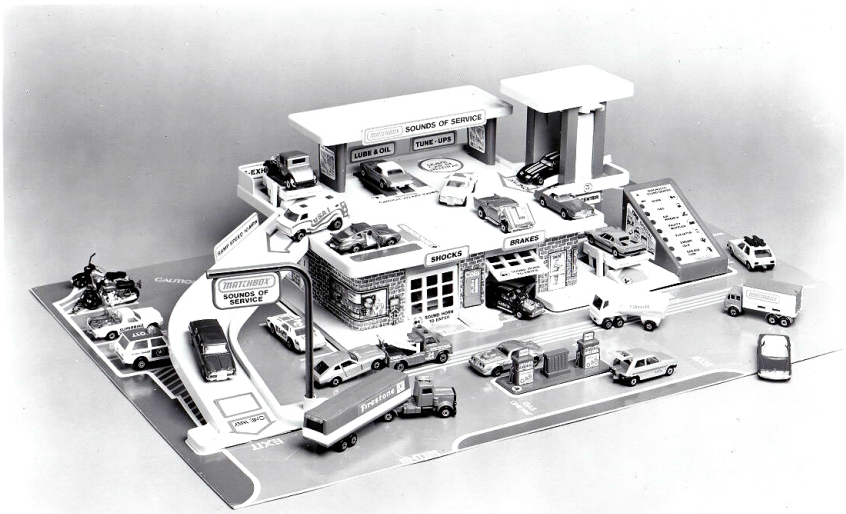
Teds Work Summary

When I look at my work history over the course of my career I ask “Did I really get to do all that!?” It was a challenge but I worked with some of the finest folks in the industry both inside and outside of Texas Instruments.

I started as a Product Engineer. PE’s received the devices after design pronounced them ready for production. We were responsible for testing them and making any circuit tweaks needed to put the devices well within the allowable tolerances and that means more devices pass final test and that means more profit for the company. I got to be a product engineer for LittleFuse Automotive Chips and a Pacemaker Chip for Cardiac Pacemakers Inc. That Pacemaker chip was groundbreaking in that it was programmable after being implanted. That’s common today but was unheard of then. While PE on that chip I wrote my first paper. I did the experiments, the research and put all my college technical writing training to use. It was called “The Effects on Chip adhesion of the Removal Of Metallization From the Mounting Cavity Of 36 Lead Chip Carrier.” My boss read it and said it was good. My first big accomplishment and I nailed it!

In the early 1980’s I was given a new job. Probably because I hung out with the lone applications engineer (Bob Smith) and played with all the neat consumer chips we made, they made me an applications engineer. One day TI routed a letter to me from the Lesney company in England. From my youth I knew Lesney made Matchbox cars. They were asking if our analog stand alone sound chip could make the enclosed list of sounds. I sank my teeth into the project and sure enough, with a had-full of components I could produce all the sounds they requested. I sent them a schematic and a sample sound chip. About 2 weeks later a gentleman from Lesney showed up in Sherman and we discussed how to make our sound chip produce all the sounds. He was thrilled (and so was I) and after a demonstration I introduced him to our marketing folks. Less than a year later Matchbox introduced their Sounds of Service toy where you could drive a Matchbox car



MATCHBOX EDP #600101 "SOUNDS OF SERVICE"
LESNEY PRODUCTS CORP., 141 WEST COMMERCIAL AVE., MOONACHIE, NJ 07074

into a service bay, press a button and hear the sound of your car being serviced. What a cool toy.

We also heard from Link. They made aircraft training simulators and were making a modern day simulator for an old Biplane, the Stearman. They wanted to know if our sound chip could make a radial engine sound. Hmmm, I took my cigar box of components and camped out in the lab. But I did it and it sounded great. I ask the design engineering manager (Doug) for his opinion and he brought in our physical chip layout manager (Aldo). They listened and agreed, it sounded very good. My design used two sound chips and even had a speed control. I drew it up and sent the schematic and some sample sound chips to Link. They contacted me for details and marketing said they bought some chips. Since they only made a very limited number of simulators and didn't make consumer products I never heard any more about it. But I sure did enjoy the experience. I recently found the schematic and built the circuitry again. It still works and it still sounds good.

After this our group changed its charter and no longer made consumer chips. With the change I moved into design engineering. We were now charged with updating the iconic 74 family of logic chips. This was exciting to me because we had used these chips in college to learn computer logic. A TI data book for these chips was our textbook. It had lots and lots of these chips. For an electronics nerd like me to actually design some was an awesome opportunity and I couldn't wait to sink my teeth into this. These were old designs and power hungry. Low power was what the industry wanted and TI had an entirely new process that was both power stingy and physically smaller. Smaller size means more profit for TI so we redesigned the entire family into this new process. We redesigned the entire family every time time time TI developed a new smaller low power process. This evolution culminated in the power sipping CMOS technology. CMOS had been around for a while but it was inherently too slow. TI figured out how to make it fast. We did this redesign of the family and I got very good at logic design. Our tools also advanced and eventually we each had our own very fast computers. Powerful enough to run our circuit simulations on. This was a very big deal in the late 80's. I also got to put my programming courses to use. I wrote 5 or 6 programs that really improved the efficiency of our design group. That was fun. One problem with these logic chips was the bane of the industry was called simultaneous switching. These parts were so fast they could not get rid of the extra current from the outputs quick enough. Constrained by the physics of the plastic package which was the industry standard we simply could not find a way to get the current out fast enough. Not getting that current out fast enough made the internal voltages change. All the internal circuits shared those same internal changed voltages and since they talked only to each other, everything inside the chip was

okay. But when they talked to the outside world that didn't have changed voltages, problems arose and false conditions were generated. We fought this problem along with the industry. But I had an idea. If we could make the inputs respond to the outside world but then use the changed voltages of the internal circuits no false signals would be generated. I tried a little modification that would do this and implemented in a simulation. It worked. It was tweaked over time and it eventually got the name Glitch-Buster. It resulted in 3 patents for TI in my name. We had the only Flip-Flop (a type of computer logic) in the industry that would not reset itself because of the changed internal voltages brought on by Simultaneous Switching. Once the glitch-busters were fully understood other designers improved on them and they too received patents for TI.

Eventually the market for these type of logic chips shrank to the point where TI left the market to other companies. I transferred to another group in Sherman and we made more complex chips, usually in teams of 2 or 3 designers. We successfully made a FIFO (First In First Out) memory that although it had very little capacity it was very very fast. It was used as kind of a stretchy pipe between data chips operating at different speeds. I was task with the Flag Pins. These pins told the data chips when our FIFO was full, almost full, almost empty, and empty. Simultaneous Switching almost reared its ugly head again but we didn't have so much current to get out so the internal voltages behaved themselves. But I was told to not contribute any current, which was tough for me because the circuitry to keep track of how full the memory was getting tended to cause Simultaneous Switching problems by themselves. So I learned Grey Code and used it in my circuits. Grey Code counts by only changing one bit at a time. Unlike binary which can change a lot of bits at a time generating a lot of current which we then needed to get rid of. I had several large counters going at once to determine how full the memory was getting. This helped a lot. Next we designed a chip for the phone company that used their SONET/ATM format. There were two of us and I designed the half of the chip that took data and packaged it into their format, determined parity to allow error checking in transmission, and then shipped it all out. Interestingly making these two deigns used software to generate the physical circuitry instead of a human brain. They sent me to Austin, Texas to learn this language and that proved to be a valuable arrow to add to my quiver. Again my programming background paid off.

Those circuits were taken over by a group in Dallas and I chose to go back to my other engineering group in Sherman. A spot was open for an analog designer. Analog Design is different than digital. Circuits using analog methods take advantage of the physics of the internal devices to make them function. There are amplifier circuits, voltage reference circuits, voltage comparing circuits and other functions you never even knew transistors

could do. It takes a different skill set but, although small, our group had some very bright people and I ask a lot of questions. Soon I mastered it and when our little groups boss decided to move on, he recommended the management of the group be turned over to me. Thus began my one and only experience in management, I didn't like it. But as I said we had some very smart people and that aspect, being part of all the designs, was pure fun. What I didn't like was having to rank people and then merge my ranking in with the digital designers. I wanted everyone of my people to be on top but that is not realistic and I lost many nights worth of sleep. Our little group turned such a profit that TI wanted it moved to the Dallas Expressway site and enlarged. My roots were deep in Sherman. My boys were in a great small town school system. I decided not to move and again returned to digital design in Sherman. I returned to a group designing signal switches. Ultra low resistance, fast on/off solid state switches that could be controlled with a simple on/off logic level. You have not heard of these circuits because they and the circuits containing them are generally deep inside of some electronic part you have not heard of. But that was about to change for me.

I'm not sure how our field sales engineer in Cupertino California heard about us in Sherman Texas, but he did. He was trying to get Apple to give Texas Instruments another try despite their low opinion of TI gained by some other group. He succeeded and since I had some experience in analog I was assigned to be on a two man design team. We worked hard and designed a great device to meet their specifications. But right before Christmas Apple choose another vendor. After Christmas our boss said "Finish it anyway." We did and even made some units. It worked so well we sent some of the units to Apple. I can't guarantee this but I heard the other companies device did not function properly and ours did. They still did not award us the contract but it got us noticed. For the next chip proposal we were on their list and I again was on the team. I went to California and the field sales engineer and I went to the Apple Campus to gain more details about the function and see their breadboard schematic. They are very secretive and would not send us a copy. Apple was a nerds paradise and I got to sketch circuit details with legends. I was literally drawing circuits on the back of an envelope with Apple Employee #16. I was inside and working in nerd heaven. Several weeks later Apple engineers wanted a status meeting. You don't say "give me another two weeks" to Apple. When they say jump, you simply say, how high? I gathered up all my schematics and put them in a presentation. My Product Engineer, my boss, and I set off for Cupertino again to present it. There was a big hole in my schematics. it was a box I just could not figure out. It was simply a square on my schematics. On the airplane I was half dozing and I suddenly set up with an epiphany, I knew how to do it! I sketched it out and it made sense. We arrived in

Cupertino and went to the field sales office. There I logged into my powerful computer on the Sherman system and entered the components. I ran a simulation and it worked beautifully. I could now fill in that empty box. At the presentation some of the best Apple engineers and managers were in attendance. Our field sales engineer did not help my nerves by pointing them out. My boss opened the meeting but quickly turned it over to me. He even suggested I go up front by the screen to be seen and heard better. As I got up and headed for the front I caught his computer power cord on my foot and yanked the computer off the table onto his lap and I went flailing to regain my balance. Everyone laughed hard while my boss and the Product engineer untangled me. But it proved to a great ice breaker and even a relaxing guffaw. From there on the presentation went off without a flaw, even the new circuitry which Apple thought I had all along. It was a highpoint in my career. Everyone loved it. They bought that chip and a door into Apple was opened.

After The Presentation.

I was again assigned to the next Apple chip but health wise, the roof fell in.

It started small. If I was walking while reading I would veer left and bump into the wall. That was odd but it got worse. I would get so dizzy I could not even stand up. It would come and go. At the BEST game setup on Friday night I had to call home and get a ride. But at the contest the next day I did okay. At the Rocket Club launch the next Saturday I was a basket case. I could not even look up to follow the kids rockets. Carolyn, my wife, was with me and took up the slack, she even put me in the truck afterwards and packed up all the equipment. She was great. She is a nurse and arranged doctor visits and they looked and tested all my inner ear functions. They could not find anything. Having enough of all the tests she arranged an MRI for me. Some people with claustrophobia have trouble with a MRI. But I was okay with it and I was slid into the tiny tube for a 25 minute session. Afterwards, as I was being pulled out, I noticed the platform table I was laying on was surrounded by MRI techs and Nurses, one had an armful of paper and a CD. She said I needed to go see my doctor, right now. That did not sound good. My doctors office was just across the street. I entered his office and it was full of waiting patients and I didn't have an appointment. I saw my Doctor through the glass and he motioned me to come inside. Ahead of everyone? That did not sound good. He ushered me back and into his office and he shut the door. That did not sound good. He sat down and looked up and said "Where is your wife?" That did not sound good. I said she was at work across the street. He said he would like her there and could I go get her. That did not sound good. I went across the street to get her and we again were in front of him. He pointed to the MRI of my head and said "as you can see, you have a brain tumor." Well two operations and two hospitals later 95% of the tumor has been removed with radiation working on the remainder. TI was great to me during my recovery and the assistant Sunday School Teacher stepped up mightily. Parents of my 4th grade Rocket Club students came forward and helped me, it was fantastic. I even traveled to Alabama for a BEST event and I tried hard to look normal. But everyone already knew about my recovery and I was treated fantastically by volunteers and students.

But my recovery may never be full. I still have trouble walking and talking and back then it was worse. When I returned to TI they had changed design toolsets and that was a big problem for me. Along with my regular workload there was this new toolset to learn and that toolset affected everything I did. I needed to be at 120% to do both and I was only at 80%. Besides TI was moving our engineering group out of Sherman. I was moved to applications. But I didn't know these ICs at all So I was trying to help customers and learn the IC's all at the same time. TI was offering a "Bridge to Retirement" for us senior employees. My good buddy Steve had already taken them up on their offer and retired. With recovery ongoing and

everything moving to Dallas, I retired. TI later announced the entire Sherman site would close. NT BEST, the founding hub of BEST robotics, was no more. But TI anew has selected Sherman, Texas as the location for a giant IC fabrication site. NT BEST may rise again.