

Chapter 6 - Life after Joining Control Data Corporation (CDC)

1970 The New Job at CDC

I left Sandia Livermore Lab and moved a half mile west on East Avenue to the CDC office in December 1969 . The move was to become a field analyst on the newest supercomputer, the CDC 7600.

I filled one of the two open positions. The other was filled by Mike Hendrickson. He had been a CDC field engineer in Sunnyvale and recently graduated from Stanford. Mike was a character. We became best buddies in a couple of weeks. He continued to live in Palo Alto and commuted on his motorcycle regardless of the weather. He and his family moved to Livermore a few months later.

The third person in the office was Chuck Breckinridge who was the Livermore account manager. He was one of the elite salesmen in CDC, and somewhat of a legend. It was nice to get to know him. We would become competitors in the future and good friends in later years. We were exchanging emails as late as around 2010.

The first five or so 7600's were to be fabricated in Chippewa Falls, Wisconsin. Then production would move to the CDC facility in Arden Hills, Minnesota. Serial number 1 had just been installed at the Lawrence Livermore Lab just up the street. Serial number 2 was in test mode before it would be shipped to Livermore.

Mike and I were told we would go Seymour Cray's Chippewa Falls lab for two weeks to get hands on experience. Seymour Cray was the designer of the CDC 6600 and 7600. He was a brilliant, eccentric, and reclusive person. He would not work in Minneapolis, so he had his own lab on the family farm in Chippewa Falls. He allowed very few people to come there. The fact we were allowed access was a great privilege.

I flew to Minneapolis and got a rental car and drove across the river to Wisconsin. Mike would join me a week later. I was told to arrive at 5pm and a receptionist would give me pass keys.

The directions were to go to Chippewa Falls on a lonely farm road and look for the lab on the left side of the road. The only clue was S. Cray painted on a rural mailbox. I turned down a long and secluded driveway to a clearing. There was a home on one side and a low brick building on the other side which was the lab. An older lady unlocked the front door and let me in. She opened her desk drawer and pulled out a small piece of paper with my handwritten name on it, and signed S. Cray. I was told we could be in the lab after midnight. Seymour did not allow loud talk or noise. If I didn't abide by the rules, I would be told to leave. That was it. She took me back to show me where the computer was, and we passed an open door. I glanced in and saw a youngish looking clean-cut guy in a flannel lumberjack shirt looking at a large

drawing of circuits on the wall. I assumed it was a design engineer as I expected Seymour to be an older bearded scientist. It was Seymour Cray and about a common looking guy as you would ever see.

I came back at midnight and got to work. The operating system was very limited, but I was able to run one of my tests. I did not get much done the rest of the time as there were all kinds of problems with hardware, software, and storms causing power outages. If the system was down, I would watch a couple of people in a back room punching miles of color-coded wires into the back plane of the next 7600. Seymour seemed to be around all the time. I was getting a cup of coffee in the middle of the night and heard someone getting ice out of the refrigerator. It was Seymour. He never said anything and neither did I. There was a sign on the coffee maker to make a new pot if it was empty ,and a sign on the refrigerator to refill the ice tray. They were signed S. Cray. He ran the place with an iron fist.

I was joined by a CDC analyst, Evans Harrigan, from CDC headquarters to guide me through things. He was one of the few headquarters people allowed in the Chippewa Falls lab. He was black ,a great guy, and very smart. He liked his beer also. Our paths would cross many times over the years.

It was a great experience even if we were not too productive. There were great taverns, and the Wisconsin people were fun to socialize with. One place we were told not to miss in Chippewa Falls was Leinenkugel's Brewery. The guys back in Livermore even instructed us to bring some Leinenkugel's back, which we did.

I would cross path with Chuck Breckinridge and Seymour Cray many years later. The background follows:

Background

CDC had a parallel design project underway in Minneapolis that was a radical departure from traditional computers. It was the Star 100. The Livermore Lab would be the first customer. In the Star 100 a single instruction would apply to all the operands in a vector of any length, so it was called a vector processor. It operated at a slower clock speed but did many things in parallel. Cray's 6600 and 7600 design was one instruction operating on one operand and referred to as a scalar processor. Cray's designs achieved the highest speed attainable with the existing technology.

Seymour Cray disliked the large corporation bureaucracy and the siphoning of funds for the Star 100. With the blessing of CDC, and startup funding, he took his 8600 design and founded Cray Research in 1972. The agreement was that CDC would retain first right of refusal on the new computer. CDC eventually passed on the 8600, and he named it Cray-1. He had great success with that design and later the Cray-2. This was a big mistake by CDC.

Chuck Breckinridge went with Seymour Cray as a salesman at Cray Research in Mendota

Heights, Minnesota. After the Cray-2 Seymour Cray left Cray Research and started Cray Computers in Colorado Springs, Colorado. He had a new design called the Cray-4 that got its great speed by being very compact and immersed in an inert oil for cooling.

Chuck went with him as the VP of Marketing and Sales. Chuck and I had crossed paths in 1984 and competed against each other on a computer procurement in Idaho Falls when I was with ETA Systems, a spinoff of CDC. I left ETA Systems in 1989 due to their inability to deliver a working product and the lack of continued funding. I then re-joined EG&G in Idaho Falls.

In late 1994 I was invited to Colorado Springs to get a preview of the new Cray-4 computer. Chuck toured me around. I was really surprised when Seymour joined us for a chat and a catered box lunch. Seymour had a commitment he had to get to. Chuck and I saw him off as he drove away in his Jeep. Before the day was over Chuck offered me a marketing position pending a new round of financing.

I was waiting for this to happen when EG&G offered an early retirement. I took the offer and we went into the mom an pop motel business in 1995.

Seymour Cray died October 5, 1996 from injuries in a car wreck. He was in his Jeep on I-25 near the Air Force academy and a reckless driver caused a three car accident. He rolled three times resulting in severe head injuries. He was 71 at the time of his death. He was one of a kind and that began the end of Cray Computing.

Our Family Life in Livermore

The Rambler Ambassador was nearly three years old and I wanted a larger V8 for pulling the trailer over mountain passes and air conditioning. I started looking for a new car and looked all over the east bay. We were in San Jose and found a 1970 Dodge Coronet 500 station wagon with a 383 Magnum V8, 3rd row rear seat, air, leather seats, air conditioning, and an 8-track tape deck. It was dark green with fake wood on the sides and was a demo driven by the dealer's office manager. We struck a deal and I went back the next afternoon to pick it up. I drove home and pulled into the garage and noticed it was hot in and around the dash. LaRue came out and noticed the same thing. We decided to have a pizza, so I went to Potter's Pizza to bring one home. When I got the pizza and went to start the car it was dead. I caught a ride home and the next morning had it towed to the Dodge dealer in Livermore. He asked me where I bought the car and I told him San Jose and he told me to take it to San Jose! We had a few words and he finally agreed to get it going but since it was Friday I would have to leave it over the weekend. We had tickets for the Oakland A's bat day game on Saturday and I had to rent a car. Kathleen and Brian each got a green Louisville Slugger bat with Sal Bando on one and Reggie Jackson on the other.

Livermore Dodge got the car running Monday morning and I took it back to the dealer in San Jose. They found electrical problems and worked on it all day. I got the trailer hitch and controller installed that week.

A Gibbs family reunion was scheduled in Idaho in late June 1970. Val was now the forest ranger on the Dubois District in Dubois, Idaho. The Forest Service maintained the Kaufman Guard Station on Birch Creek just north of Lone Pine between Idaho Falls and Salmon. Val could use it for the reunion. There was a house and a lot of space for tents and trailers. We hooked up our trailer to the Dodge and headed to Idaho on Friday afternoon.

We started up the Sierra's and was nearly to Auburn when the car started bucking and jerking. I was afraid it was going to die. There was a trailer park just off the freeway and I pulled in about 6pm. The next morning I took it to the Dodge dealer in Auburn and they worked all day on it, but didn't find anything. We hitched up and took off late in the afternoon and it started acting up again, but not as bad. We needed gas and I stopped and filled it up. It ran better. I got more gas in Reno and it ran normally. It looked like a case of bad gas again.

We had a nice reunion, visited our friends in Salmon, and camped a night in Patterson. Then returned to Livermore. We drove 2,123 miles total and spent \$113 on gas at an average 45 cents per gallon. It computes to be 8.5 miles per gallon. Not good but par for the course.

After Mike Hendrickson, wife Sue, and family moved from Palo Alto to Livermore we enjoyed outings together. One was a tent camping trip above Yosemite National Park the summer of 1970.

We left after work and went through Modesto up into the Sierra's high above the north side of Yosemite and arrived late. We got our tents setup and went to bed. We then heard a loud bear like roar that scared the daylights out of us. It was Mike. The next morning, we sat on a large granite boulder and had bloody marys in the sunshine. Mike and I decided to take his two kids, Troy and Robin, and Kathleen and Brian on a long hike to the valley floor. LaRue, Julie, and Sue would meet us with our car in the late afternoon at Yosemite Village. We hiked along a creek and trail several miles to the top of Yosemite Falls where we looked down on the valley floor below. The trail then went straight down parallel to the falls. We got to the bottom extremely hot. Mike dived into the ice-cold fast running river. I thought he was a goner for a while. The women arrived, and we headed back up the mountain.

We had another outing the end of December. We took our trailer December 29 south of San Jose to Pinnacles National Park the site of underground caverns. Mike and family came down the next day and it was pouring down rain. Mike is a Stanford graduate geologist and we were anxious to get his take on the caves. Once inside the cave entrance Mike gave us a detailed running dialogue.

We returned to Livermore the next day and had a New Year's Eve party at their place. Mike had a lot of beer. He had an old fridge with a large keg inside and a convenient tap on the outside of the door.

On the Move

After a year in learning mode in Livermore CDC was anxious to get Mike and I in a more productive mode. The National Center for Atmospheric Research in Boulder, Colorado had CDC computers and Mike was transferred to support that system.

An analyst was needed at the Hanford Lab in Richland, Washington. The job was to assist Westinghouse engineers in using the CDC Cybernet Data Center in Palo Alto. They were disgruntled with the Hanford Univac 1108 provided by Computer Sciences Corporation (CSC) and were looking elsewhere.

A CDC analyst on site would help them convert to the CDC system. That person would also be the pre-sales analyst for an upcoming procurement, and hopefully the sale of a CDC computer for the Hanford lab.

I was asked if I would be interested. If yes, I was to fly to Seattle and interview at the CDC Seattle District Sales Office in Renton. I was not sure I had an option so flew up to see what it was all about.

The Seattle area was in a depressed state. Boeing was laying people off by the hundreds. There was a saying going around which was, "The last person to leave Seattle turn out the Lights". I was told that over a 150 Boeing people applied after CDC advertised the job in the paper.

After my interview I was told to fly over to the Tri-Cities and spend a day looking around. I found the area to be depressed. The Hanford Lab was in a down cycle. However, Westinghouse had a contract to build the Fast Flux Test Facility (FFTF) reactor so there was some hope. They were the people that I would be working with as well as an independent energy consulting company, Jersey Nuclear. I was to promote and assist them in using the CDC Data Center also.

Everyone I talked to advised against buying a house if I got the job as it would be a bad investment. There was a lot to think about. When I got back to Livermore I was offered the job.

I knew that CDC would not keep me in Livermore much longer, so it was off to Richland, Washington. It was ironic that Mike's desire was a job in the Pacific Northwest and my choice was Colorado. Much later Mike ended up working out of the CDC office in Renton, so we would meet again.

I went alone to Richland to get started. I lived in a motel for a couple of weeks then went back to Livermore, and we listed the house with United Realty. We then decided to leave everything in Livermore and live in our travel trailer while we looked over the housing market in Richland.

It was a hot trip going up in June 1971. Mitsu, our Siamese cat was meowing so loud that we

finally put her in her cage in the trailer. When we stopped that night she couldn't make a sound. The next day was even hotter through Portland and up the Columbia River Gorge. The Dodge overheated, and we had to stop a couple of times to let it cool off.

We got to Richland in the evening and pulled into a county campground along the Columbia River. The temperature was over 100 degrees. We noticed the people in the campground were a different looking bunch. The next morning they were all gone, but the trailers and tents were there. They all returned that evening. It dawned on us that they were gypsies picking fruit during the day. We moved to a nicer trailer park.

Our Life in Richland, Washington

We found a newly completed house at 2159 Crestview Avenue in east Richland. It was built by a builder with a great reputation. It was a split entry with four bedrooms with a total of 2,100 sq ft on two floors.

The street ran east and west on a long wide sand dune formed by blowing sand. The elevation provided a nice view out the front looking over the Columbia River area and the back looked over the tops of the houses behind. After some more looking we made an offer of \$31,500 and put money down on June 20. It was contingent upon our house selling in Livermore and it was accepted. We then received an offer on June 21 for \$28,850 on our Livermore house and accepted. We had to close in Livermore then we could close in Richland. We had an agreement to rent the Richland house for \$4 per day until closing which happened about a month later.

The 4th of July weekend was coming up. We decided to take the trailer and meet the folks at the Bumblebee Campground on the Coeur d'Alene National Forest near Kellogg.

We got there and parked. The ignition switch on the Dodge started smoking. We had arrived a day early, so I planned to get the car checked out the next day while garages were open. I went to Coeur d'Alene and they recommended the Dodge dealer in Spokane, so I headed to Spokane. They worked on electrical problems all day and I went back to Bumblebee.

Other than the car problem it was a nice camping trip with the folks. We left the trailer in Kellogg as we planned to start using the two weeks we were authorized in a motel. We stayed at the Hanford House which was a newly built hotel and convention center on the Columbia River in Richland.

We made a quick trip to Livermore to get the moving process going and say goodbye. The movers packed and loaded everything into a big moving van and away we went. Arriving back in Richland we checked in at the Hanford House again. That evening we had a ring side seat on the balcony of our room for the awards to the powerboat racers. They had just completed a week of racing on the Columbia river. It was also being broadcast on the ABC Wild World of Sports.

The next day the moving truck arrived and unloaded our stuff. Our new phone number was 509-946-9165. Our next door neighbor's last name was Asay, and they were from Utah. Her first name was LaRue! It was comical when the two LaRue's introduced themselves to each other. Turns out that he was a cousin of Gene Asay that I served with in Scotland. Gene Asay was one of two airmen that drowned on a lake in Scotland when their boat overturned while on a fishing trip. Small world again.

Now the landscaping work began. For a decent lawn you had to add mulch to the sand. I ordered a full load of bark mulch, which was 23 cubic yards. The delivery arrived when we were shopping. We returned to find a pile of mulch covering our whole driveway about five feet high.

I bought a new wheelbarrow and started distributing the mulch about four inches high over the planned lawn area, and then rototilled it in. Next was a sprinkler system front and rear. It was a lot of PVC pipe to bury, but digging in the sand was fast and easy.

I had to dig about six feet down to connect to the water main. It took about an hour in the sand. It was a huge hole since the sand kept caving in. LaRue ran to the store when I started digging and when she got back all she could see was my head sticking up.

The plan was to plant the lawn in the spring.. In the meantime build a cedar fence around the back yard, a 1-foot concrete mowing strip all of the way around, pour a large patio, and widen the driveway with a trailer pad beside the garage. The backyard was several times larger than the Livermore house and there was a lot of work to do.

I completed the sprinkler system in late summer then built the backyard fence. The fence was 6 ft high cedar, 80 ft on the left side, 80 ft across the back, and 55 feet on the right side. I also built a gate for access from the trailer pad, and a gate in the back. The back gate was so I could go through and dump grass clippings along the back of the fence to stabilize the hill and the sand.

Then it was time for concrete work. The patio would be 60 feet long along the back of the house. It was 20 feet wide on the right end, and curved free form to 10 feet for the left end.

The driveway expansion and trailer parking pad would be 60 feet long and 10 feet wide. That was a lot of concrete to pour and finish without help. We decided to buy a cement mixer and do it ourselves in small sections that we could pour and finish in one day. I used 1x4 redwood dividers in 5x5 sections. LaRue and I could finish one or two alternating sections per day on a weekend. I put down a good base of sand and gravel before pouring concrete.

With that all done I decided on a curved free form front sidewalk that was 3 feet wide by 32 feet long in exposed aggregate. It seemed like all we did the first few months was build fence, mix, pour, and finish concrete. The two of us did it all. My notes show that it took 34 tons of sand

and gravel and 120 sacks of cement in several deliveries. We got the lawn, shrubs, and trees planted in the spring and our place looked great. We were the show place in the neighborhood.

Christmas 1971 we decided to go to Kellogg and spend Christmas with my folks and Bev. It was cold and snowy up that way, so I got snow tires and tire chains to be prepared. We had a good Christmas and met Bev's boyfriend, Tom Franson, who was working for a finance company in Kellogg.

We had acquired a new dog named Penny. She was small and white with a few black markings. Penny was outdoors and ran into the street and was run over and killed. So, there was trauma also.

We headed back to Richland after a few days and left late in the afternoon. We went through Spokane on the freeway west and had just passed by the small town of Sprague where Tom grew up. It was well below zero.

Something blew with a big noise in the engine, and we were stranded on the side of the freeway. Nobody would stop. Even the highway patrol kept on going. I saw a farmhouse about a half mile away on the other side of the freeway and decided to go and see if I could call for help. I could hear a big dog barking inside and I could hear someone, but they wouldn't answer the door. I knew they were in there and kept knocking. Finally, a guy peeked out and eventually said I could use the phone. He recommended a tow truck operator in Sprague.

I could see a female peeking through a crack in the door across the room. I figured she had a gun on me. I couldn't get out of there fast enough. I got back to the car and everyone was freezing.

The tow truck arrived and told us the nearest service was in Ritzville about 30 miles further west, and we were hooked up. There was not enough room in the tow truck for all of us, so LaRue and I rode in the car dangling off the hook. He dropped the car at the Dodge dealer and us at a mom and pop motel. They were nice people and loaned me their car to get our stuff out of the car.

The next day we found it was going to be major engine work. Luckily the car was barely within warranty. It would be a couple weeks getting parts and the engine rebuilt.

The Ford dealer had a rental car which was a two door Mercury Cougar that I rented. Somehow, we got all of us and our stuff into it and went on home.

On our way home we decided we needed a second car as LaRue had taken up selling Avon. On December 30, 1971 we found a new four door four cylinder Mazda with standard shift and light metallic green. It was \$2,250 with a dealer installed radio. The dealer was Bob and Floyd's Mazda and Used Cars in Kennewick. The next day I took the rental car back to Ritzville and went by Greyhound bus to get back to the Tri Cities. I had to kill time in Ritzville and ate lunch

at the Golden Pheasant Cafe. Then a pool hall watching the local wheat farmers play pool and snooker. Those old boys were good.

The Dodge continued to have problems. You never knew when the turn signals and stop lights were going to work. It was time to cut our loss. That spring I traded for a new 1972 Oldsmobile Delta 88 Royale 4dr hardtop sedan loaded with everything and with a 454 engine. The Olds was \$5,104 and we were given \$2,404 for the Dodge. I ran into the salesman a month later and he said the Dodge sure had a lot of electrical problems! I acted dumb.

We took a shakedown camping trip with the new car and trailer to Fishhook Campground where the Snake River meets the Columbia River, and all worked well.

A week later we left for vacation pulling the trailer to Lolo Montana to Salmon then up to Glacier National Park. From there it was Calgary, Banff, the Canadian National Parks, and back home. No car problems for a change.

Vacation 1973 we towed the trailer to the Oregon coast then up through the Olympic National Park and back home. Leaving Richland we had a severe head wind going down the Columbia River and averaged 4 miles per gallon. We could just make it between gas stations. At least we had no more car problems. Without strong head winds the mileage was acceptable for the rest of the trip.

It was nice being within a four hour drive to Kellogg, Idaho and the folks. There had been employment changes for Dad over the last few years. When they came back from Guatemala Jack Bradley made Dad the underground mine manager of the Bunker Hill Mine in Kellogg

Jack Bradley and his wife were killed in a car wreck on the San Francisco/Oakland Bay Bridge. It was a big shock and loss for Mom and Dad. After a while the new management of the Bunker Hill Company sent Dad to Superior, Montana to get the Nancy Lee Mine operating again. The folks were in Montana for a couple of years. When they were ready to come back to Kellogg Dad decided to leave Bunker Hill, and took the job of underground mine manager of the Sunshine Mine.

The spring of 1972 we went to Kellogg for a visit. My brother Garry was there, and Dad asked if we would like to tour the Sunshine Mine. We said yes and the next morning we packed a lunch and went to the mine and got hard hats and miner's lamps.

Dad was busy, so he had a shift boss escort us on the tour. We walked in a ground level mine tunnel to the Jewel Shaft where a huge hoist drops a cage on a cable down into the mine. The Jewell shaft is the only access to the many levels of the mine below. We got in the cage and dropped straight down the Jewel Shaft to the bottom 6,000 ft level. We toured around then went up to the 3700 ft level. We walked nearly a mile and toured the big rooms for machine shops, etc.

At noon we stopped at a widened area called the Blue Room. We were eating lunch and talking to the shift boss and four or five miners. All of a sudden one of the miners jumped up in alarm when he caught the smell of smoke. The shift boss answered the phone on the first ring. He was told there was a fire in the mine, and we were to head back to the Jewell Shaft.

The miners broke out breathing back packs that were stored for emergencies. We piled into ore cars that were hitched to an electric powered locomotive. We didn't put on the breathing apparatus as we might need them later. When we got to the Jewell Shaft the smoke was coming from a level below, and not from above where it could block our only exit. The cage came down and stopped at our level and Dad came flying out. He said, "get these guys to the surface", and up Garry and I went. He stayed to assess the situation and direct operations. We got to the top and walked back through the tunnel to daylight. Fire trucks and ambulances were arriving with sirens and lights going. We were worried how bad it was going to be. TV crews were arriving, and we went home and watched it all.

It turned out the fire started on the level below the one we were on and was confined to old timbers. They were ignited when dynamite was set off to blast rock. The fire was put out without any serious consequences. It turned out a lot more tragically the next time.

Shortly after that Dad was in one of those big rooms in the mine and a fist sized rock fell and hit him in the back of his head splitting his helmet apart. He was out for a while and had a big cut on the back of his head. He was checked out at the hospital, stitched up, and he thought he was ok. Later his balance was off, and his speech was slurred, so he was put on medical leave.

I was on my way to the airport on May 2, 1972 to catch a flight and I heard on the radio that a mine disaster was taking place in the Sunshine Mine. I knew that Dad was home on medical leave or he would have been in the middle of it.

The official report later states that two electricians in the electric shop on the 3700 ft level smelled smoke and yelled a warning. A mine foreman and a miner in the Blue Room heard the warning and headed for the Jewell Shaft encountering heavy smoke. This was the exact scenario that Garry and I experienced only much worse. The men started closing access doors to other areas of the mine. This caused ventilation problems and they were now stranded.

It was a major disaster over many days that killed 91 miners. Even the hoist operator of the Jewell Shaft died because of the smoke. Dad knew the mine better than anyone, so he was brought in from medical leave to help direct the rescue. Eventually 80 miners were rescued, and the mine was closed for several months. The disaster was caused by some old dry timber that was somehow ignited.

Dad was not able to work after his accident. The folks bought the Motel Deluxe in Salmon and operated it for about six years. Dad continued to have balance and slurred speech the rest of his life. He had a problem later with a heart valve that doctors attributed to the blow on the back of the head. The valve was replaced with a pig valve. He passed away suddenly August 27,

1993 at age 79 when the valve quit working.

My Work in Richland

CDC installed a user terminal in a building in Area 300 where the Fast Flux Test Reactor (FFTF) was being built. This was about five miles due east of Richland and our house.

There was no CDC office in Richland, so I was to work out of the house. The Renton office shipped me a desk and chair and installed a second phone line for business use in our house. I sat up my office downstairs in the family room. I found it difficult to work with all the distraction, and I was constantly running out to Area 300 to solve problems and interface with the Westinghouse engineers. Westinghouse soon provided me a desk next to the user terminal and I began using it as my office. This arrangement worked very well. I became a trusted partner with key engineers on the project.

My immediate job was to work with the Westinghouse engineers to promote and assist them in using the CDC Data Center in Palo Alto via the user terminal over a broadband line. I worked with the data center salesman, Dick Bennett, based in the Renton office. Dick was young, dynamic, personable, and one of the best CDC data center salesmen selling computer time.

My secondary job was as a pre-sales analyst promoting the CDC computer for when the Request for Proposal (RFP) would be released. The new computer would then replace the Univac 1108 owned by the contractor, Computer Sciences Corporation (CSC), and leased to the AEC. In that capacity I worked with the CDC salesman, Bill, who was based in the Renton office. His job was to sell a new computer. He was an older guy, set in his ways, and not open to new ideas. His mode of operation was to call strictly on upper management and ignore the engineering users. This is the strategy IBM utilized in the business world and it worked very well for them in that environment. Selling in the scientific and engineering world you also need to work the users. They ultimately are the driving force and make the recommendations.

Whichever salesman was in town to make sales calls I would change hats and go along to provide technical support. The two salesmen were at odds with each other. Dick was making big commissions selling computer time and wanted to keep it going. Bill's job was to sell a computer so that the work would be done in Richland. I was caught in the middle trying to promote both. Dick's success was with both management and the engineering users. Dick and I got along well and saw eye to eye. Bill was a different animal and was resentful of Dick and the success he was having at Westinghouse and the consulting company, Jersey Nuclear. Consequently, he didn't keep me informed on what he was doing or his strategy.

On November 24, 1971 my manager in Renton was on a business trip to visit the analysts in the Portland, Oregon office. He caught a return flight to Seattle on Northwest Airlines in the late afternoon. This was the flight that was hijacked by a Don Cooper who later became known as D.B. Cooper. I got a first-hand account of it all. The odd thing about it is that a coworker of mine in Las Vegas was now working in the Portland CDC office. His name is Don CoopeHr. e

went through a lot of hassle whenever he flew after that incident.

As time went by it was getting closer and closer to when the RFP would be released for the new computer. One day a Westinghouse engineering manager that I knew came to me with some advice. He said that if Bill keeps working the account the way he is CDC would not win.

Bill was discussing his pricing and configuration strategy with the top administration people that included CSC management who wanted CDC out of the picture. The decision for the new computer would be based on cost versus performance. If the competition had inside information they could bid accordingly. CSC wanted a Univac solution like the one they were providing, so the CDC strategy would probably be passed on to Univac. Therefore, it was a losing situation for CDC. I passed this on to my manager in Renton in my weekly report. In about two days the branch sales manager in Renton arrived in Richland to meet with me. About two days later I was summoned to Renton to a meeting chaired by Boyd Jones, the regional sales manager, in San Jose.

I knew this was a showdown that I would not enjoy. Boyd Jones was a stern-faced retired Air Force officer, and a friend of Bill's. Boyd had placed Bill in his current job. If I remember correctly they were brother-in-laws. I didn't know Boyd Jones and he didn't know me, but I knew he was originally from Utah.

I flew over the morning of the meeting and arrived shortly after the meeting had convened. I walked in and from the way Boyd Jones looked it was going to be a bad day. Bill was at the podium presenting his sales strategy, and how it was a winning one. He always had a smirk on his face and it was still there. I surmised he was winning the battle. I was called to the podium and presented what I was told by a person that could be trusted. I worked with these people every day. Then I concluded we needed to change the sales strategy or lose the order. Boyd asked who could make us successful on the upcoming procurement. My advice was there should be one salesman in Richland, and it should be Dick Bennett. I was told I could leave the room.

I could hear loud voices in the conference room. I sweated it out until the meeting ended. I was then told Dick Bennett would be the only salesman in Richland, and I would be his analyst. For a while I thought I would be going down the road. The message was, "You better win this one". *(A year later we did)*

My Role in the Computer Procurement

The RFP for a new computer to replace the existing Univac 1108 was released in early 1973. The specs were for a computer in the performance range of the CDC 6600, the new Univac computer (1110), and the new IBM 360 model 165, and in the price range of \$5-6 million. It included a benchmark test consisting of many programs that run on the local Univac 1108. It required a demonstration and timed run of the benchmark attended by the Richland selection committee, a proposal answering technical questions, the exact configuration of the proposed

computer, and the cost. Vendors had 60 days to demonstrate the benchmark and present the proposal. Upon delivery in Richland the winning computer was required to run the benchmark again in equal to or lesser time before it would be accepted. This was to prevent cheating with additional hardware on the demonstration benchmark.

The day the RFP was released I picked up the magnetic tape containing the programs and data to be benchmarked and flew to Minneapolis to get started. The benchmark lab was across town in the Arden Hills facility where there was a computer and configuration similar to the one we would be proposing.

The CDC 6600 had been out for a while and the Univac 1110 and the IBM 360 model 165 were new on the market. CDC put new paint and skins on the 6600 and named it the Cyber 74. It was the same old dolly in a new dress. It had the same performance as the 6600, so the competition knew what we could do. They were promising much better. We did not know what they could do. We were at a disadvantage from the start.

My first look at the fifteen or so programs that were on the benchmark tape told me that we had been had. The programs were all big and tough to convert as they contained all kinds of Univac extensions. This was to make programs run fast on the Univac 1108 as well as the new and compatible Univac 1110. It looked impossible. However, I had a few months working with Westinghouse engineers who were converting Univac 1108 programs, so I knew what to look for. The extensions handled data and scratch files that had to be written to or read from external drum storage devices that were very fast and a unique Univac specialty. The first step was to go through the programs and remove all the specialized stuff and replace with standard Fortran. This was a monumental task as the programs filled eight trays, each four feet long with keypunched cards. When I got the programs converted and running correctly I would have to deal with the problem that Univac drum storage was faster than our disk storage. That would come later.

The benchmark lab scheduled two-hour blocks of time on the configuration you required. The blocks of time were often four hours apart around the clock and weekends, it was difficult to get much sleep. One or two local CDC analysts were provided to assist me. I soon found these guys to be inexperienced and worthless. They were wasting my time as I was training them. One night I told them I didn't want them around. The manager of the lab was ineffective and not willing to bring in experienced people. I informed my management and requested two experienced guys from our Renton office, and they came out later. Then a trouble shooter, Bob Korsch, from headquarters across town showed up. He hung around for a few nights observing. He was known as a "corporate gunner" that reported to the top and a guy you did not mess with. I didn't know if it was me he was observing or the lab manager, or both. A short time later the lab manager was removed, and Bob Korsch took over as temporary manager. He was effective and remained the manager for many years.

I had about six weeks to get the programs converted and running smoothly before the customer came back for the demonstration and timing run. It was 7 days a week 24 hours a day with

about 4-6 hours of sleep squeezed in when you could get it. It took about four weeks to get the programs running with the correct results. Then I had a couple of weeks to fine tune things. Reading and writing to disk storage was a bottle neck resulting in wait time which was not good. Total throughput time is what counted, and we couldn't afford time wasted for input/output to disk storage. CDC had just announced a new product called Extended Core Storage (ECS) that works just like finger drives on personal computers today. You plug it in and you can access files with zero wait time. It was about the size of a car and took a lot of space in a computer room. It was also expensive . The cost had to be factored in and a decision made if it was cost effective. After many timing runs it proved it's worth and became a part of the proposed configuration.

While the other two analysts and I were working in Arden Hills we stayed at the Paul Bunyon hotel and convention center nearby. The Univac plant was a couple of miles away. One morning three guys were eating breakfast next to us and were grouching about what a difficult time they were having with the Richland benchmark. We managed to sit by them a couple more times to listen. We were all ears and learned a lesson to watch ourselves in public. We picked up a lot of valuable information that we used against them.

We managed to squeeze in a decent meal once in a while and a favorite place was Lindy's Steakhouse that was an old farm house in the country. There were three choices listed on a menu stand at the table The choices were ground sirloin, sirloin, and top sirloin. Your choice was accompanied by a green salad with their house dressing, a platter of their special hash browns, and a basket of garlic bread. We always went for the top sirloin. The steak came out on a sizzling platter, looked like a roast, and always cooked perfectly. Rare was a cool blue center and absolutely melted in your mouth. When you were through they brought a small piece of candied watermelon rind. That was it. One night, John Denver and his wife came in and were seated behind us.

(LaRue and I visited Lindy's a few years back and the place was the same and the steaks just as good. The young red headed waitress that waited on us was a spitting image of a red headed waitress in the old days. It turns out that she was the daughter. One of the sons opened a Lindy's Steakhouse in Seeley Lake, Montana and we have been there twice,.The steaks were the same.)

An evaluation team of about a dozen people made up of AEC, Westinghouse, and CSC management and technicians arrived for our big show. They had just been to IBM, and I was anxious for any hint of how it went.

A day of demonstrations and benchmark run of an hour and fifteen minutes went well. The CSC reps picked on everything. They even requested a second run of the benchmark on short notice to see if the results could be duplicated. They went so far as to look behind cabinets to see if extra equipment was hooked up, as if they would know. The Westinghouse and AEC reps seemed to be pleased with our performance. Their comments sounded like we did much better than IBM.

We had to wait several weeks for the evaluation team to make their decision and it was a long anxious wait. Finally, we were announced the winner and awarded a \$5.5 million contract. This was a huge win for CDC, our Seattle District office in Renton. and the Western Region office in San Jose.

August 1973

I was told I would head the installation team and the acceptance testing. This required a rerun of the benchmark in equal to or less time than in Minnesota ,and then a period of thirty days of better than 98% availability for the users. The system arrived and was installed in the Federal Building in downtown Richland. I was provided office space among the CSC people.

After the new computer was installed I ran a test run of the benchmark and ran into problems. About an hour into the run jobs began aborting. I turned the system over to the customer engineers to run diagnostics and no problems were found. I reloaded the benchmark and in about an hour jobs began aborting again. My analysis pointed to a problem with the ECS memory that we were using heavily as a scratch input output device. I configured it out of the system and reloaded the benchmark and it ran perfectly. The only problem was we were fifteen minutes or so over our target time of one hour and fifteen minutes.

At least I could tell the customer engineers that ECS was causing the problem. Their diagnostics did not show any problems, so I would try again. In about an hour I got the same failure. We went back and forth with the same results for about three days. I concluded that something in ECS was causing a hardware error after being hit hard for a long time.

Sunday came, and it was the last day that we could qualify. We were down to the mandatory live demonstration in front of the customer. I decided to make the run using ECS for the first forty minutes. The remaining jobs would not use it. We made it through to completion but were several minutes over the target time. The CSC reps were gloating as they could see us getting disqualified. However, we were allowed three tries according to the rules. For the second run I upped the ECS usage close to sixty minutes. We ran to completion and were still several minutes over the target. Everyone took a short break and during that time I decided I would configure ECS for the entire third and last run. I knew that the customer engineers had noticed that a certain wire was very close to a memory module. It was possible that heat, caused by prolonged use, could be causing the problem. They rerouted the wire. It was a huge longshot. My helper, Lou, said It's not going wrkk

We reloaded the benchmark and held our breath when we got to sixty minutes and beyond. We made it through with a couple of minutes to spare. We had qualified and now could move on to thirty days of acceptance tests. The dalesman, Dick Bennett,man was on cloud nine. He took me, LaRue, Leo, and the customer engineers out for a great dinner and celebration.

We started the thirty-day acceptance period the next day on Monday. The first week went well

and then the system started crashing about four times per day. At that rate we would fail. My investigation led to numerous operating system modifications that were made by CSC. They said it was to make the CDC system look more like the Univac system for the convenience of the users. My protests fell on deaf ears, so I bounced it up to my management.

My management requested a meeting with Richland high level management. The meeting was chaired by AEC Richland in a big conference room in the Federal building. I was in my office. The sales manager of the Seattle District rushed in and said the meeting was not going well. Could I drop everything and come to the meeting.

I walked in and could see the smirks on the CSC manager's faces. The AEC manager asked me to present my analysis of the problem. I placed it squarely on CSC and their modifications. The smirks quickly changed to hostile looks. The AEC manager then asked me how the problem could be fixed. I replied the solution was to remove the CSC modifications. Then grant thirty days of acceptance testing with the operating system that we delivered. CSC protested strongly but were told, "If Harry says we do it this way, then that is what we will do." If looks could kill I would not be here today.

The acceptance period went well. CDC received a check for \$5.5 million dollars. CSC had to remove their Univac 1108 that had been earning them \$8 million a year for several years.

I later received a large wood and bronze plaque with the following

CONTROL DATA CORPORATION

Presented to

HARRY E HATHHORN
SEATTLE DISTRICT 1973

FOR CONTINUED OUTSTANDING
CONTRIBUTIONS AS AN
ANALYST
CONTROL DATA CORPORATION

William C Norris
President

I was invited to the first ever Professional Services Division symposium for top performing analysts in the company. Five were being honored over a two-year period, and I was one of them. The symposium was a week in Rancho Bernardo, California just north of San Diego. A

highlight was a motivational speech by retired Navy Captain Bucher who was the commander of the spy ship USS Pueblo that was attacked, he crew held hostage, and tortured by the North Korean's. It was especially interesting to me as they were doing the same thing I had been doing in the Air Force.

Before I went to the symposium LaRue and I were invited to a special dinner at a gourmet restaurant in Bellevue, Washington. It was special recognition by high level management. The place was noted for their escargot and that was a first for us. We were treated royally that evening.

In late August Chris Christopherson who worked out of the Renton office, and the salesman responsible for Idaho, approached me. He had a prospect which was EG&G, Idaho. The AEC had an IBM 360 Model 75 in Idaho Falls, Idaho. They were a prospect for a CDC 7600 class computer in a couple of years. He also was working with a consulting company, Energy Incorporated (EI), that was interested in using the CDC Data Center in Palo Alto.

This was a scenario like I had worked in Richland, and he would like to have me in Idaho Falls. EG&G, Idaho was the prime contractor at the INEL and would be responsible for the computer procurement. They were the same company I worked for in Las Vegas. That would be a plus, as well as being from Idaho. My role in Richland was essentially complete. I did not want to hang around fighting with CSC as a support analyst. I said I would be interested if he could work it out.

In late September Chris got back to me. I was to go to Idaho Falls with him to meet people and assess the situation. It looked like a huge challenge in Idaho Falls. CDC lost to IBM a few years earlier, even though CDC was the preferred vendor, and had the best computer. The procurement was tailored for CDC, but the analyst messed up the benchmark. IBM won and now EG&G management and the users had a grudge against CDC. I thought it was something I could turn around. I loved the pre-sales environment. I was ready for a new challenge.

A few days later LaRue and I were told to fly to Idaho Falls and look for housing. Before we left we listed the house for \$39,500. The realtor was skeptical as that model had never sold that high. We farmed the kids out with the neighbors, flew to Idaho Falls, and stayed at the Westbank Hotel. LaRue looked at houses while I met with EG&G and EI people.

We had no idea how long we would be in Idaho Falls and we didn't want the work of another new house. LaRue liked the older established house at 245 Ronglyn Avenue and I liked it also. It was all brick with a family room, living room, dining room, kitchen, pantry, 1 1/2 baths, and two bedrooms upstairs and a finished basement with two bedrooms, a bathroom, huge fruit room, huge recreation room, a craft room, a laundry room and a furnace room. It was built in 1955 by the owners of a furniture store and the carpets and drapes were all high quality. The wife had passed away and he moved to Island Park with a new wife. He would only entertain a full offer of \$40,000, so we submitted our offer at his asking price. After the realtor tracked him down he accepted.

Our flight home was on Hughes Air West (the yellow airplanes called the flying bananas) via Boise, Lewiston, then to Pasco. We had an hour to kill in Lewiston, and we went to the bar to watch the Oakland A's in the final game of the World Series. It came time to board. It was the last of the ninth inning with the A's in the lead. We were being paged over and over but we had to see the ending. The A's won and we dashed across the tarmac while frantically being waved aboard. The pilot asked who won.

When we got home I made a long banner and hung it across the front of our house with "Oakland A's" in yellow and green. We sat on the front porch that evening with our drinks, our A's caps, and the green A's bats of the kids.

In the next day or so we received an offer on our Richland house at our full asking price of \$39,500 much to our and our realtor's surprise. Maybe we should have asked for more, but we were happy to have it done so we could close on the Idaho Falls house.

I had some work to do to turn over the account to my old friend, Don Cooper, who was moving from the Portland office. I decided I would leave the Mazda at the Pasco airport and fly back and forth until the turnover was complete around Thanksgiving. We hated to leave the Richland house and all the work we had done. The movers packed and loaded us up and we departed for Idaho Falls on October 24, 1973 pulling our Golden Falcon travel trailer with the new Oldsmobile.

It was windy and raining hard. The gas gauge on the Oldsmobile was on empty when we got to Boise that evening. I pulled into the first gas station we came to and coasted the last fifty feet to the gas pump out of gas. We stayed at the Holiday Inn across from the airport and went on to Idaho Falls on the 25th. I parked the trailer at the house, and we checked into the Westbank hotel. It was Julie's seventh birthday. We had a birthday dinner in the Bonneville Hotel dining room. We moved into the house a few days later after we closed, and a house cleaner had gone through it.

My Work in Idaho Falls

I finished up my work in Richland the day before Thanksgiving. I put snow tires on the Mazda and departed after work. I hit a snow storm through the Blue Mountains and the rest of the way. I got to Burley around 1am and the freeway was closed. The Mazda had good road clearance for the deep snow, and the snow tires were effective. I drove around the barrier and kept going. I was the only vehicle on the road from Burley to Pocatello. I got to Idaho Falls at 5am Thanksgiving morning. The folks had come down from Salmon and they had a tough trip also.

The winter of 1973-1974 was bitterly cold with a lot of snow and temperatures down to 20 and 30 degrees below zero. We never really wanted to live in Idaho Falls because of the cold winters but now we were here. I wondered if we could adapt and like living in Idaho Falls.

Chris was a wheeler dealer and made an agreement with Energy Incorporated (EI) to provide us an office in their building downtown. In exchange, I would help them convert their programs to run on our Palo Alto Data Center 6600. He convinced CDC to install a user terminal at no cost to EI since it would produce revenue. Chris went so far as having EI sign a letter of intent for a computer system within a couple of years to sort of validate things and bait CDC management. Chris would continue to live in Seattle and fly back and forth almost weekly. He obtained budget for a nice monthly expense account for entertaining prospects. Chris used it liberally.

My main effort would be with EG&G to meet key users and build trust. They operated the IBM 360/75 computer for the INEL that was selected after CDC botched the procurement a few years earlier. It was woefully inadequate when it came to the reactor safety research program called RELAP that was developed at the INEL and used worldwide. A typical reactor simulation on the IBM 360/75 could take several hours. A justification was being built for the acquisition of a new modern supercomputer.

In one of my first meetings at EG&G I met with Dick Wagner who was now the head developer of RELAP. The original two developers of RELAP had left EG&G and were now in ownership positions in EI. That would help me greatly in the future. Dick asked me how much faster the CDC 7600 would be versus the IBM 360/75. I told him I would expect around ten times faster. That got his attention, and challenged me to prove it. I accepted the challenge with all the confidence that I could muster.

Converting RELAP would be a major undertaking since it was programmed around the IBM 360/75 and its scientific computing limitations. IBM lacked the numerical accuracy (at least 10-12 decimal places) required using single precision floating point notation in a 32-bit word. Single precision is the normal mode of operation with CDC computers and its 60-bit word. So, the programmers devised a scheme using double precision and double precision notation using 64 bits on the IBM system. I knew that the way IBM does normalization within the 64 bits it provides less accuracy than CDC with 60 bits. I planned to exploit it.

EG&G programmers programmed the reference to the first variable in an array as A(1,1) in IBM notation. It would have to be changed to A(1) for CDC notation and a massive task. RELAP had many thousand lines of code that would have to be changed to run on a CDC computer in single precision.

CDC computers could run RELAP in double precision with no changes. However, it would take twice as long per calculation and was not necessary. Luckily the people at EI had accomplished some of the conversion and I could follow what they did. However, it would still be a big effort. Knowing this I loaded up and flew to Minneapolis where I would have access to a 7600. I worked day and night with little sleep for a week and finally got it to run.

I flew back with the results on a computer printout about a foot high. I met with EG&G management and Dick Wagner. I held my breath while Dick flipped through page after page of

the results. After quite a while he said the results were good and we were 10.8 times faster than the IBM 360/75! The EG&G and DOE people were impressed. With this speedup they would be able to run a complete reactor simulation in an hour or two versus twenty-four hours on the IBM 360/75. .

Chris and I began pushing for a quick sole source procurement for a CDC 7600, and EG&G management picked up on it. The normal computer procurement cycle in the AEC, now known as the Department of Energy (DOE) was around three to four years. It required a feasibility study and justification to be submitted. If it was approved a funding request had to be submitted for congressional action in the next budget cycle two years out. A sole source procurement could be accomplished in six months, but is only approved in urgent circumstances.

RELAP was the only computer program in existence that could simulate reactor failures and predict the outcome. If a major accident occurred (such as happened few years later at Three Mile Island) EG&G and DOE would not have the computer power in place to address the accident. EG&G submitted this as the justification for a sole source procurement for a CDC 7600. It had a good chance but was rejected at the final hearing in Washington. It was not all bad as EG&G could proceed with an expedited competitive computer procurement. We would have to fight it out with the competition.

I have no doubt that high level IBM management used their Washington DC clout to shut down the sole source request. We knew we were getting under IBM's skin as they were complaining to EG&G and the AEC about my activity in Idaho Falls. They started bringing in IBM sales and technical people with Idaho backgrounds to make sales calls. It was amusing. They even replaced the regular salesman based in Boise with the hotshot salesman based in Houston. He was the salesman for the last procurement in Idaho Falls, which IBM won. However, he remained in Houston and only came to Idaho Falls infrequently. Chris and I would run into him in the Stardust bar and had some good discussions. I told him one night I didn't want to see the IBM jet flying in with IBM executives to go fishing with key INEL people as was the case in the last procurement. We learned later that IBM issued a directive that IBM people were not to frequent the Stardust.

Chris and I were deflated about not pulling off the sole source procurement, but we had made a lot of progress in the first six months in Idaho Falls. The Seattle District's annual sales meeting was at a resort on the Oregon Coast that spring and Chris and I went over. It was a short time after the sole source procurement had been rejected in Washington and we were dejected. At the award's presentation we were both given a length of rope "to hang in there". We didn't see the humor in it,

I learned a lot when I converted RELAP and made the timing run in Minneapolis. It took many hours looking through the program listing over a foot high to find the changes that had to be made, and then keypunch the corrections. Being under extreme pressure and dog tired it was easy to make keypunch errors that took time and effort to correct.

I found there was a consistent methodology used by the EG&G programmers to get around the short comings of the IBM 360/75. I decided I would write a program that would scan for a match with what I was looking for. I provided that via a keypunched card. The program would initiate the change without me having to look through the listing.

My goal was that I would not have to go through a listing and keypunch a card to make a change. Once my program found a match it would create a change directive according to my input data. This was then written to a file for the CDC UPDATE utility to make the changes.

I worked on the program in my spare time over the next year or so. It was difficult programming. I had to scan every column of the 80 column punched cards looking for a match with the data I provided as input. Fortran and CDC computers were designed for fast computations using 60-bit words and not manipulating bits and bytes at the character or single digit level. I learned how to do this on the program I wrote while at the Lawrence Livermore Lab, so I knew what I had to do. I was fortunate as I could use the Palo Alto Data Center 6600 via the user terminal at EI to debug my program as I went. I kept adding functionality until I could convert the many thousands of cards of RELAP without me touching any part of it.

It was amazing that the computer did the conversion in less than a couple of minutes and was error free. I could now convert any program by simply changing the input data that was appropriate for that program.

I named my program "EDIT" and used it extensively. The program is 217 FORTRAN statements. That is about three inches of keypunched cards. I still have it stored in the top drawer of the desk in my shop. I also reproduced it in a WORD document. I have included it at the end of this chapter as an Addendum.

I was in a lull waiting for the Idaho Falls computer procurement to get underway when I got a call that I was needed in Minneapolis to work on a benchmark for Lockheed Corporation. I got there, and the three analysts assigned were in trouble. The benchmark demonstration was in less than two weeks and they didn't have anything converted and running.

Lockheed had given them the toughest programs they had that were running on a Univac 1108. They made heavy use of unique Univac extensions to FORTRAN. The analysts were working on a couple of programs each. That was about all they would get done. They had decided three other programs were too difficult. They would only get to them if they finished what they were working on. They had decided a fourth program, which was Lockheed's structural analysis program named REXBAT, was too large and complex. Therefore, there would be no attempt to convert it.

I told my coworkers to concentrate on the three programs they were working on and I would work on the three difficult ones they had set aside. With my EDIT program I had all three running correctly in two days. I then decided to tackle REXBAT. It was a massive program

and looked impossible. However, within a week I had it converted and correctly running two of the three sets of data. The third set ran correctly for a long period then would crash. You knew it crashed as the last page of the printout was a full-page picture of Snoopy sitting on top of his dog house.

It came time to run the benchmark for the evaluation team. Two of the three data sets for REXBAT was a fantastic accomplishment according to the Lockheed people.

The purpose of the benchmark was to qualify vendors if Lockheed should decide to replace the Univac 1108's in the future. We ran our demonstration, and the evaluation team was surprised at what we accomplished. However, Lockheed eventually decided not to go ahead with a competitive procurement. They had a sweetheart arrangement with Univac. It is my belief they were afraid they might end up with a CDC computer.

Shortly after I returned to Idaho Falls Lockheed paid CDC a consulting fee and expenses for me to meet with the REXBAT team to discuss the how and why of what I did. I flew to Sunnyvale, California and discussed my rationale of removing the Univac Fortran extensions with the use of my EDIT program. I am not sure but what the results of the third data case that I produced on our computer was correct, and the Univac results were wrong. That may have been what the meeting was all about.

Our Life in Idaho Falls

We settled in and joined the Newcomers Club and was quite active with socials and potlucks. We met a lot of professional people that were also new arrivals for jobs at the INEL. Two couples that we met and socialized with were Kay and Layman Lott who moved from Boulder, Colorado, and Neil and Pat Cox who moved from Tucson, Arizona. Layman was a Phd engineer with EG&G and Neil was a Phd chemist with EG&G ,and formerly a college professor. They were not quite sure about what I was doing in Idaho Falls since I had no official connection with the INEL.

Our house was just three houses from where the IBM salesman lived that beat CDC and sold the 360/75 to the INEL a few years earlier. He was no longer with IBM as he had started his own data processing business downtown. We never did get together to discuss things,. I am sure he was watching what was going on.

The kids soon got into skiing by going to Kelly Canyon with friends ,and LaRue went with lady friends she met in Newcomers. They started by renting skis, and then with stuff from the ski swap. I wasn't about to take up skiing but finally relented to go once. I rented stuff and we went to Kelly Canyon on a nice spring day. I signed up for a morning ski lesson. The instructor started me on the rope tow and beginners hill snowplowing and making turns. Then gradually into skiing parallel. I was doing good, so we got on the lift to the top and I made it down skiing parallel with the instructor. The lesson was over, and I was full of confidence.I took the lift to the top on my own. My confidence and what I had learned gave way to panic at

the top. All I could do is traverse across and stop until I got brave enough to turn around and go across the other way and stop. I finally got to the bottom after about an hour, and was soaking wet from sweating so much. I was done with skiing and found a place to sit and wait in the lodge.

After a couple of hours, I decided skiing was not going to defeat me. There was a rope tow on a gradual slope behind the lodge. I got my stuff and went out again. I got myself together and started having fun. The hook was set.

The next weekend we went to Targhee and after that to Salmon. We bought new boots and skis from our friend Grant Haveman who had a ski shop in his Ace hardware store. I got Kneisle skis, LaRue got K2's, and we both got a pair of Scott ski boots, which were the hot new boots on the market. LaRue's were orange on the bottom and yellow on the upper. Mine were lime green. Julie got a new pair of yellow Hummer skis and new boots. Kathleen and Brian already had their stuff. The next day we went skiing with our new gear on Lost Trail Pass with Carol and Grant. After that we went to Big Sky, Montana. It became one of our favorite places to ski. My fourth time on skis we jumped in over our heads. We rode the gondola to the top then spotted a chair lift going on up into a bowl on Lone Mountain, and headed for it. We got to the top of the bowl and it looked too steep and frightening to head straight down. The guy in front of us was traversing across the top of the bowl so we followed him across until he stopped. We asked him where the easiest way down was, and he said it was his first time here, and he didn't know. It was straight down in deep snow and moguls, but we made it with a couple of falls. That fall we bought a family ski pass for Kelly Canyon and joined the Idaho Falls Ski Club. We had a lot of good parties and ski trips with the ski club.

I decided we should do some backpacking as a family. We began acquiring the gear. We bought Jansport backpacks, lightweight sleeping bags, cooking gear, ponchos, rain fly's, and hiking boots from REI in Seattle and local sporting good stores. Even Julie who was around seven had her own small backpack.

Our first backpack trip was in Yellowstone. We took an overnight trip to an isolated lake. I was in the lead and Brian was bringing up the rear when I heard him yell "moose, moose, moose!" I looked back and we had walked by a huge bull moose laying just off the trail. We hurried on up the trail to put distance between us.

We sat up camp by the lake by strung two rain fly's to keep the rain off us. We forsook a tent as they are too heavy to pack. We caught trout, cooked them in foil for supper, and then it was time to bear proof the camp per park ranger's instructions. The first instruction was to hang all food from a tree limb away from camp and out of a bear's reach. The second instruction was to not sleep with the cook which was not feasible.

It rained all night and the thought of grizzly bears made for a long night. At one point during the night I pushed up on the rain fly's to drain the puddle. They separated and dumped the puddle of water on Julie. The next morning, we were hiking across a large meadow. We came

to a backpaker crouched down and pointing to moose off to our left that were really agitated. All we could do is crouch low and move on down the trail.

Yellowstone was probably not the best place to take a family backpacking. The next day we departed on a two day trip to another remote lake. I rained most of the way which was about seven miles. When we got to the lake and evaluated the weather we decided to head back out.

Brian and I took a backpack trip to the White Clouds and the Little Boulder Chain Lakes. I stuck my six pack of beer in Brian's pack before we left the car without him knowing it. We set up camp next to a small creek. I put the beer in the water and it was cold after a short while.

There were fish in the lakes, but they weren't biting. We had canned stew that night. We hiked up high on Castle Peak and looking down on the string of lakes they resembled a chain. Thus the name.

Another trip we left the kids with the folks in Salmon as they didn't want to go backpacking. LaRue and I backpacked up a creek off highway 28 south of Salmon with the goal to reach 4th of July Lake. It was seven or eight miles all up hill.

We started late in the afternoon and were chugging up the trail. LaRue wondered if there were rattlesnakes to worry about. My reply was, "it is too high altitude for rattlesnakes". A short time later I saw what looked like a big rope in the trail. When we got closer it was a big rattlesnake with an attitude. I had my 22-pistol in my backpack, so I had LaRue get it out. I remember Dad telling me how he would shoot the head off rattlesnakes and that was my intention. However, I was shaking so much I couldn't come close. We detoured around and got out of there as he was highly annoyed.

We kept climbing higher and higher in the hot sun and we ran out of gas about a mile short of the lake. We made camp on a grassy spot beside the creek and caught some Cutthroat trout for dinner.

We got some big rocks out of the creek, made a fire ring, and got a good fire going. I brought four mini bottles of gin for evening martinis. I poured one each into our tin cups and we sat on a log by the fire to enjoy. We just got seated with our tin cups in hand when a rock in the fire ring exploded. We both tipped over backwards and the tin cups went flying. We had two mini bottles left. We moved the rocks away from the fire and started over.

We planned to sleep under the stars. We spread out a large black plastic sheet and rolled out our mats and sleeping bags. I had my pistol and flashlight by my head. During the night I heard something walking on the plastic at the foot of our bed. I grabbed my flashlight and pistol ready for the worst. I flipped on the flashlight and it was a tiny cottontail rabbit. It was hard to sleep after that excitement. We went back to Salmon the next day.

The Idaho Falls Computer Procurement

The DOE finally approved EG&G (after delays and jumping through bureaucratic hoops) to issue an RFP for a large-scale computer to replace the IBM 360/75.

It would be a fully competitive procurement with a huge benchmark and lengthy evaluation period. The RFP was released early 1976. I picked up the benchmark on magnetic tapes and headed to Minneapolis.

I found that the benchmark consisted of the RELAP reactor safety program and about seven other large programs. Each program had several sets of data. I was familiar with all the programs due to my involvement with EG&G for nearly two years.

In all there were 44 jobs and the run time was expected to be between four to six hours. It was intentionally designed to be over four hours. The published mean time between failure for the CYBER 76 that we would be bidding was four hours. That could be a problem.

The CYBER 76 was the old 7600 with a new name and new packaging. We referred to it as the same old dolly in a new dress. It was a number cruncher and had to have a computer to interface with the users. We would bid a small CYBER 173 as the front end.

IBM and Univac knew what they had to beat. IBM had recently announced a new model called the IBM 370/168 as their new giant killer. There was not much known about its performance. We suspected they would have to bid two processors to meet the performance specs. We also knew IBM would submit a bid with a competitive price. You never knew what UNIVAC (Sperry Rand) would do. I knew we were in for a dogfight.

We were allowed six weeks to prepare for a live demonstration with the evaluation team in attendance. I went right to work with my EDIT program on an old 7600 in the Arden Hills, Minnesota benchmark lab. I had all but one job running correctly in a few days. The third set of data for RELAP ran correctly for about 25 minutes then would go into a never-ending loop. My conversion looked good, but something was going wrong. I needed to talk to Dick Wagner at EG&G in Idaho falls. That was prohibited by the rules of the RFP.

I knew that Dick moonlighted at EI with his former coworkers on RELAP. My office was with EI, so I made a quick trip to Idaho Falls. I got with Dick in the evening to discuss the problem. He quickly found it was due to the superior accuracy of the CDC computer. It was not accounted for in the program that was developed on their IBM computer. He generated a fix and I was in business.

I had the programs converted and running correctly and needed blocks of at least six consecutive hours for timing runs. I knew from experience that I could not live with an hour here and hour there in the benchmark lab. I needed to make many timing runs and decide what to do to speed things up. This would be impossible to do on a computer used by many people.

I liked to visit the manufacturing floor to see what was being built, and for what customer. I discovered that a new CYBER 76 was in final checkout, and there was no customer name on it. It was the model we would be bidding for Idaho Falls. I told my management that I needed that system, so I could work around the clock with no interruptions. I also wanted it in the “fish bowl” on the second floor, so that the customer would be impressed.

My request went up the chain. Then Chris and I were called to present it to the man himself, Bill Norris. He was the founder, President, and CEO of CDC. We timidly walked into his big office on the top floor of the new glass tower,. This was CDC Headquarters near the airport in Bloomington. Minnesota. He listened for a while and asked questions. Then authorized it if we, “guaranteed the order”. Wow, the pressure was on big time.

Within a few days the new CYBER 76 was moved from the checkout floor to the “fish bowl” on the second floor as I had requested. The “fish bowl” was called that because it was behind a glass enclosed wall above the grand stair case of the lobby in the Arden Hills facility.

I knew it would wow the evaluation team. My friends in the benchmark lab were impressed that I pulled it off. The manager, Bob Korsch, assigned my old friend, Evans Harrigan, to generate and tune the operating system the way I wanted it.

I was pleased getting Evans. We had worked together in the Chippewa Falls Lab during my Livermore days. I knew he was the best available on operating systems.

I could handle all the programs that had to be converted, and the timing demonstration. I also needed a topnotch analyst to do the interactive demonstrations on the second day of the evaluation team visit. I knew of Bill Gray who worked in software development in the Sunnyvale, California facility. I requested Bill, and eventually got him. I had a good team for a change.

It took a couple of weeks to get the CYBER 76 moved and checked out. Also, the necessary peripheral equipment that we would be bidding all checked out and working together. It was a monumental task, and the clock was ticking. It was the old game of a team of hardware engineers and software people often in conflict.

It finally came together. It was time to make full timing runs. The initial run took four hours and 15 minutes. It was in the ballpark of 10 to 12 times faster for each job than the Idaho Falls IBM system.

I knew of some things I could do to bring the elapsed time down. I would put in my changes, and the first thing of the day was to run another timing run. However, I was only gaining a minute or so. I expected a lot more. I made timing runs over the ensuing days. There was little or no improvement. I believed the elapsed time was good, but I thought we could do better.

Bill and I worked sixteen-hour days seven days a week. With about two weeks to go I was tired and planned to spend a weekend at home. However, the Western Regional Sales Manager walked in about midweek and wanted me to show him where we were. I am sure it was a special trip for him as he probably didn't believe the reports he was getting.

The first thing he asked was if I needed additional resources. and I said no. I ran a demonstration from beginning to end and he was impressed. However, I told him I needed to squeeze some more minutes off the elapsed time, but really wanted to go home for the weekend. He said to stay and keep working. CDC would pay for LaRue to fly out for the weekend, which she did.

I had been having meetings with Evans to discuss issues and kept telling him, "I feel like there is a governor in the system holding me back. No matter what I do the elapsed time barely improves."

We tried different versions of the operating system to no avail. It was down to the last day and late afternoon before the scheduled demonstration.

Evans walked in and said he thought he had identified the problem. When the operating system was generated a debugging feature was turned on. He explained that it would cause an interrupt every time input or output was initiated. It was to log a trace for fixing problems. He said it could cause an eighteen percent degradation in throughput if there was a lot of input/output going on. Just as I thought all along. There was something stifling me.

Chris was to meet the evaluation team of about ten people at the airport and we were all scheduled to go to dinner at a fancy place. It was around 5pm and I needed to make one more timing run to see what the improvement would be.

I told Chris that he and his management were on their own with the evaluation team. Bill and I had things to do. I didn't tell him anything else. I made the timing run and saw a huge improvement. The elapsed time went from four hours ten minutes to three hours and ten or so minutes. I was ecstatic.

The next morning, we all met early at the hotel and went to the Arden Hills Facility. We entered the lobby. There was a wide spiral staircase to the second floor "fish bowl" that had drapes that were normally closed. I had them pulled open that morning for our guests. I told them, "look upstairs and you will see the system we are demonstrating. It is the exact system we will bid in our proposal". It made a nice impression.

Demonstrations are usually conducted in crowded noisy computer centers with computers all over the place. The CYBER 76 in the "fish bowl" was impressive. I was proud of the effect it had on the evaluation team.

I had a nice conference room set up with a detailed briefing binder for each person. It

contained all the changes to the programs and timings of all 44 jobs we would be running. I led off telling them how easy the conversion was. "I did not touch a single card or card image". I held up my handful of punched cards that was my EDIT program. "This did all the work and every change it made is documented in your binder. To prove it I will hang the IBM magnetic tape you released with the RFP and run this program. In less than two minutes it will have made the complete conversion, and we will start the benchmark". Then I said, "you can expect an elapsed time of around three hours and ten minutes". Chris's head popped up from his hangover state with, "you mean four hours". I came back with, "we'll see". Chris kept muttering, "four hours". Now it was show time.

We moved into the "fish bowl". I hung the IBM magnetic tape and ran my conversion "program. It did its work in about a minute. It was time to start the timing run. I told them, "when I start the benchmark I will back away from the operator's console and not touch anything per instructions in the RFP". The RFP stated, "the operator will not assist in scheduling jobs or interfere with the order of the jobs for execution. The operating system must do it all automatically." However, I had some tricks up to my sleeve to automatically control the order the jobs were processed.

I also told them they could sit at the console which was two big cathode ray tubes. They could watch the progress of jobs being processed. They could also watch the contents of memory change on anything that was running in the computer. They were free to look at anything. They loved it. I circulated around explaining things, answering questions, and exuded complete confidence.

The timing run ran in three hours and ten minutes. Chris was flabbergasted, and the evaluation team was smiling. I knew we aced it, but we still had a long list of mandatory demonstrations to perform the rest of the day and the next morning.

It was lunch time and Chris and the sales managers from the Seattle Branch Office and San Jose Regional Office took the evaluation team to the conference room for a catered box lunch. Bill and I had to get ready for the mandatory demonstrations that would take up the afternoon and the next day. We grabbed a sandwich out of a machine. I also wanted to double check our timing run to ensure we processed every job correctly, which we did.

We finished the day around 6pm and the CDC Vice President of Sales, Bobby Robertson, had a chartered bus outside. It was for transportation to a famous Swiss restaurant in Stillwater, Minnesota.

Bill and I began setting up the next morning demonstrations as we had not been invited to go to dinner. We thought they were gone when Bobby Robertson came busting in the room saying, "you guys are coming with us." We scrambled aboard to cheers. Robertson handed us a large glass of extremely good red wine. He had a couple of cases in reserve. Everyone was in a good mood and really wound up during the hour bus ride to Stillwater.

The Swiss restaurant was fabulous. Everyone was singing after dinner and having a great time.

We had the bus driver drop Bill and I off at the Arden Hills facility around midnight as we had to get ready for the next day. We got about four hours sleep.

The next day went well and the evaluation team departed in the afternoon for IBM in Kingston, New York. I felt very good vibes coming from them. I don't believe we could have done any better.

(I recently visited with a former DOE representative who was on the evaluations team. He did not remember much of the IBM demonstration except they had a lot of trouble performing the benchmark timing run. It was midnight before they left the facility and there was no place to get something to eat His impression of IBM was not good.)

We had a lot of work to do finalizing our proposal as we had to answer a long list of mandatory questions. We got it done and submitted about two weeks later which was the proposal deadline. We waited until the last minute to turn the proposal in so that our price of \$8.4 million could not be leaked to the competitors. Then it was a long wait. A lot of rumors flew around Idaho Falls. Then we finally got the call that CDC was awarded the contract.

It was quite an accomplishment for me with back to back big wins in Richland and Idaho Falls against UNIVAC and IBM.

After the Idaho Falls Computer Installation

My next assignment was to install the system and get it through the 30-day acceptance test which went smoothly. It was a big day when Chris and I and a CDC courier picked up the check for \$8.4 million at the DOE building on April 26, 1976. We went to the Bon Villa Club and had bloody marys. Chris presented the check to the bartender to see if he could cash it! It blew his mind.

We initialed the check before we put the courier on the plane that evening. I still have a photocopy of the check in my drawer somewhere.

It was agreed that I would work under contract to EG&G converting programs and then move into sales. I requested Bill Gray to replace me. He accepted and moved to Idaho Falls. Both of us would end up working for EG&G in 1980.

Our Airplane

Bill Gray was a private pilot and glider instructor, and was looking for an airplane to buy. I wanted to learn to fly. Chris expressed interest, so we decided on a three-way partnership. Bill found a great deal on a 1971 PiperCherokee 140 (N591FL) in Ohio for \$7,500, and we decided to go for it. Bill and I flew to Toledo, Ohio to acquire the plane if it passed his inspection. It

was a beautiful four passenger (two adults and two smaller people, or three adults), 150hp, low hours, and painted white with red trim. We were impressed when we saw it and inspected it.

Bill took a check ride with the seller. Then we handed him the check and departed. Bill is a cautious type, so we flew about an hour and landed at Valparaiso, Indiana to go over the airplane and plot our next leg.

The plane checked out and we continued and flew south of Chicago observing the skyline. We landed in Moline, Illinois for fuel and were advised of a weather front blocking our route due west. Our plan then was to turn North and follow I-35 to Minneapolis where we could bunk up with fellow CDC people that we knew were in town. However, it began raining hard, so we landed in Mason City, Iowa and parked the plane. The Holiday Inn sent a car and we spent the night there.

The next morning, we headed North again. We got to Albert Lee, Minnesota Bill landed to go over the plane again. I think the real reason was that Bill lived in Albert Lee when he was young, and learned to fly out of that airport.

The weather cleared to the west, so we turned and headed west across South Dakota. I was the navigator. I had great vision and Bill's vision was not too good. He insisted that I have a map in my lap and call out landmarks every few minutes. In the flat midwest we flew IFR (I follow roads) and sometimes railroad tracks. Bill would circle low over a town, and I would read the town's name on the water tower to make sure we were where we thought we were. It worked as we kept on course. We refueled in Mitchell, South Dakota and headed west over the badlands following I-90 to Billings, Montana.

I relieved Bill at the controls every now and then and that was fun. After five hours I was watching the two fuel gauges approaching the empty mark, and we had another half hour to go before reaching Billings. Bill would tap the fuel gauges, and didn't seem too concerned. We were following the interstate and had a place to land if we had to. I wasn't aware at the time that we had a five-gallon reserve in each tank after they showed empty.

We made Billings and ready for a rest stop after five and half hours. The Billings tower called us, "One Foxy Lady", the phonetic annunciation for the last three digits of our airplane number N591FL. He should have referred to us as "one foxtrot lima". We liked "one foxy lady" and it stuck.

The weather briefing said our weather going west was getting worse. We decided to have a look and took off with the idea we could return to Billings. We skimmed through to Butte and were flying through a rain squall when a bolt of lightning knocked out our electrical power. We had no electronics. Bill started down to make a landing on the freeway if necessary. He told me to check and reset the circuit breakers which were between my knees. I got it done and we were ok, so we turned south for Dillon, Montana.

We decided to land in Dillon to top off the tanks. Bill wanted reserve to get over Monida pass, or detour around, if the weather got worse.

We were filling up in Dillon and a guy out for a flying lesson came over and offered to buy our plane. It made us feel good, but we declined his offer.

We were now only about an hour from home, so we called ahead to expect us. It was getting dark when we landed in Idaho Falls. LaRue, and Bill's wife Nancy, were there to meet us with champagne and snacks. We set it on the wing and rehashed our journey.

My Flying Lessons

An engineer at EG&G was a Certified Flight Instructor (CFI) and I linked up with him to take flying lessons after work. One evening he told me to fly to Rexburg and do a touch and go. Then to Rigby and do a touch and go. Then land in Idaho falls and stop in front of the Red Baron office and hangar. I was surprised when he signed my student license. He got out and said, "do five touch and go's, taxi back here, and park in your usual spot". Wow, I was soloing after seven hours of dual instruction! I did have the benefit of flying with Bill on the trip from Toledo and trips to Boise and Salmon. I had been having trouble with my landings up until that evening and was wondering if I would ever get it right. That evening all eight landings were perfect. I walked two feet off the ground when I got out of the plane. Bill and Chris knew I was flying and had come out to watch. We went to the airport bar and celebrated me soloing. Chris wanted to be a part of it all but never took a lesson.

The Teton Dam Break

On a nice Saturday morning on June 5, 1976 Bill and I planned to wash and wax the plane. He would also give Brian a ride. On the way to the airport I heard on the radio that the Teton Dam might break. I never heard of a dam breaking, so never thought much of it.

Bill said they would fly towards Rexburg and the Teton Dam and see what was happening. I stayed at the airport as we didn't have the backseat in the plane. National Guard helicopters swooped in and our congressman, big George Hanson, stepped out declaring an impending disaster, and was interviewed by the press.

Warnings were now coming over the radio. Idaho Falls and the airport would be under five feet of water.

Bill and Brian returned and were excited. They saw the flood hitting Rexburg and saw houses, dead cows, and trees floating in the flood water. Bill said he would fly the plane to Driggs to save it. He asked me to get his wife Nancy and son David and take them to our place as we were on higher ground away from the river. It is strange he left his Volvo station wagon that was worth more than the plane at the airport. Bill took off and I went to get his family.

The flood was projected to hit Idaho Falls late Saturday afternoon. We were fortunate that the initial direction of the flood water was out over flat land away from the Snake River. It would take hours before it would flow back into the river. This provided time to muster volunteers and place sandbags along the river bank through downtown Idaho Falls.

Crews worked all night and stacked sandbags over five feet high on the east bank and about eight feet high on the lower elevation west bank of the Snake River through Idaho Falls. By Sunday morning the flood water was at the top of the sandbags, but they were holding. It was solid water and the falls were no longer visible.

The CDC office was in a basement about 50 yards from the east bank of the river and would be flooded if the sandbags failed or the water came over the top.

My brother Garry and I went to the office Sunday afternoon to get important documents. He stood at the top of the stairs to warn me while I went into the basement office to gather things. I got what needed to be preserved and we got out of there. Water was beginning to flow over the top of the sandbags when we departed. I took pictures of trees, carcasses, house tops, etc. floating down the river. It was a scary scene.

By Monday the water began receding and we were no longer in danger. The Broadway Bridge was a mess and would take a long time to get it back into service. The hotels and downtown area were saved by the sandbagging effort. It was quite an accomplishment.

My New Job

I was finished with my job as an analyst in Idaho Falls and was selling computer time and structural analysis applications for the CDC Data Center in Palo Alto.

I was working with Morrisson Knudsen (MK) in Boise. They had major construction jobs all over the world and the designer and builder of the Teton Dam that just broke. I had made major strides in getting them to use the Palo Alto Data Center for doing structural analysis.

I was scheduled Monday morning after the dam broke to give a presentation in Boise. I called my contact at MK Sunday evening to see if I was still on for Monday morning. I was advised it would not be a good idea given the circumstances. So much for that.

ADDENDUM My Computer Program

The computer program I wrote in my spare time to convert programs follows:

```
PROGRAM EDIT (TAPE1, TAPE2, TAPE3, INPUT, OUTPUT, TAPE5=INPUT,  
1TAPE6=OUTPUT)  
DIMENSION LS1(50), LS2(50), ICODE(50)
```



```

INTEGER S1(50,80), S2(50,80)
INTEGER TAB1(80), TAB2(80)
DIMENSION LSTART(80), INDEX(80)
INTEGER EXPAND(80)
EQUIVALENCE (IN(73), EXPAND(1))
DIMENSION IN(92), ISAVE(92)
DIMENSION IGNORE(80)
INTEGER DELETE(14), PERIOD, BLANK
DIMENSION IDECK(7)
ISAVE(91) = 10H //ORIGIN
ISAVE(92) = 10HAL LINE
PERIOD = 1R.
BLANK = 1R
REWIND
C*   READ IN THE DIRECTIVES AND CHARACTER STRINGS TO LOOK FOR
9000 FORMAT (4I5,4X,R1,4X,R1)
      DO 100 I=1, 50
      READ(5,9000) LS1(I), LS2(I), TAB1(I), TAB2(I), ICODE(I), IGNORE(I)
      IF(EOF(5)) 150,90
90   CONTINUE
      NS = I
      READ(5,9100) (S1(I,J), J=1,80)
      IF (ICODE(I) .EQ. 1RD) 100,91
91   IF (ICODE(I) .EQ. 1RP) 100,92
92   CONTINUE
      READ(5,9100) (S2(I,J), J=1,80)
9100 FORMAT(80R1)
100  CONTINUE
      WRITE(6,9101)
9101 FORMAT (1H1,* //FIRST 50 STRINGS ONLY WERE PROCESSED //*)
150  CONTINUE
      WRITE (6,9150) NS
9150 FORMAT (1H1,* //*, I2,* STRINGS PROCESSED AS FOLLOWS //*)
      DO 175 I=1,NS
      WRITE (6,9175 LS1(I), LS2(I), TAB1(I), TAB2(I), ICODE(I), IGNORE(I)
9175 FORMAT (1X,RI5,4X,R1,4X,R1)
      WRITE (6,9176) (S1(I,J), J=1,80)
      IF (ICODE(I) .EQ. 1RD) 175,171
171  IF (ICODE(I) ,EQ, 1RP) 175, 172
172  CONTINUE
      WRITE ( 6,9176) (S2(I,J), J=1,80)
9176 FORMAT (1X,80R1)
175  CONTINUE
      WRITE (6,9177)

```

```

9177 FORMAT (1H1,* //MATCHING STRINGS WERE FOUND AS FOLLOWS //*,//)
C*          READ IN A NEW LINE FOR EDITING
 180 READ (1,9180) (IN(I), I=1,90)
9180 FORMAT (90R1)
      IF (EOF(1)) 999,200
200 CONTINUE
      DO 190 I=1,90
      ISAVE(I) = IN(I)
190 CONTINUE
      INEDIT = 0
      NOV = 0
      DO 250 I=1,NS
      ISTART = TAB1(I)
      ISTOP = TAB2(I)
      IC = ICODE(I)
      NCS1 = LS1(I)
      NCS2 = LS2(I)
      J = 1
      L = ISTART
      NODEL = 0
202 CONTINUE
      IF (S1(I,J) .EQ. ISAVE(L)) 205,225
205 IF (NCS1 .EQ. 1) 215,207
207 DO 210 JJ=2,NCS1
      JJJ = L + JJ - 1
      IF (JJJ .GT. ISTOP) 250,208
208 IF (S1(I,JJ) .EQ. ISAVE(JJJ)) 210,225
210 CONTINUE
215 IF (IC .EQ. 1RR) 220,216
216 IF (IC .EQ. 1RD) 260,217
217 IF (IC .EQ. 1RP) 248,218
218 IF (IC .EQ. 1RI) 240,219
219 IF (IC .EQ. 1RB) 230,214
214 IF (IC .EQ. 1RU) 400,220
400 DO 401 JJ=1,7
401 IDECK(JJ) = 1R
      JJJ = 0
      JJ = 0
420 JJJ = JJJ + 1
430 JJ = JJ + 1
      IF (ISAVE(L+JJ+NCS1-1) .EQ. 1R( ) 410,402
402 IF (ISAVE(L+JJ+NCS1-1) .EQ. 1R( ) 404,405
404 IF (JJJ .GT. 1) 410,430
405 IDECK(JJJ) = ISAVE(L+JJ+NCS1-1)

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      IF (JJ .GE. 7) 410,420
410  WRITE (3,9410) (IDECK(JJ),JJ=1,7)
9410  FORMAT(* /DECK *,7R1)
      WRITE (6,9411) (IDECK(JJ),JJ=1,7)
9411  FORMAT(* /DECK *,7R1)
      GO TO 250
220  CONTINUE
C*    SPECIAL CASE TO HANDLE A SUBSTITUTION STRING THAT IS LARGER
      THAN THE ORIGINAL STRING
      NC = NCS2 - NCS1
      IF (NC .EQ. 0) 221,223
223  NOV = NOV NOV + 1
      LSTART(NOV) = 1
      INDEX(NOV) = 1
      GO TO 224
221  CONTINUE
      DO 222 JJ=1,NCS1
      IN(L+JJ-1) = S2(I,JJ)
222  CONTINUE
224  INEDIT = 1
      L = L + NCS1 - 1
      IF (L .GT. ISTOP) 250,225
225  CONTINUE
      L = L + 1
      IF (L .GT. ISTOP) 250,202
230  DELETE(I) = 10H/BEFORE,
      GO TO 242
240  DELETE(I) = 10H/INSERT,
242  DO 245 J=1,72
245  IN(J) = S2(I,J)
      GO TO 261
      WRITE (6,9280) (ISAVE(K),K=1,92)
250  CONTINUE
      NODEL = 1
C*    IF LINE IS EDITED DISPOSE OF ACCORDING TO ICODE
      IF (INEDIT .EQ. 0) 8250,260
8250  WRITE (3,9300) (ISAVE(I), I=1,80)
      GO TO 180
260  CONTINUE
C*    *DELETE CARD LOGIC HERE
      DELETE(1) = 10H/DELETE,
      IF (NOV .LE. 0) 261,300
300  JC = 74
      LBIAS = 0

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```

    LAST = 0
    DO 310 I=1,80
310EXPAND(J) = BLANK
320L = LSTART(NOV)
    IF (L .LT. LAST) 323,321
321L = L - LBIAS
323I = INDEX(NOV)
    NCS1 = LS1(I)
    NCS2 = LS2(I)
    NC = NCS2 - NCS1
    IF (NC .LT. 0) 330,322
322JC = JC + NC
    JJ = JC
    JJJ = JC - NC
325IF (JJJ .LT. (L+NCS1)) 330,328
328IN(JJ) = IN(JJJ)
    JJ = JJ - 1
    JJJ = JJJ - 1
    GO TO 325
330 CONTINUE
    DO 335 JJ=1,NCS2
335IN(L+JJ-1) = S2(I,JJ)
C*    SHRINK UP THE LINE
    IF (NC .LT. 0) 336,337
336NC = IABS(NC)
    JJ = L+NCS2 - 1
    DO 339 I=1,JC
339IN(JJ+I) = IN(JJ+NC+I)
    JC = JC - NC
    LBIAS = LBIAS + NC
    LAST = L
337NOV = NOV - 1
    IF (NOV .LE. 0) 340,320
340NOV = 1
261CONTINUE
    DO 255 I=1,13
    II = I + 1
    If (ISAVE(73+I) .NE. BLANK) 251,256
251DELETE(II) = ISAVE(73+I)
255CONTINUE
256DELETE(II) = PERIOD
    NDIGIT = 14
    III = I + 1
    DO 259 I=II,13

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      IF (ISAVE(73+I) .NE. BLANK) 257,258
257DELETE(III) = ISAVE(73+I)
      III = III + 1
      GO TO 259
258NDIGIT = NDIGIT + 1
259CONTINUE
      WRITE(6,9259) (DELETE(I),I=1,NDIGIT(I))
9259FORMAT(1X,A8,13R1
      WRITE(2,9258)(DELETE(I), I=1,NDIGIT)
9258FORMAT(A8,13R1)
      IF (NODEL. EQ. 1) 270,264
264IF (IRC .EQ. 1RD) 290,270
270WRITE(2,9260) (IN(I),I=1,72)
9260FORMAT (72R1)
      WRITE(6,9262)(IN(I),I=1,72)
9262 FORMAT(1X,72R1,18X,* //REPLACEMENT LINE *)
      WRITE(3,9300)(IN(I),I=1,80)
9300FORMAT(80R1)
      IF (NOV .LE. 0) 275,271
271DO 273, J=1,80)
      IF (EXPAND(J) .EQ. BLANK) 273,272
273CONTINUE
      GO TO 275
272WRITE(6,9272)(EXPAND(I),I=1,80)
9272FORMAT(6X,1H*,80R1,4X,* //CONTINUATION LINE *)
      WRITE(2,9273) (EXPAND(I),I=1,80)
9273FORMAT(5X,1H*,80R1)
9261 FORMAT(1X,90R1,3A10)
275WRITE(6,9261)(ISAVE(I),I=1,92)
C*      GO BACK TO PROCESS THE NEXT CARD IN THE PROGRAM
      GO TO 180
9280FORMAT(/1X,90R1,2A10,*--PRINTED ONLY*)
290WRITE(6,9290)(ISAVE(I),I=1,92)
9290FORMAT(1X,90R1,2A10,*--DELETED*)
      GO TO 180
999 ENDFILE 2
      REWIND 2
      CALL EXIT
      END

```

End chapter 6

