "pure". I won't detail the computer "firsts" attributed to the Whirlwind project but they are many and pretty much include the birth of the minicomputer industry around Boston. You can read this one page here: http://books.google.com/books?id=rUwEAAAAMBAJ&pg=PA115 . Well, this got my interest and attention, starting me on a path to trying to learn more about computers. There was no access for a young kid to computers back then, I had to satisfy myself with visits to the local main library and study of whatever materials I could find there. Most of these dealt with hardware design (vacuum tube :-) and logic design. I don't recall finding anything about "software" or "programming" but after all I was going to be an electrical engineer and this meant designing and building material things of an electrical nature of which a computer was, of course, one, not designing something as ephemeral as software :-)

Recall I said this issue of "Life" caused two seminal events in my life. There was also an article on model rocketry, a hobby of which I had previously been unaware. As a result, I got into this hobby and built a number of models during the next two years, launching them either from my parents large back yard (which led to losing some of them in the surrounding trees :-) or from an abandoned farmers field a quarter mile south of there which was much more open (and about half a mile right off the end of Runway 28 at the Rochester airport :-) When I arrived at CIT in fall 1966 my interest in radio and broadcasting led me to immediately get involved with the campus radio station, WRCT. There I met up with another incoming freshman who shared an interest in model rocketry, Pat Stakem. Working together with him that fall in front of an ASR35 Teletype tied to the G-20 computers, we both learned the rudiments of Algol. We remain friends to this day. You can see this article starting at: http://books.google.com/books?id=rUwEAAAAMBAJ&pg=PA133 . By scrolling around from any of the above links, you can read this issue of "Life" magazine. Again, it makes for an interesting read.

Getting back to the story, with my new found interest in computers I spent a lot of time in my junior year of high school (64-65) and the summer beyond studying what I could find about computers. Again, this mostly involved basic hardware and logic design including the study of truth tables and Karnaugh maps. So when, at the beginning of my senior year of high school, a school wide "math project" was announced, I knew at least what my subject matter for the project would be. Originally I was just going to illustrate logic design by building some simple "AND" and "OR" gates with switches, lights and batteries, but then thinking about it, that seemed too simple for a decent project. One of the books I had found discussed the design of something called a "half adder" which would take two binary inputs and provide two binary outputs, one representing the "sum" and the other the "carry" of the addition of the two inputs. This book went on to describe combining two half adders together made a "full adder" which could also add in a third binary "carry" value from the immediately less significant binary digit in a binary "word". Further, with the exception of the low order bit, which as it didn't have a carry input needed only a half adder, full adders could be used at any bit position in a word and thus could be used to add together two binary "words" of any length. At first, doing a binary adder seemed too complex and I considered somehow just building a one-bit half adder for the project. When I realized, however, that a half adder function could be designed using only two DPDT switches, one side of each switch wired for the sum output (an XOR function) and the other for the carry output (an AND function) I realized that a full adder and in fact a multi-bit binary adder was a possibility.

This realization led me to design and build a four bit binary adder. For this design, the "input" half

adders would each only require a pair of DPDT toggle switches (four pairs required for a four bit adder) and DPDT toggle switches were not hard to find. As the "output" half adders needed to be controlled electrically, DPDT relays would be required, once again a pair for each bit position, but this time only for the three most significant binary digits. These were harder to find. However, my father was able to secure six used DPDT relays from the scrap department of his employer. The only issue was the only DPDT relays he could find had 110 VAC magnet coils, not the low voltage DC ones for which I was hoping. Thus my design, if I was not careful, could result in a "shocking experience" as it would have to run off the commercial power mains. Dry cell batteries for power were no longer an option. Well in today's sophisticated world, such a simple project would likely either be laughed off the stage or, sadly, viewed as too hazardous for a young person to build due to the danger of electric shock. Back then, however, it was viewed as almost remarkable that a young kid could build a "computer" and the project got rave reviews :-)

Of course, pack rat that I am, my four bit binary adder still exists and still works as well as the day it was built. Here it is adding decimal 11 and 7 (1011 and 0111, look at the switch positions :-)
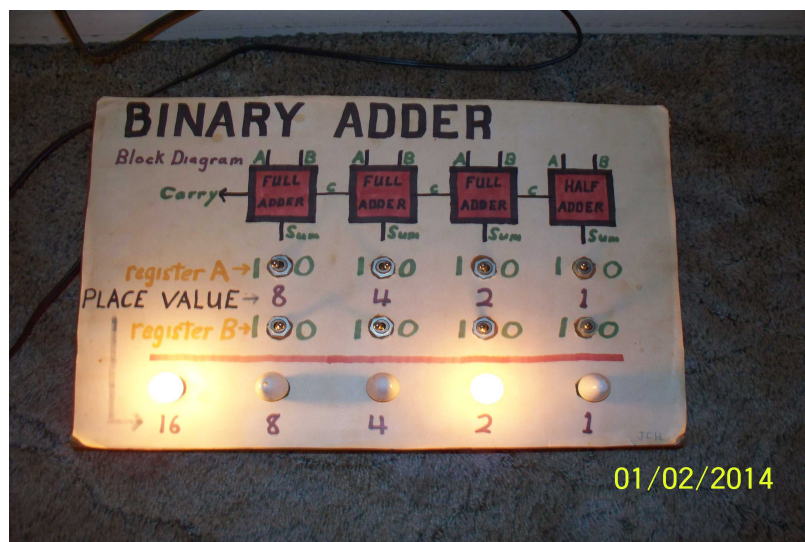
The underside of the unit shows the six relays and the wiring.

Also during my senior year of high school, that fall of 1965, my parents and I visited the CIT campus for the annual fall "Homecoming" event. Here in Rochester, NY there is an old and active CIT/CMU alumni association or "clan" and my father was a member. (I've now been a member of the board of this local clan for about 30 years.) One of the other members back then had a son already attending CIT as a grad student and during this visit this son took me under his wing and we toured the campus. Given my interest in computers he arranged for us to visit the fourth floor of Scaife Hall and see the pair of Bendix (by then labeled Control Data) G-20's in action. It was the first time I had ever been in the presence of an electronic digital computer and the first time I ever heard the staccato sound of a line printer at work (and those G-20 printers were loud :-) The rest is history...

About 30 years after first reading that article on Whirlwind in "Life", I acquired a Whirlwind module, Register Driver Type I, Serial No. 3, for my collection. So it wouldn't be right not to include a photo or two of that Whirlwind module. After all, Whirlwind is what started it all :-)

Recently while looking through some old files I found a print of a photograph I had taken the evening in late 1965 that the student's parents were invited to visit the school to view the results of the school wide math project (I was my high school's "official" photographer and this photo may have appeared in the student newspaper). The student projects were arrayed on tables in front of the student lockers which lined the hallways of the high school. The photo shows the adder itself along with parts of the five signs I had prepared to illustrate logic design along, of course, with some of the other student's efforts. The man in the photo was the father of a classmate, Sue Fisher. As the photo documents that school wide math project as a whole, I think it is an appropriate addition to this write-up.