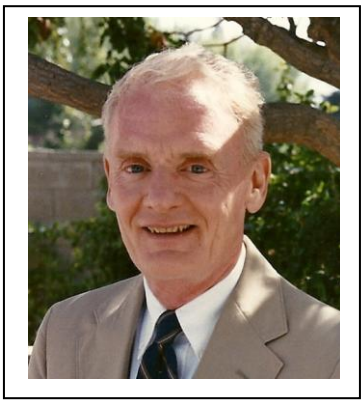
Experiences During 40 Years at HP

Hank Taylor



Foreword

Mr. Information Flow —Hank Taylor

There is a truism in the military; that you may be promoted to command an Army Unit, but you aren't IN-COMMAND until you can communicate with your Unit. It is the same in any organization—no corporation can manage its business unless it has established a viable and efficient communication system within the entire corporation, both inside and outside. Further, no corporation can manage its operations unless there is a comprehensive information system where the data undergirds all activities; production control, order processing, purchasing, finance, accounting and many others including HR.

As the Hewlett-Packard Company grew rapidly from its 1940s Palo Alto inception, through its expanding presence outside the state into Loveland, CO, and then Germany and many other states and countries, the communications were traditional. All the global sales offices were part of the communications mix. US Postal mail was primary for all written communications, (UPS was not everywhere yet), and the ATT TWX (teletype) services handled more urgent written communications. The Ma Bell telephone system, which was the so-called common carrier telephone service was highly used, and ATT adapted that system for businesses, with their WATS tariff arrangements (Wide Area Telephone Service).

HP production processes of those 1950s years were based on batches, which we called “runs.” The schedulers got their runs data from information in the “order books” in marketing. These were staffed and hand logged from customer orders and individually managed for things like government priorities. Inventories were controlled with the venerable Kardex system, each purchased part updated by hand on its individual drawer card. Work orders for fabricated parts were likewise scheduled by hand, based on sometimes long cycles of casting, machining and plating. It all worked amazingly well, but was cumbersome and frustrating. All those hand systems were just waiting the on-coming computer revolution, and HP’s purchase of a Big-Daddy Sperry-Univac central computer.

LONG BEFORE the advent of the Internet, as we know it today, and its pervasive reach with email and file transfer, there were creative people working in HP's central services to modernize our communications. US communications business and technology of the 1960s was a regulated monopoly, with just the beginnings of alternative competitors. Down in the main computer complex, many hand operations were being replaced by punched cards and large format computer printouts of schedules, purchase orders and other data-driven processes.

In the early 1970s HP 2100A engineering computers were broadly deployed in the Company to support electronic communication and also provided some limited, but important business processing. By the late1970s HP business computers were appearing in mid-sizes, and the HP 3000 series was being deployed to replace processes being done on IBM and other externally made computers. Our Information Technologies (IT) geniuses were just waiting in the wings to exploit the capabilities of our own business computing equipment and leverage HP communications and IT processes to be the best and most technically advanced of their time. It was only fitting that the world's pre-eminent technology company would establish the central services teams to create Comsys for Internet-like written communications and Telnet for leveraging the commercial telephone system to our advantage. The definitive HP Journal article of Sept 1986, proclaimed that Comsys was “piggybacking” on 453 world-wide HP 3000 computers, “while they were idling.”

Hank Taylor of the HP Information Technology section, was in the middle of all of those revolutions, and not JUST the hardware innovations needed for collecting, batching, and scheduling world-wide use of the commercial telephone facilities. But, even more so, he envisioned the human cultural changes that ALL of our HP people were going to need to accept and use (learn to type). He was cheerleader for this powerful new set of communication tools and data services like HEART that were being put into place to run the company. In many ways, his memoir reads like his manager saying, “Let’s see what Hank will do with this.”

Hank's Memoir recalls many personal observations of our company and our HP people relationships. His walk through HP’s IT history will be long remembered.
--John Minck

Bud Eldon, Bruce Wholey, Ralph Lee and me

Part 1. HP's Foundation of Trust

Looking back on a wonderful and satisfying life and an interesting and challenging HP career, I still can't imagine my good fortune. At HP, Dave and Bill established many attributes deep in the DNA of our company that were uncommon. Generally these traits fell under the umbrella of what we called the HP Way. These traits were somewhat illusive and were seen in different ways by different people within the company. For me, since most of my career at HP involved changing the way people did their work or encouraging them to cooperate---when on the face of the request it did not appear in their own best interest---one characteristic stands out.

In all the other companies that I worked with closely, I never saw anything like it. These traits were a common trust in the organization's integrity, fairness and humanity. Further, our personal responsibility was to help the company succeed and be the best it could be. There was a strong feeling that each of us had a common goal to help the company progress and that trumped personal preferences. This created a spirit of cooperation and common sense that I have never seen elsewhere. If a person could make a solid case that their proposal, even though it involved substantial change, or investment, yet resulted in the least expense to the company, the best product, the most productivity, the best quality or the best service, that proposal was virtually always approved. More importantly that proposal was accepted by people throughout the company.

In trying to figure out where this uncommon ethic came from, it seemed to me that it grew out of the personal integrity and clear, logical, people-oriented judgment of Dave and Bill. The original profit sharing scheme was a striking example this as it not only shared the success of the Company, but also trained people at all levels to ask, "How will this action (large or small; mine or others) affect the Company?" This instilled in HP people, at a gut level, a concern about the overall impact of an

action on the company, and that as the company succeeded overall they did also. It seemed to suppress ego driven decision making.

Through all my time at HP, I was involved with very able HP people in numerous projects, some of which resulted in major administrative, operating and job dislocating changes for people in the Company. Some of these will be described below. All of these companywide projects would have been virtually impossible without the framework of trust that Dave and Bill established.

Graduate School

I had worked at several jobs to make my way through Brigham Young University, and, in the spring of 1955, graduated with a degree in Business Management. My department Chairman at BYU had graduated with a Doctorate from Harvard Graduate School of Business. About a year before graduation I told him of my interest in an MBA degree. He assured me I would be accepted and he noted that in my chosen undergraduate program, there was much the same content as I would get in graduate school. So he waived all of my business management courses and in their place I was to take what interested me. Thus, in my last year, I took courses in geology, botany, tree & shrubs, English, advanced grammar and other non-business courses. When replies to my applications came back I had been accepted at Harvard, Stanford and Northwestern.

During our senior year at BYU, Colette Green agreed to marry me. She was a very attractive student leader and "Snow Queen," graduating with a major in Elementary Education and a minor in Art. Together in the fall of 1955, with the help and transportation provided by her father and mother, we set off for Harvard Business School in Boston. My school preference would probably have been Stanford, but at the time most of my earnings had gone to my undergraduate degree. We had little money for the costs of graduate school and at that time Stanford had no funding for financial aid. Harvard was able to be very helpful in this respect, so that's where we went.

In the summer before moving to Boston I worked three jobs: one as a graveyard shift arc welder at a pipe company, one as an analyst for the BYU financial Vice President and as an upholsterer at my family's furniture store. Colette worked as a window display designer for the furniture store. While at Harvard Business School I also worked several part-time jobs; J.C. Penney, HBS publication distribution, MIT Lincoln Labs and at General Electric's executive training program in Crotonville, NY, as a summer intern writing cases. Colette worked at Miss Cannon's Children's Store in Harvard Square. She had intended to teach school to help support us, but nature directed otherwise. Our first child was born in April at the Boston Lying Inn, (kind of a medieval clinic where people with no funds could get low cost obstetric care).

We loved the Boston area and our experiences there, but we were far from our families. They were eager to see more of their new grandchild and they knew a second one was expected a few months after completing the MBA. For this reason we decided that I would search for a job somewhere west of Denver.

There were numerous interviews at the HBS placement office. Hal Edmonson and Tom Christensen came from Hewlett Packard and seemed like really good guys. They were the only interviewers who took my picture. Today that might have been considered racist, but in those days it seemed a smart way to remember who they interviewed. The interviews at the placement office resulted in a number of factory visits to a variety of western companies. From these visits the offers of greatest interest boiled down to: Ramo Wooldridge in greater Los Angeles (this was before it became Thompson-Ramo Wooldridge or TRW), Hewlett-Packard in Palo Alto, Del Monte in San Francisco and Longview Fiber in Longview, Washington. (1956-7 was a much better time to look for work than 2010 thru 2012.)

Having received offers of employment from all of these companies I prepared a very analytical spread sheet with these job options listing on one axis and all the factors of importance to us on the other; then rated each alternative. The two that came to the top were TRW and HP.

When I had visited TRW, they had a classy building and showed me what would be my spacious office and the impressive title that I would have, plus what to me, was a very impressive salary.

On the factory visit to Palo Alto, Tom Christensen had met me at SFO and drove me down 101 to HP's headquarters building. Once in Palo Alto, he selected the best possible route, up University Avenue past scores of stately mansions. We arrived at 275 Page Mill Road, the company Headquarters at the time. It was just across the Southern Pacific railroad tracks, facing a street lined with rusty tin warehouses and a large building materials supply yard with gravel piles, concrete mixers and stacks of cement blocks.

I was escorted through a small lobby which also housed the company switchboard and some personnel functions. When I stepped through the door beyond the lobby I was in the front office with a sea of gray desks, completely in the open, all bathed with brilliant indirect sunlight from north facing clerestory (factory like) windows. There I met Frank Cavier, Ed van Bronkhorst, Keith Elledge and others. Dave and Bill's offices were along the western wall of the big open space and these were the only 2 offices in sight. The base salary offer was just adequate and with it there was a confusing explanation of a production bonus in each paycheck, which was a bit variable and not guaranteed, but could equal as much 30% of your total pay. Frank Cavier said the starting job would be to work as a trainee in cost accounting and that this would help me to become familiar with the company products. I was excited by the fact this was a smaller company, just a little beyond the startup phase.

When I returned back in Cambridge I asked a friend in Engineering at MIT what he knew about HP. He said he knew nothing about the company, but that when engineers queued up to check out test equipment for their lab work the HP equipment was always gone first. This was a heartwarming recommendation. Palo Alto beat L.A. for location and HP was still a small company, under a thousand employees and sales in the last complete year, 1956, were just $20 million. All the HP facilities were in Palo Alto so there would be no capricious bouncing around the country with training assignments. These plusses offset the higher wages and plush offices of Ramo-Wooldridge. In addition HP exuded a no nonsense, no frills work ethic that was appealing to me.

The HP Choice

I accepted the HP offer and came to work in July of 1957, after graduation. Colette and I drove across the country in the first car we had owned since we were married, purchased just as we left the Boston area. It was a $700, well used, somewhat rusty, blue and white Ford Victoria. It ran most of the time and looked pretty good, as the paint actually held some of the rusted body parts in place. We visited our families in Canada and Utah as we drove across the country. In mid-July we drove into Palo Alto. It was afternoon, much of the landscape was dry and brown. Even the sky was brown from heavy smog. Colette was 8 months pregnant and quite uncomfortable. We had a restless 1½ year old boy to add to the challenges of the arrival day. Colette looked around as we arrived at our destination and asked, "Is this it?" It didn't match her vision. We booked a room in the Coronet Motel (which is still there more than 50 years later) while we looked through the Palo Alto Times house rental listings and called the likely prospects on the Motel's pay phone.

I reported in, at the HP headquarters, to Frank Cavier. I told him that we were looking for a place to live and then would like to take a week to visit my parents and brothers who were temporarily living in Southern CA. Then I would report to work on July 27th if that was OK. He said that would be fine

and asked me to talk with Ann Laudel, who served as the telephone operator supervisor, receptionist and the personnel department of the company. She was an attractive blond with a southern accent and a very low voice that sounded nice over the public address paging system. Her mellow paging was heard frequently throughout the entire plant and her telephone operators had equally nice voices. Ann got me through all the necessary personnel paperwork. I had had a fairly high security clearance with MIT Lincoln Labs and we set about to extend that, though it was not urgently needed at HP.

After the paperwork was done Frank suggested that I talk with Eileen Dugan in the HP Lab library. She was the housing expert. She had maps and a lot of good advice. One warning I still remember was that we should stay well away from the sloughs as they smelled awful when the tide was out and the wind was unfavorable. .

[Note: The air quality in the Bay Area has been cleaned up remarkably well since 1957. Also the creeks which created the sloughs have been largely concrete lined to the Bay and lost their not so charming stench.]

We did find a nice small home on Moreno Ave in Palo Alto and were lucky to avoid a bidding battle to lease the home as several people were there at the same time wanting to take the place. The owner somehow liked us and said it was ours. Probably that was because of HP's good reputation and my future job there.

Our first rented house on Moreno Ave

Just before departing to Southern California, Frank Cavier said it's really a hot July day, so you should take the coastal route to L.A. The inland route will be very hot today. That made sense, so as we rolled away we pulled out the California map to see what our route would be. Well, to newcomers it looked like the coastal route was highway 1, so that's what we took. It was beautiful, stunning actually. We really enjoyed the incredible views for first hour. Then as the winding road continued on and on, and our gasoline got lower and lower, we realized that there was no chance for a refill on this route for at least 60 more miles. Before we found a gas station we did run out. Drivers on the highway were very nice to pick me up as I started to walk miles to a gas station and again as I returned to our car with a full gas can. This route took us several extra hours and we stopped at a pay phone to call my folks and tell them that we were going to be several hours late, but we did finally get there.

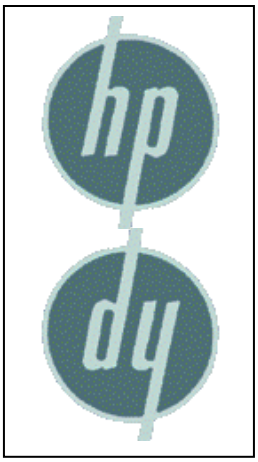
It turns out what Cavier meant by Coastal route was US 101, not Highway 1, and coming back to Palo Alto we took 101 which was beautiful also, but not as spectacular, or as slow.

Part 2. The Early Years

The New Job

Keith Elledge was in charge of Cost Accounting for the Company and became my first boss. It turns out that a full inventory count had been taken just before I reported to work. This was a big painful process, done under the direction of Public Accountants so that an audited P&L and Balance sheet could be published for HP's first public stock offering. Up until this time the Company had been held by Dave and Bill. Some key employees held equity interest in a small systems integration subsidiary called Dynac, and then later changed to Dymec, but no one but Dave and Bill had ownership interest in the HP parent corporation. The symbol (hp) turned upside down made a (dy)

for Dymec and this dy symbol was on the floor as you walked into their little factory in the Redwood building at the back of the HP factory. As you came out of Dymec back into HP the same symbol made an hp.



The hardest thing to give an accounting value to was the work in progress inventory. All the partially completed elements of instruments in progress had been logged on paper worksheets when production lines shut down on the valuation closing day. The worksheets listed partially assembled instruments, sub-assemblies and components. Cavier was right; the cost accounting process did put you very close to the products and component parts. Finished products and raw component parts were easier to value. All this inventory valuation work was completed along with the other accounting work and a Prospectus for the stock offering was able to be assembled and distributed to potential investors.

Some of the people who started around the same time that I did and who helped during this intense accounting exercise were: Al Dossola, Joe Barr, John Prendergast, Betty Badenhop (Sox), Del Filmore, Wayne Briggson, Bob Grimes.

HP Stock IPO

The new HP shares were valued at $16 each. Dave and Bill set aside shares to gift to employees who had been with the company for some time. The number of shares gifted was determined by length of service and wage level. Those of us who had not been with the company long enough to qualify for any gifted shares were offered the chance to buy 10 shares at the offering price. This was a gift also because no IPO shares were available to the common man though brokerage houses.

To exercise my 10 share gift was impossible because we had tons of debt, and no money. I talked my father into buying 5 of my shares and Colette's father Tom Green, against his better judgment, bought 5. Tom grumbled that he had never in his life seen a stock that was worth 20 times earnings, which was the HP IPO asking multiple.

When the 10 shares were delivered to me I transferred 5 to my father and 5 to my father in law. The share price advanced rapidly in value and then split 2 for 1 and over the years split several more times. This made Tom really anxious, so each time the stock split he would sell the new shares to keep his share balance at 5. "Risky business," he would say, but finally he gave up selling the new shares and just let them pile up. He eventually passed the shares along to Colette and my father who sold none of his split shares eventually passed on his shares to me.

The Organization

It was a little hard at first to know who to talk to about a work related issue. I asked Frank Cavier if he had an organization chart that I could look at. He had a very interesting reply. He explained that Packard didn't care much for organization charts. Dave felt they could be quite limiting and when new issues arose it was too easy for the ball to fall between the boxes, or to define the problem outside of your responsibility. He was also somewhat leery of hierarchical levels and strict reporting lines. Fortunately I sat next to Betty Badenhop (later Sox) and shared the telephone between our desks with her. Her solution to this ambiguity was to memorize the names of every person in HP and when she had a name and face linked up she checked them off on the internal telephone list, a one page sheet. So when I needed to know who to talk to, I asked her.

I often walked out to the production line and machine shop with questions about new assemblies or prototype machined parts. Labor and material cost had to be estimated so that new products could be

priced profitably. On one trip I talked to Swede Wild, the supervisor of HP's machine shop. He's a big raw boned, rough and ready type of guy and was very knowledgeable about machining processes. He answered all my questions and when done I found myself in the middle of the machine shop coffee break.

To an attentive group Swede told the story of a little problem he had had the night before. It seems that on highway 101 some kids in their car were taunting him in his truck. They tailgated, flashed their headlights in his rearview mirror and pulled alongside to feign a side swipe and then laughed uproariously at their own cleverness. After suffering this for several minutes Swede came to his off-ramp and the kids tailgated him off the freeway. Down the off-ramp a ways Swede hit his brakes hard and the kids crashed into his reinforced steel tail gate which was equipped with vices and other heavy tools.

The kids couldn't stop and crashed into the back of his truck. Swede and the kids got out at the same time. Big old Swede towered over them as they all inspected the damage. The damage result of the crash was kid's car 90% and Swede's truck 0%. The kids were moaning and groaning about what their parents were going to do to them and were whining about Swede's quick stop. He said simply, "Didn't you see that dog run across the road?" To me he was a prototypical HP kind of manager who had simple quick solutions to difficult problems.

When the accounting close was complete, the prospectus issued and the shares sold, we immediately started all over on another full accounting close, this time for HP's October fiscal year-end so that the first public annual report of the company could be issued. It was like Groundhogs Day. It seemed like we kept doing the same over and over. I kept trying to convince Cavier that we should make this whole process simpler and gave him specific suggestions, but he felt that the simplifications might not be as accurate. He also knew that I would never make a great cost accountant so he came to me one day and asked if I would like to start up a Systems and Procedures department for the Company. This sounded great to me. The Company had grown rapidly and many of the internal processes had not kept pace with the growth and transaction volumes. As a result there were opportunities to streamline processes everywhere.

The first Christmas Party I attended at HP included all the employees of the company on the afternoon of Christmas Eve. The construction of Building 2 in the Stanford Industrial Park complex was just completed and nothing had been moved into the 50,000 square foot upper floor yet, so its wide open spaces were prepared for the party. There was music, refreshments and Dave and Bill gave talks thanking everyone for a great year. Then the two of them announced the percent of Christmas bonuses to all assembled, and handed out the bonus checks to each of us personally, shook our hand and wished us a very Merry Christmas. These Christmas bonuses were over and above the production bonus which was an integral part each paycheck.

In the regular HP Christmas parties, Dave or Bill would hand out the special bonus (which was in addition to the monthly production bonus.)

Systems and Procedures

As I started to put together this new activity for HP, David Bates became my new boss and mentor. The initial tasks were fun and relatively manageable. The HP campus was expanding with a large complex of new buildings being completed about 1 mile up Page Mill Road in the Stanford Industrial Park. The internal mail was not flowing well and I was asked to fix this problem and then I was asked to supervise the mail delivery people. The manual delivery system got sorted out quite quickly.

As the new six building complex was being developed I suggested the possibility of building in pneumatic tubes for mail delivery. Bates suggested I talk to Cavier. So I did and laid it all out with a design, investment expenses and projected return on investment. Cavier said I should talk to Packard. I asked how in the world would I do that and Frank said simply, just catch him at coffee break.

Packard and Hewlett almost always came out of their offices at coffee break, so I stepped up to Dave like a gnat to an elephant, and laid out my proposal. He listened respectfully and then said, "No. We don't want to do that." He explained that there is too much value in having people walk through the plant to see each other face to face. I appreciated the clear and instructive response. One highlight of Hewlett and Packard's management style was a periodic meeting at morning coffee break time. Everyone would gather somewhere in the wide open spaces of the office, factory, or lab to hear Packard and/or Hewlett give a report on the progress of the company, the results of marketing shows where HP showed their new products, the review of a new product coming from the labs, new large sales contracts, a special employee achievement of some kind, or whatever was most pertinent at the time. These were not long meetings and they happened once or twice a month as I recall. These were valued by employees at all levels.

Over the years these coffee talks were replicated by local managers worldwide throughout the company.

Office Tools

Among the tasks of the Systems group was the responsibility to order all office equipment like desks, chairs, filing cabinets, electric and manual typewriters, copy machines, mailing and postage machines, calculators and so forth. Harold Peterson did a lot of this work and our task was to look for labor saving devices and to keep standards so we could take advantage of quantity purchasing and make service requirements simpler.

This Friden mechanical calculator was a wonder in its day, with a loud clacking and the carriage jumping from column to column. It did square roots.

We were using a number of big heavy, expensive Friden calculators that had thousands of little gears inside to do multiplication and division. Friden also made a huge calculator that was very, very expensive that in addition to multiplying and dividing did square roots. It lived in HP Labs and had a tall flag on its rolling cart that could be seen over the work benches of the Lab so that it could be easy to spot then roll away. The only output of these calculators was a series of dials along the top from which you could read your answer

One day we came across a less expensive, smaller unit that did all of the Friden calculations and in addition gave a paper tape output. Gene Doucette was the first to try it. He was doing bill of material explosion which broke down the quantity of component needed to build a production run of products. The new calculator worked well, but about the third morning after Gene had begun to use it he came in to find it completely broken and partly disassembled with a note that said, "Sorry, Bill." During night Hewlett had come out to see how it worked.

Reproducing pages was really awkward in these early days. Letters were typewritten and if copies were needed, carbon paper was used. There were several ways to make more copies from an existing page. One of the more popular was to create the master pages on translucent vellum and then put the master through a blue print machine (Ozalid) which used an ammonia solution on light sensitive paper. This was the same kind of machine used by engineers for reproducing their large drawings. You could also make a copy on creepy, flimsy, tan, heat sensitive paper (Thermofax) that turned black in the sunlight.

You could also type on a purple ink-backed master and then load the typed master onto a machine (Ditto) which could crank out purple copies which faded away in time. The best copy quality for higher quantities came from a lithograph process used by the HP print shop, but this could take a day or two to get the copies made. Our Systems group was asked to manage the print shop. The shop used metal plates and also a Xerographic process to create masters for a printing press, but it was all manual handling until the masters went onto the press where copies were cranked out rapidly.

What an amazing breakthrough the first automated Xerox copying machine was. It had automated the photographic scanning of a master and produced the number of black and white copies that were selected. It was the same process we used in the print shop where we exposed a xerographic plate and then mounted it on a pronting press to make copied. HP people lined up to use our first office-friendly Xerox copy machine.

The Xerox 914 copier changed office processes forever. Although the sheets had to be hand fed on the flat plate. The waiting lines could be long.

In the early 1950's computers were not in broad use and were generally an awkward tool except for some kinds of simple number manipulation, as in some accounting and some research projects. HP acquired its first computer from Sperry Rand in the early 60's and began the painful process of developing applications. Before computers, the control and facilitation of administrative systems was accomplished with multi-part forms. When these forms were well designed they could facilitate complex processes and improve efficiency.

Instrument Repair Process

An early systems assignment for me was to review our instrument repair process. Carl Mahurin headed this activity and by going through the repair flow and information flow it was possible to significantly simplify the repair procedures and shorten the repair processing time.

Our First Palo Alto Home

In 1959 the owner of our leased home on Moreno told us that he wanted to sell the home we were living in. Because we had two young boys and were expecting a third child, he judged that the home was too small for us and told us he had sold it to someone else for $14,000. We were not quite ready, financially, to pay for a larger home, but we began to look, out of necessity. We found a 3 bedroom home on David Drive in Palo Alto and agreed to buy it for about $21,000. This was a mammoth stretch for us. We assumed the first mortgage of $18,000 that the seller had carried, negotiated a $1,000 second mortgage from the seller, borrowed the realtor's commission of $750 as a third mortgage, borrowed $600 from my father in law and got an unsecured bank loan for $500 and took the remaining $250 from our meager savings. It was a nice sunny, open, tract home built by Mackay and we loved it.

Annual Management Meetings

Hewlett and Packard held annual off site management meetings and in the late '50s about 40 people attended. Cavier asked me to attend one of these meetings that was to be held in Monterey, CA. I didn't qualify to be there, but he had created an important exposure opportunity for me. We had meetings the first evening and stayed overnight with a meeting through most of the next day. After dinner the first night there was a casual session where Al Bagley, Carl Cottrell and other collaborators had put together a skit which poked fun at just about everything that was going on in the company at the time.

The annual Monterey Management meetings included posters which found humor in management events. Caption reads: "I'll take the liverwurst on rye. . . with a little cole slaw on the side."
Speaking is Frank Cavier who hired me.

They had some clever lines for me to read about my penurious control of office supplies and equipment. No one escaped the friendly ridicule. Hewlett played himself giving a very complex, detailed description of how the challenging new payroll system was going to work and then Packard read his script explaining how a simple straightforward payroll system was going to work. It was hilarious, and at the same time impressive to see that the company leaders could laugh at themselves without difficulty. I recall the banquet posters, which were prepared for these conferences. They had cartoon bubbles with the thoughts or spoken words of those in the picture. Very funny!!!

After this light hearted session most everyone retired to the bar where a good number of folks were drinking a gin fizz. It looked kind of interesting so I told the bartender to make one for me without the gin. Everyone in the group said that's not a good idea. I said why not? You all say it's great and the gin has no taste. Well the bartender made one for me without the gin and the group was right, it was not a good idea. Better to just stick to my ginger ale.

The next day leaders presented their recent results, challenges and plans for the coming year. Ray Wilbur had just been hired to be HP's first high level Personnel Manager. He gave a very stirring

keynote address on the importance of our people and that it was as important for them to grow as fast as the Company did. Dave and Bill gave a wrap-up and shared their insight on what needed to change, improve and focus on for the company to continue to be successful. Dave said that Ray Wilbur's talk was the most significant thing we had heard in meeting.

After the meeting I rode back to Palo Alto with Dave. I felt intimidated at first, but we ended up having a nice conversation about our respective activities and families.

Corporate Purchasing

The Purchasing Department invited me to review their procurement processes. I designed a purchase order that created a receiving report and facilitated the payment of invoices, and streamlined the full process. Don Anderson headed the department at this time and was great to work with.

Ed Porter

One day Colette came to HP to pick something from me. She parked in front of the 275 Page Mill building, close to the entry and little front lobby. As she left the tight parking spot with our little kids in the back of our car, she cramped the wheel a little too soon and her front end hit the rear of the car on her left. The dent she made was quite noticeable and she felt awful. She went back in and talked to Ann Laudel in the little lobby/reception area. Ann checked to see whose car it was and went to get Ed Porter, the Vice President of Production who was the driver of the damaged car. Colette's anxiety had doubled by the time he came out and she profusely apologized. Ed waved her off and said don't worry about it, no problem. He didn't even collect license or insurance numbers. We both loved him.

Porter was on the Palo Alto City Council and later became the Mayor. One Monday night I went to council meeting with some boy scouts. An interesting agenda item came up where a black man was trying to get Council approval to build a mortuary in the southern portion of the California Avenue area which would serve the residents there. The application was denied on what seemed to be a technicality. I felt sorry for the fellow. The next day at work Porter said he noticed that I was at the meeting and asked what I thought about it. I mentioned my concern about the funeral home application that had been denied. Porter said we did him a favor. There are a number of projects (a county court house and upscale apartments) coming along for that area that will change it from a less expensive residential neighborhood to professional and commercial district. He added, "We were not free to talk about these projects in public, but we did save the fellow a fortune. He would have invested his money and then would go broke when all the residents moved away."

Apricots

One summer Dave Packard announced that he had a lot of ripe apricots in his orchard that were going to go to waste and he invited anyone who wished to come and pick them. Colette and I and our three young boys went to Los Altos Hills where his house had been built in acres of apricots. While we were picking, Packard drove his car down into the orchard. I thought we were in trouble of some sort. But he got out of his car, visited with us for a while, helped us pick and then roared away. We ended up with a good supply of apricots which we dried and canned.

Sales Order Processing

When Building Number 3 in the Stanford Industrial Park (1501 Page Mill Road, Palo Alto) was complete, most of the HP administrative staff moved from 275 Page Mill by the tracks, to the new classy, glassy building on the hill. Our Systems and Procedures group made this move along with the rest of HP's admin people. During this time a couple of my BYU friends were recruited into the

group. Roger Sant and Lee Simmons had spent time in the Air Force when they graduated from school as a fulfillment of their ROTC contracts. Roger then went on to the Harvard Business School for an MBA. He said the thing that attracted him to HP was the list of 7 Corporate Objectives that Dave and Bill put together. He had not seen anything like it in other companies. It focused on Profit, Customer, Field of Interest, Growth, People, Management and Citizenship.)

This Univac II photo is typical of the installation that HP used to automate payroll processing in the early 1960s.

About 1960, a new Sperry Rand Univac computer was purchased by the HP and a small programming staff was built up. The programming group in the Electronic Data Processing department (which was separate from our Systems group) had done a great job of programming our first payroll system and several accounting processes. Then they set about to do an automated sales order processing system using our relatively new central computer installed in the lower floor or our new building number 3. A number of difficulties were encountered in this effort. It had been a courageous effort to even try at this point in computer development. Our new mainframe computer had way less memory than you would find in a small I-Pod today. [The complexity of this task became clearer when, many years later, Heart was developed.]

As a result of the problems being encountered, Noel Eldred, the VP of Marketing, asked if I could help unkink the processing of sales orders. Roger Sant worked with me and we took a very simple approach proposing 3 or 4 state-of-the-art Smith Corona Marchant (SCM) machines. These machines were programmable, had a nice keyboard plus two additional input readers for punched paper tape, or edge punched cards and two outputs for tapes or cards.

Eldred was favorable to the proposal and asked me to make a presentation to the Management council, which consisted of about 15 to 20 top managers of the company who met in the board room. This was in the days before computer generated projection or even overhead slides so we took a 2'x 3' paper pad and some crayons and made about 6 panels. The presentation went well and the project was approved to proceed. At the conclusion Packard said dryly, "We should give crayons and a pad to everyone."

At that time purchase orders were typed in hard copy by customers and signed original was sent to the respective field sales representative offices around the world. There it was retyped and the retyped copy was then mailed into Palo Alto where it had to be manually entered again for the manufacturing factory, for sales statistic and for accounting functions. [Customer Orders were retyped by sales reps because they represented multiple manufacturers and they had to separate items for the appropriate supplier.] These reps were independent, non-HP people and were very good at what they did.

With the newly programmed SCM machines, the orders received from HP's sales rep offices were processed in Palo Alto by operators at each of the 4 machines. Product information was entered from pre-punched cards, as was the customer coding and address information. These cards were pulled manually and fed through the machines to give consistent data input. The output consisted of: a hard copy order for the HP factory and with carbon paper acknowledgement for the customer and one for

the sales rep. In addition a summary tape was made concurrently which was used after shipment to create an invoice to the customer and finally a statistical tape was made which could be read into the company's main computer to generate sales statistics, commission reports and backlog information. Les Oliver and Bob Stephenson in Marketing were the inside champions on this project. The computer group of Matt Schmutz integrated the paper tape with sales statistics into the mainframe computer to keep sales statistics.

One day during the programming and implementation, I was eating lunch in the cafeteria and Packard with some other managers came in and sat across the table from us and asked how the sales order processing project was going. It had been a difficult day and I said, "We are doing a little pioneering." Packard said "That's OK. That's what we do." When we got done the system worked well and became the pattern for the next generation of sales order processing.

After completion of this project, Roger left HP to start up a tech company of his own and was quite successful. He later went on to become Under Secretary of Energy in the Bush 41 Administration. From there he launched some successful energy producing companies. Lee transferred into the Personnel department that had been formed under Ray Wilbur.

The Seven Objectives of the HP Way
Second version published in 1966

1 - PROFIT, To recognize that profit is the best single measure of our contribution to society and the ultimate source of our corporate strength. We should attempt to achieve the maximum possible profit consistent with our other objectives.

2 - CUSTOMERS, To strive for continual improvement in the quality, usefulness, and value of the products and services we offer our customers.

3 - FIELD OF INTEREST, To concentrate our efforts, continually seeking new opportunities for growth but limiting our involvement to fields in which we have capability and can make a contribution.

4 - GROWTH, To emphasize growth as a measure of strength and a requirement for survival.

5 - EMPLOYEES, To provide employment opportunities for HP people that include the opportunity to share in the company's success, which they help make possible. To provide for them job security based on performance, and to provide the opportunity for personal satisfaction that comes from a sense of accomplishment in their work.

6 - ORGANIZATION, To maintain an organizational environment that fosters individual motivation, initiative and creativity, and a wide latitude of freedom in working toward established objectives and goals.

7 - CITIZENSHIP, To meet the obligations of good citizenship by making contributions to the community and to the institutions in our society which generate the environment in which we operate.

Roger joined the group as a systems analyst and Lee came in as a support person to the group. As none of us drank coffee, at break time we grabbed a fourth person and went to one of the ping pong tables that were on most of the large porch like decks outside each buildings and played lively doubles for 10 minutes.

Community Service

HP leaders had always set a great example of serving in the community. I could see that giving service in my community was a good thing to do if the opportunity presented itself. When I was still quite new in the company, Frank Cavier worked out an invitation for me to join the Board of Directors of the Palo Alto Red Cross and gave me some good coaching on what a non-profit board member does. There were many local luminaries on the Board: Percy Mitchell (after whom Mitchell Park was named), Bill Lane who was the Managing Director of Sunset Magazine and many others. I was a very small fish in a very large pond. From there I found my way onto the Board of the Stanford Area Council of Boy Scouts of America where I served happily off and on for probably 25 years. I also had the opportunity to serve on and chair a special study Committee of the Palo Alto school system and Colette and I served as co-Presidents of our local schools Parent, Teachers and Students Association. And over my career with HP I had a consistent opportunity for church service as detailed below.

By 1960, the LDS or Mormon student population at Stanford had become quite large and the Church authorized the formation of a Stanford Ward. An LDS Ward is a geographically organized congregation of 200 to 500 people and it is led by an ordained Bishop with two Counselors. These 3 and all other positions in the church are filled by lay people who serve in their spare time without pay. I was asked to be the First Counselor to Bishop Ron Poelman in the newly formed Ward. In February we began staffing the brand new Stanford student Ward.

Membership was about 250 young people. Assignments were made to more than 150 of the student-aged members to help with the operation of the organization. Two years later Ron received another Church assignment and I was called to be the bishop. It was a challenging and joyful opportunity to work with these bright and energetic young people. Mitt Romney attended the Stanford Ward in his freshman year and then left on a church mission to France. I served in this calling until 1967 at which time I was called to be the Bishop of the southern Palo Alto Ward. The dividing line between the two Palo Alto Wards was Oregon Avenue.

My change to a family ward was good because we now had 4 children and they were attending this family ward while I was serving in the student ward. Being able to attend church with them was a plus. A normal family ward like our Palo Alto Ward had a wider range of activities than a student ward and for that reason was a little more complex. There were programs for children including nursery age. There were a range of activities for teenaged youth. There were 8 times more Sunday School classes to staff and so on.

In 1972, I was released from this bishops calling and shortly after was called to be the first counselor to help lead the stake. An LDS stake is a geographical organization consisting of 8 to 12 wards and totals three to five thousand members. The leader of a stake is called a Stake President and like a Bishop he has two counselors to share the responsibilities. The boundaries of this stake included Menlo Park on the north and Cupertino on the south and everything in-between. It was called the Palo Alto Stake. After two years this Stake was divided into two Stakes; Los Altos and Menlo Park. I went with the Los Altos Stake served in this capacity for a total of 9 years and had many wonderful experiences with wide range of people.

When I was released from the Stake Presidency, in the early 1980s, I had a delightful assignment to be the scout master in my family ward. At the time I became Scout Master our ward had just 3 scouts, so I went to several Palo Alto schools and recruited more than 40 additional boys into our troop. A number of the recruited boys came from difficult home situations and benefitted from more than a normal amount of attention. Our Troop had a great time back packing in the Sierras and Trinity Alps, snow hiking, swimming in lakes, cliff jumping, skiing, rain camping, learning to cook on campfires, hang gliding, organizing service projects and learning as merit badges were earned and requirements passed off.

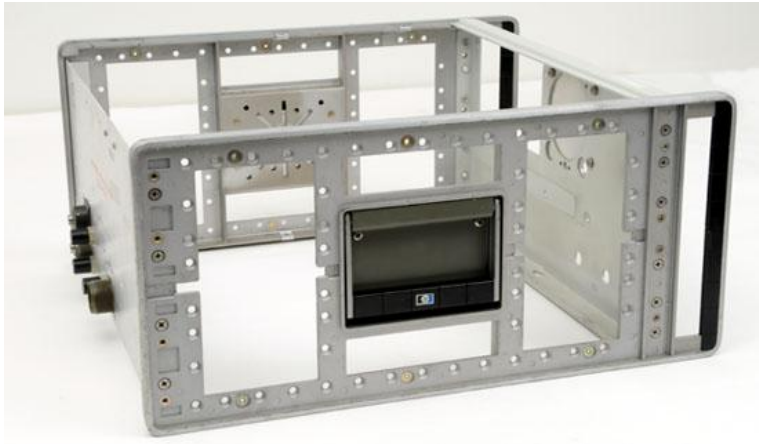
After 5 years of great fun with the scouts and youth, the Los Altos Stake had a boundary change and our ward was assigned to be part of the Menlo Park Stake which encompassed everything from Palo Alto on the south to San Carlos on the north. A short while after this boundary change I was asked to serve in the Stake Presidency of the Menlo Park Stake, where I continued even after I retired in 1997.

Jean Chognard

I was troubled one day when Colette and I received a fairly large bill for our home insurance from a carrier that we had dropped and replaced with another insurer. Their claim was that they insured us for two extra months beyond our policy's expiration and they wanted to be paid for $1/6^{th}$ of a year plus late fees. This demand for payment from us had been made several times. I went to talk with Jean, HP's patent attorney. HP had no resident legal counsels, and Jean was our only lawyer. He got a big smile on his face and became very animated at the prospect of a good legal struggle. After a moment's thought he said, "Here is what you do. Type up a letter on formal looking consultant's letterhead and tell them that it is not a good practice to charge people for things that they didn't order. Then under a separate cover send them a bill for your consulting services referencing your letter of advice. Don't be cheap." This sounded good to me so that's what I did and I never heard from them again. Another simple HP type solution to a vexing problem.

Industrial Engineering

After a few years of managing the Systems and Procedures activities in the early 1960s I was invited to come into the Industrial Engineering Group. Carl Clement, the head of Industrial Design, had designed a series of modular electronic instrument enclosures. There were many preset sizes but every size could be very easily mounted in a standard racking system or they could stand alone on a test bench. The backbone of the cabinet system consisted of two die cast aluminum frames which supported everything else. All of the aluminum shells were all pre laminated with an attractive blue-gray vinyl so that no cabinet painting was required.



The Clement System I gave extreme flexibility to product designers, while providing a sophisticated brand image for HP.

My tasks were to expedite the completion of key tooling for various cabinet components, schedule their production and availability and meet the commitments for their planned use. Prior to this every

HP product was housed in a different size and shape cabinet and many could not be rack mounted. The cabinets were well received and design engineers no longer had to create a unique enclosure for each electronic test and measurement tool we produced. This was a great way for me to become more familiar with HPs lab processes, tool and die making, machine shop processes, die casting and technical documentation standards.

Part 3. My Move into Management

Purchasing and Materials Management

Don Anderson, the head of HP's purchasing activity that I had worked with earlier called me over one day and said that he wanted me to come and work in purchasing. I thanked him for the confidence, but told him that I didn't feel that was the right direction for me. Sometime later Bob Sundberg, who was the head of all materials activities, including Don's purchasing department asked me to stop in. When I did, he reaffirmed the offer and hoped that I would consider the possibility more carefully. Again I thanked him, but said I just couldn't take the offer. Shortly after that Ed Porter, VP of manufacturing, who was Sundberg's boss, called me into his office and asked if I wouldn't take the assignment in purchasing. I told Ed no, I really, **really** didn't want to do it.

The NY Giants had moved to San Francisco and one day a number of my fellow workers decided it was time that we saw a real major league game now that we could. I believe it was a Wednesday that the Giants had a day game. I'd never before cut out of work on a week day, but thought this one afternoon can't hurt. I've already worked a lot of extra time and I'll certainly do more in the future to make up for the lost afternoon. So we all went. The next day everyone said that Packard had been looking for me all afternoon. I went over and reported in to Margaret Paull, Packard's tough-as-nails secretary. She said hang on a minute and in a short time sent me in. The company still had only two enclosed offices, one for Dave and one for Bill, but now there were a few smaller ones, open at the top, for Executive Vice President level managers like Porter, Cavier and Eldred.

Dave chatted in a friendly way for a short while. Baseball never came up. Then he said, "We'd really like you to take the job in purchasing." I was taken aback. As my mind raced through possible responses, I concluded that it was time to give the real reason for declining so consistently. So I told him that I was concerned about the way the department was currently functioning and that it would be very difficult to put it right without making significant changes which could hurt a lot of people. He listened carefully and then said, "That's why we want you there." I said, "OK then, I'll do it."

Just at the time I was coming over to purchasing Don Anderson announced that he was moving and would be leaving his job and that I was to take his place as head of purchasing reporting to Bob Sundberg. So I began to dig in. We made a number of simple process changes that seemed to work well.

Some changes were not popular. I asked the purchasing agents to stop going out to lunch, or dinner with vendors. Instead, if they needed to work with vendors through lunch, we had the department pay for the two of them to eat in the HP Cafeteria. Instead of dinners out we periodically invited our major suppliers into HP for a nicely catered dinner on site with table cloths and wine. This served to recognize

A tour before dinner with a portion of 250 suppliers who attended a "vendors' night" at the Stanford plant are seen during tour with Hank Taylor (right).

that gratuities like long lunches were no longer to be tolerated. The evening dinners started with a plant tour. At the banquet, we had senior HP managers give some HP orientation and at the same time thank them for their efforts on behalf of HP. Bob Sundberg and Ed Porter coached me on the appropriate wine to serve for these occasions, because I had no clue.

We also let the vendors know that we no longer wanted Christmas gifts and if any still slipped through we gifted them to the Veteran's hospital. As a result of these changes we no longer had missing afternoons and we became less socially beholden to our vendors. These changes set a more realistic business tone for the purchasing department, however the real problems had yet to be addressed.

Teaching Management Training Classes

The Personnel Department had training courses for new managers. They asked me to teach one of these and I was first teamed up with Gene Doucette, who had been a school teacher and had broad experience in HP. Our group met several evenings a week, after work. About 15 people were in the group. We focused on the HP styles of leadership and the instruction seemed to be well received. I had the opportunity to teach a number of these and other courses over several years.

In that first class, one of the illustrative stories I used came from the Pacific during WWII. It was told of a destroyer captain who described some of the fierce sea battles he had been in. Several times he had the chance to pursue an enemy vessel, but could not keep up with them. He repeatedly barked the order down the communication tube to the engine room to give us more speed, but got no results, so they could not keep up with the target. When things calmed he went down into the engine room and told the men there all he needed was an extra 5 knots and our ship could hit more targets and be a big help to the whole fleet. The guys in the boiler room replied that they couldn't go faster because their boilers were scaled up.

The captain came back to the bridge discouraged. He pondered boiler scale and the somewhat sour reception he got in the boiler room. As he thought more about the engine room he realized that in all their battles these men were blind to all the surface action. More than that, in the depths of the ship they could feel and hear the pitching of the ship and the blasts of the guns, the torpedoes and the depth charges exploding, all without knowing if the next moment was their last. Except for being a blind target they had little idea how they fit into the efforts of the team. The captain's thoughts triggered an idea.

The ship had a fellow on board who had experience as a radio broadcaster and the captain ordered some work to be done on the public address system, especially in the boiler room. When the next battle started he put his radio man on the PA system. This broadcaster gave a vivid description of all the action as seen from the deck. Enemy planes were shot down; their large guns hit some targets. Every detail was broadcast. One of the enemy ships started to retreat and the destroyer captain started pursuit. All these details hit the boiler room and to the Captains amazement he had 7 extra knots. The pursuit was successful and the enemy ship was sunk. The captain went down to the boiler room and thanked the men and said we could have never done it without your great work. Just as the captain was leaving he turned and asked what happened to the boiler scale? The crew chief smiled and said we solved that problem days ago.

This was a great lesson on the value of keeping the whole team informed. I had Bob Sundberg who had been a radio announcer record the story with a little extra drama and we used that tape with numerous management training groups.

Materials Engineers

Sometime before my move to purchasing, Bud Eldon had taken over the Systems Group and had made some good process changes for the company. He stopped by purchasing one day and told me that the Material Engineering group in HP labs was ready to be transferred, or abandoned and a suitable home had not yet been identified. They were a talented group and purchasing used them extensively to determine if the products from manufacturer A were electrically and mechanically interchangeable with products from B. In fact once a product had been put into production they were the only group that could certify that a competitive manufacturer's product could be substituted for an original part, or certify that the next generation of a manufacturer's product was compatible with his old product and that our instruments would still work if we changed.

I told Bud about my organizational concerns in purchasing which were not yet resolved. We agreed that it would make a lot of sense to move the materials engineers into purchasing. Larry Johnson headed that Materials Engineering group. He was a workaholic wizard with electrical components. I liked him. The proposal was made and the transfer of about a dozen engineers to our purchasing group was made.

This transfer put the 15 or so purchasing agents in an awkward position. They were the ones who gave the purchase order requests to typists and talked to vendors over their formerly long lunches. Order quantities were determined by inventory control under Dick Were and the items to be built into products were determined by the development engineers. These could only be substituted by the materials engineers who verified electrical and mechanical congruence. The purchasing agents' contribution was near zero.

This led to the dismissal, or reassignment of the purchasing agents. Just one stayed on to buy the non-standard items that had to be searched for and the purchase negotiated. Some of the departing agents transferred within the company to other jobs and some left the company. When all the dust settled 22 people had left the Purchasing Department and the full purchasing cycle for production materials was given to Inventory Control group under Dick Were, who was already doing 90% of the job.

Our plan to change our material management processes to feature Materials Engineers and Inventory Managers to replace traditional purchasing agents was described in a comprehensive article in the industry trade magazine Purchasing, in Feb, 1964. To read this interesting overview of HP's system, Google HPmemory.org and go to Part 3 of this Taylor memoir.

It's Hard to "Unemploy" People

I hated firing people. On the days that I knew that this was going to happen I was nauseous and tense. Sometimes a reasonable and constructive discussion could take place, but sometimes it was a contentious, difficult exchange.

One of the purchasing agents that I dismissed was a great fellow, with many friends in HP. He often went hunting, fishing and to the Ranch with Dave and Bill and other senior leaders of the company. He very much enjoyed the social elements of a purchasing agent's role; the lunches and dinners with vendors and the review of their new products and the contacts with other HP people. Where he really struggled was being tied to a desk and spending significant amounts of time doing analysis and processing paperwork.

In working with him on alternative career paths, I invited him to go to Stanford and take a Kuder Preference Test and a Strong Vocational Interest Test. No clear results came from this. I suggested that he look into the career characteristics of a forest or park ranger. This didn't click.

The allotted time for his job search came to an end and he left HP. I didn't see him again for 5 or 6 years and then one day ran into him at a title company in down town Los Altos. We visited for a while. He looked prosperous, better dressed than his typical HP attire and was very upbeat and happy. After he left the woman from the title company who was helping us expressed surprise that I knew him and said, "He is the nicest and most respected realtor in the entire Los Altos area."

I thought about this for a while and concluded that it can sometimes be helpful to force a person to look at what they are doing and reevaluate their life's direction.

Common Part Numbers

By the early 1960s HP manufacturing divisions had multiplied. Those that had split from the mother company to other locations took with them the HP part numbering formats. But a number of companies had been acquired and these had entirely different numbering systems. These new acquisitions joining HP tended to use many identical parts in common with HP divisions but with different numbers. The difficult decision was whether the acquired companies should use the same numbers that HP divisions were using. One strong factor in favor of common parts was our global service and repair operations. Having a single parts documentation system was highly desirable. But, without a careful, technical review it was hard to be sure similar parts were interchangeable. So it would take a significant effort to merge the numbering of parts to one system company-wide.

After a careful analysis we concluded it was economically advantageous to convert all parts and components to a common numbering system so that we could get maximum quantity advantage from our total corporate buying. The conversion and the resulting higher usage with suppliers would give us more leverage on pricing and also on any issue of quality. This decision to merge to a common numbering system also meant that new parts being set up anywhere in the company had to be screened by our materials engineers to see if we already had that part set up, or if we needed to set up a new number.

Hal Dugan, Materials Specifications Manager, and a variable delegate from Materials Engineering were given the task of going to all of our acquired divisions and converting their numbers to the HP common numbering system. They went to Moseley in San Diego, F&M in Pennsylvania, Boonton in New Jersey, and Sanborn in Massachusetts plus others over time. The materials engineers played a huge role in determining compatibility before a number was changed to an HP part number. It was an arduous task, but greatly increased the volumes we could commit to our suppliers. Higher volumes gave the manufacturers longer production runs and substantially lowered their cost, a good part of which they passed along to us.

Hank, talking with Bob Sundberg

In addition to the conversion of numbers, Larry had the materials engineers develop a listing of preferred parts for use by design engineers. This also helped to focus product design on using fewer, more proven components. This helped increase our purchasing volumes and made quality management easier.

The last missing link was bringing in from all divisions their annual forecasts of part usage. With some effort we got these and with these forecasts summarized it was possible to present

our full annual usage volumes to multiple vendors for competitive bidding.

The establishing of a strict business-like relation with vendors, the dismissal of traditional purchasing agents, moving the placement of production purchase orders to Inventory Control and now the completive bidding managed by materials engineers was very disturbing to Bob Sundberg, my direct boss. He had established excellent relationships with most of our old line suppliers and distributors. Now they were all being subjected to less personal contact and competitive bidding. This was so uncomfortable for him that he felt he had to leave HP. When he left I was asked to take his spot as Corporate Materials Manager. It is not the way I ever hoped to get a promotion. He and I had talked through the direction HP had to go several times, but he did not agree with the direction. I had hoped we could work through his distress, but he never got comfortable with the proposed changes.

Materials Management

My new job now had not only the responsibilities for corporate purchasing by materials engineers managed by Larry Johnson, but added the departments of Inventory Control managed by Dick Were, all the Stock Room personnel and processes, plus the receiving and shipping departments, managed by Al Spear, Material Specification managed by Hal Dugan, and Logistics, managed by Rod Ernst. This totaled something over 400 people.

Bob Sundberg had a nice office in the corner near the entry of Building 3, with glass windows, an attractive desk and chairs and had a large, artistic map of the world on one wall. I had learned the value of sitting closer to the troops, so I kept my gray desk and sat outside with the rest of the group. We turned Bob's former office into a very nice conference room.

The group began to collect worldwide component usage projections from all HP entities giving us substantially larger purchase volumes. This collection process was formalized and made routine. With this global usage information Larry Johnson's Material Engineers began to get competitive bids and place contracts which all divisions could procure against and have their orders shipped directly to their sites. All divisions began to benefit from the whole company's usage volumes. I was astounded to see how much lower the unit price bids were for these larger quantities.

As these new lower prices began to work their way through the system I noted on the company Profit and Loss statement that the material component in our cost of goods sold actually dropped 2 percentage points and this went directly to the bottom line. Higher purchasing volumes also gave us a hidden benefit, of greater leverage over quality, reliability and availability.

Contract Development

The HP 5061A Cesium Beam Frequency Standard
HP Memory Collection

Cesium Beam Tube in an HP 5061A
HP Memory Collection

It was challenging and fun to set the framework for our large Corporate Purchase Agreements and to rework HP's purchasing terms and conditions which were preprinted as "boiler plate" on the back of our Purchase Orders. But by far the most interesting and complex contract that I worked on was the one for Al Bagley. It covered the development and purchase of a cesium beam tube from Varian. The tube was to be the heart of HP's highly accurate time standard instrument. I must have had more than a dozen sessions with Al to reflect his wishes. When the contract was done, as I recall, it had unique development milestones, penalties for tardy performance, tight quality specifications, quantity estimates, price/volume formulas and to top it all off HP ended up with ownership of the patents for the tube. Bagley was a genius at whatever he did. This very successful product provided a giant step forward in extremely accurate time keeping.

This incredible time keeping instrument was accurate to plus or minus a second in a million years, or some such extreme precision. The accuracy prompted Len Cutler, the project manager to send engineers around the world to compare the time standards of major developed countries. Lee Bodily was asked to go to Boulder, Colorado to set an HP 5061A to the U.S. time standard. From there he flew on to London to make the first comparison. By the time he arrived at the National Laboratory where their time standard was kept the instrument had been on batteries for longer than Lee wanted. If the instrument lost power he would have to return to Boulder and start over again.

When he got into the UK Labs Lee told the supervisor who received him that he was very anxious to plug in his instrument before he lost battery power. The supervisor said, "Sorry old chap it's Tea Time and we will plug in after that." When the supervisor left for tea Lee skipped and tore apart an English Power socket and hot-wired the 5061A to the raw wires now hanging out of the wall. Lee had a higher priority than British Tea Time.

Correlating time from Europe to Asia
with "Flying Clocks"
Photo Courtesy of the Hewlett-Packard Company

In Germany, the reception conveyed a little skepticism

and after the German time keepers were briefed on the traveling clock, Lee was told to wait and that they would do the measurements themselves in their secure labs. They finished and brought Lee's clock back and declined much further comment.

In Japan, the measurements went well, but Lee was thrown into a mild panic when a nice woman came in to scrub his back while he was bathing.

The whole trip was a cultural awakening for a western farm boy, turned engineer.

Protecting HP from Shortages

One day in about1964, I noted that doom sayers in the Wall Street Journal along with other trade journalists were forecasting that a major copper shortage was just about upon us. We looked at the major copper components that we depended upon that could become scarce. Among them were transformers, coils, power cords and other wire products, etc. We tallied up an investment in a 6 to 12 month inventory of these components. It was not a small sum, but probably under $100,000. When I proposed to Ed Porter that we increase our stock of these items he suggested we talk to the Management Council and all there agreed we should go ahead with the protective purchases. The orders were placed and received. The purchases kept HP quite well supplied when the shortage did materialize.

During this copper shortage was the time that a lot of the light bulb manufacturers converted the base of their bulbs from a copper alloy to the gritty aluminum that we often get now. Also some effort was made to change high-tension electrical transmission lines from copper to aluminum. This didn't work out too well.

A couple of years later I was in the warehouse talking to Al Spear and noted a few dusty pallets in the very high racks and asked what they were. He said they were transformers and coils (largely made of copper) that had become obsolete. We didn't guess right on everything. It hit me that being safe had its risks. But at least we got through the crisis and ended up with some valuable scrap.

Bill Hewlett

One night when most people had gone home, Bill Hewlett came out of his office, which was close to our area, and stopped at my desk. He was trying to estimate something very difficult and wanted to know the weight of water. I had some reference books but we didn't find what he wanted. I told him that I thought that a gallon of water weighed about 7.7 lbs. He nodded and thought for a while and seemed to remembered an old childhood rhyme and started back to his office muttering, "A pint's a pound the world around." I have no idea what he was working on.

Waltham

HP's recently acquired Sanborn Company in Waltham, MA had a very large sum embezzled over the period of a year or so. It appeared that the loss involved their materials department. As a result I went back to Waltham with another inventory person, prepared to stay until the problem was sorted out. Prudent accounting and inventory control normally helps protect against such fraud, but with two collaborating, they can often circumvent the protections. One person ordered twice to get double the quantity of parts needed, then buried the second order after it had been paid. A second person in receiving pulled out the extra materials and then they resold it. Once it was figured out we suggested some process changes to Bruce Wholey who was the new division general manager. A problem like this never cropped up again in any division that I'm aware of. Merging another company into HP

takes time, a lot of work and serious trust building with employees to instill the ethical integrity and high standard that HP had come to expect.

Open Door Policy

One day there was a real commotion several desks away. There were screams and shouts and a flurry of activity. The next thing that I saw was Dick Were heading for Executive offices with a flaming waste basket in his hands. With flame flaring into the air he went straight into Hewlett's office and out the rear doors to a private patio where he could set it down and put it out. Bill joked that this was the ultimate in an open door policy.

Logistics

Rod Ernst, our logistics manager came to me and said that he had an idea that he thought could speed our shipments to customers by a week and at the same time lower the shipping costs. He called it air freight consolidation and explained how it would work. An air carrier and many different local truckers at the destination end had to be contacted and persuaded to perform but it looked very good. Bay Area divisions had to be persuaded to pool their shipments to consolidate them by destination before going to customers. We worked out all the relationships and Rod put the air freight contract together, initially with Flying Tigers and somewhat later with United Airlines. It cut our average shipping time from 14 days by truck, to less than 7 days by air freight and short haul trucking. It was often as fast as two days. As I recall the costs were only about 90% of what they had been by our standard ground shipment.

These were great benefits for customers and for HP.

NEW AIR CONSOLIDATION program was launched from San Francisco airport August 1 after a countdown covering several months of pulling together loose ends. Now that the plan is smoothly in orbit, shipments from all HP Palo Alto plants are picked up daily, consolidated into a single shipment, and flown overnight to the Newark, N.J., airport for redistribution to customers in 13 Eastern states. Transit time has been reduced to as little as two days to some locations. Left to right: John Edgar of Flying Tigers Line; Rod Ernst, HP traffic manager who masterminded the plan; Norm Craccholio and Pete Bonnet.

With HP's growing truck freight traffic, our logistics people launched an airlift program that saved money and a LOT of shipping time to the East Coast. From Measure Magazine.

Stockroom

Al Spear was the supervisor of the main company Stockroom. He worked out a system of conveyor belts that delivered requested parts to the production lines. They ran through several of the Bldgs 1-6 complex, each building had 2 or 3 floors each with a little over 50,000 sq ft per floor. This replaced loaded pallets delivered with hand trucks and forklifts and helped to increase the speed and accuracy of material delivery to lines where HP products were assembled and tested.

Shipping

The unmovable DEADLINE of month end always created a flurry of activity throughout the company. Sales Engineers closed sales as months ended, scrambling to meet their quotas and pad their commissions. Some of our customers had expiring budgets at month end, so they pushed out purchase orders before funding expired. Somehow the HP manufacturing pace picked up at month end to meet production plans and quotas. HP's top management was always concerned about what got out the door at month end because only the items transferred to a carrier could be counted as a "shipment" in that month's P & L statement. These factors worked together to create a huge crunch in our shipping department at month end. They were a little like the boiler room guys in the Destroyer story. Everything was coming down on them, but they had no idea what was coming, or how they fit into the total picture. They had no easy way to even know the dollar value of what they shipped.

With this in mind I started taking them daily order numbers from Maria Bilzer's report to give them a clue what might be coming soon, and secondly got the daily dollar value of the goods they had shipped. When a top manager came by and wanted to see how we were doing the shipping clerks had the numbers. Their commitment to getting everything possible out the door increased dramatically and they even began to work on the truckers, who picked up our finished product, to come a little later in the day, or to come back a second time. The destroyer captain was right, it pays to keep your crew informed.

Recruiting

HP had a superior recruiting program for engineers. These recruits constituted the lifeblood of the Company's product innovation and hence our revenue stream. It was a very well-coordinated effort.

As new Divisions were being formed, experienced people were badly needed to manage and supervise production, materials, accounting, marketing, EDP and other areas. Good people for staffing all the new divisions were in desperately short supply. It was clear that there was also a need to recruit good people for administrative areas. I talked to the Personnel leaders and told them that I would like to mount a recruiting effort to add about a dozen potential first line managers and supervisor and that I would work out a rotational training program for them. I must have also gotten the approval of Bruce Wholey or John Young, but I don't recall if I did or not. We did successfully recruit a dozen or more good potential leaders from San Jose State, Cal Berkeley, Stanford and a number of other schools. We laid out about a 9 to 12 month training schedule for each of them, some started in Materials, some in other functional areas and rotated on from there. It was a very successful effort. I don't recall that any of those hired ever made it through 9 months of rotations. They were picked off well before that. If memory serves me correctly, Jim Brownson and Al Steiner among others were part of that effort.

Travel

In my early days at HP I had a few occasions to travel in the U.S. and Europe. Wherever I went the HP people were gracious and helpful. Generally in a short time we could resolve any problem that needed to be worked out.

I was a pretty naive traveler. On an early trip to Europe Colette was able to accompanying me. Her parents had graciously come to stay with our children. Together we had had some close calls catching airplanes, so for this trip we went early to SFO for this European flight. At the airport I went to exchange some money into German Marks and they asked to see my passport. Yikes! We

had both forgotten to bring our passports. Colette's was at home and mine was in my desk drawer at HP in Building 1.

We had been dropped off at the airport so we had no easy transportation to go back for the missing passports. Nick Kuhn was our neighbor directly across the street. It was a Saturday and I reached Nick on the phone at home and told him of our dilemma. He was willing to help. I started to tell him how to find the emergency key into our house to get Colette's passport and he stopped me and said," Everyone knows where your spare key is." Then I tried to describe how to find my passport at HP.

He found Colette's passport quite easily, but at HP the guard crew had no idea where to find my desk (the HP phone book just had building number and floor). Nick, being a resourceful fellow, dialed my phone number and wandered through Building 1 until the ringing phone brought him to my unlocked desk,

Nick delivered our passports to me at the airport and though we had missed our originally scheduled flight we caught one about 3 hours later. Fortunately security was not the big issue that it is today and with Nick's help the recovery was fairly smooth. Once in Europe HP meetings went well. Colette was very courageous and had the adventures while I was at work. On her own she took the train to Heidelberg for a day and then lost her way back. Finally a kind English speaking German helped her get back to our hotel in Boeblingen.

Then in Grenoble she ordered a luncheon meal at our hotel. She had grown up in Canada and had studied French for almost 5 years so she was more comfortable here than in Germany. As she studied the menu she spotted Ris d'Agneau and knew that this would be some dish of lamb and concluded this would be safe. When she was served it turned out there was full quivering brain of lamb on her plate with an almond on the top. Her stomach turned and she knew that she could never eat it. As sometime happens in nice European restaurants the waiter hovered very near to see if she enjoyed her meal. He was also trained not to bring a bill or menu back again until this course had been finished. She carefully ate the almond off the top of the brain and then gradually spooned the rest of the brain into an envelope in her purse when the waiter's back was turned. And finally she had done enough that the waiter brought the bill and let her escape.

On a trip in the U.S., I recall one morning in Loveland, Colorado stopping for an early morning breakfast at a small restaurant before heading into our plant there. To my surprise Dave Packard, Bill Hewlett, Barney Oliver, Noel Eldred and a few other HP leaders were there. We ate and visited. The Leaders were just returning from NYC where they had held an HP Board of Directors Meeting. When we were done eating Packard picked up the bill for all of us, about 8 people. The total was $24 and when he saw it he said, "We are going to have all of our meetings here." I suspect the cost of this meal was very different from the bills he got in New York City.

In Germany I had worked most of the week at GmbH and still had more to do so I stayed over the weekend. On Saturday Hans and Heiki Vogel took me on a wonderful excursion around the area and graciously translated all the needful explanations. The next day I told them I would go on my own and try not to get lost. I went to Church there and met a very nice German family who invited me to their home for dinner. I had had one quarter (shorter than a semester) of German in college and they had a young daughter who had taken some English in school. It was interesting that we could talk about a wide range of things; from governmental differences to cowboy movies, but it took a lot of hand waving and picture drawing. It was a warm, wonderful afternoon.

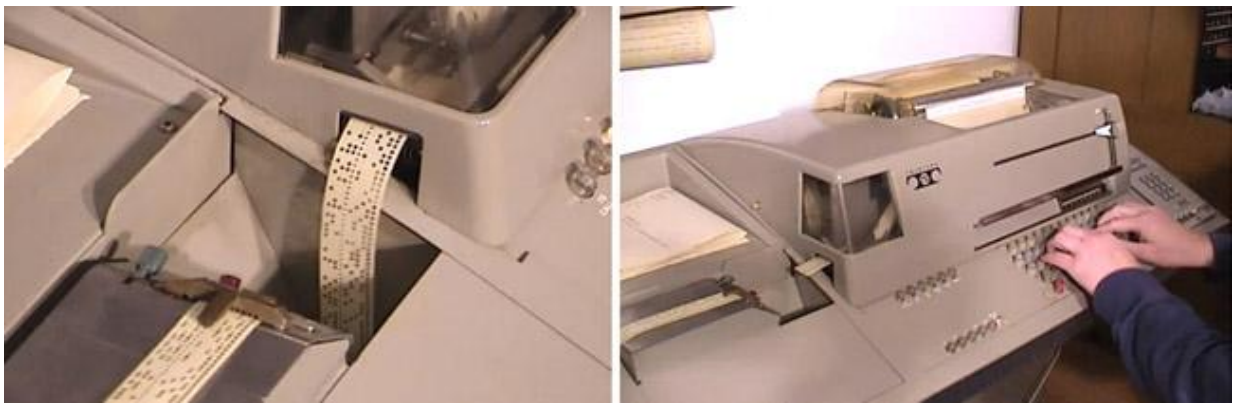
Leaving Grenoble I recall getting a ride to the Lyon airport with Angelo Carlessi as we were speeding down the motorway Angelo decided it was too hot and started to take off his overcoat. I leaned over and offered to steer the car. Angelo said, "No, no, it's OK, I am steering with my

knees." Happily we survived, but I was never sure we would make it. Later in the Telecommunications area I did a great deal of traveling through North America, Europe and Asia to meet with our telecommunications managers around globe. It was rewarding to be with them face to face to work out solutions and plan future directions. As mentioned below Dean Hall spared me from excessively frequent travel.

Sales Representative Acquisition

Back in 1958, John Young was a promising young Stanford MBA Graduate who accepted an offer to work at HP. After establishing himself in HP for a couple of years, he was assigned to negotiate the purchase of most of our Sales Representatives. He did this well and 13 of the 15 national Rep organizations agreed to be acquired. HP then organized those sales representative organizations into 4 U.S. Sales Regions and similarly one region was developed in Europe. One benefit of the acquisition was that the new HP Sales Offices no longer handled non-HP products.

With the Sales Representatives organizations becoming a part of HP, Bud Eldon, the current systems manager, saw that sales orders no longer needed to be typed twice. We could capture the data once in the sales office and let that data flow through the rest of the company without re-entry. The SCM machines had no data transmission capability and the best device at that time that could transmit data was an ASR35 teletype machine. ASR stood for Automatic Send and Receive. This machine could punch or read a paper tape, and print a document from a tape or from the keyboard, or from a transmission.



These two photos show the ASR 35 we used for our data acquisition, transmission and printing functions. Courtesy of You Tube.

These machines were used to create a digital copy and hard copy of an order. The digital copy on tape could be transmitted at the speed of about 60 characters per second or about 500 bps. These teletype machines were installed in the field and factories to transmit orders and shipment information for the company. Carriers were paid by the character for transmission. Field offices kept paper tape copies of each order they entered and when the factory notified them of shipment, the sales office pulled that order's paper tape and used it to create an invoice to the customer. These teletypes were the beginning of our data transmission activity.

Oregon Expressway

As the first few companies moved into The Stanford Industrial Park in the later 1950s (HP being one of those) it became clear that the Park was going to expand rapidly. There were large reserves of Stanford land that had been designated for leasing to industrial businesses who wished to locate here.

At that time, the City of Palo Alto and Santa Clara County realized that the existing two lane residential road called Oregon Avenue was going to be totally inadequate to carry the traffic that would develop. So plans were made to provide a link from highway 101 on the East, through to the Industrial Park and then eventually connect to the planned interstate highway 280 in the West foothills. The Oregon Avenue improvement planning stirred a heated debate in the City of Palo Alto, and ultimately went to a citizen referendum for a final approval.

One day I was in church sitting next to David Haight who was then the Mayor of the City. We talked briefly, when we should have been listening, and he asked softly "What should we do about the Oregon expansion?" He knew I worked in the Stanford Industrial Park, but was also a resident of the City. The proposals had extremes. One plan called for a freeway to be developed with very limited access between highway 101 and the upcoming Freeway 280. The polar opposite was to do almost nothing to the two lane road. Residents were truly worked up about the issue. The freeway solution would cut the city in half and to do nothing would throttle the City's traffic and kill the development of the Industrial Park. I whispered back to him "Widen the street, limit the cross streets and put synchronized traffic lights at the streets that cross Oregon to smooth traffic flow." He nodded and added those thoughts to a thousand other inputs he had gathered, I'm sure. In the end, that's about what the city and county did.

When Oregon Avenue was widened to make Oregon Expressway all 90 of the houses on the South side of the street had to be removed. Colette was driving me to work one morning so that she could keep the car for the day. As we drove down Oregon all of these houses were for sale to be moved. The prices were pretty low and I joked with her saying that if you bought one of these you could probably make a fortune.

About 10:30 that morning I got a call from Colette who calmly told me that on the way home she bought one of the houses. I was dumbfounded and finally asked her how she proposed to pay for it and where she was going to put it. She said "That's your job, I negotiated the purchase. It is beautiful, hardwood floors throughout. And not only that, it has tile in the kitchen, … etc., etc."

Over several weeks I talked to the Cities of Los Altos, Mt View and East Palo Alto and none would take a house moved from Palo Alto. They all said, "It won't meet our building code." Because other cities would not take it we went to the City of Palo Alto offices and looked through every property record for vacant lots. We found several that were available on Christine Drive which had just been extended through to Middlefield Road. We put a 10% deposit on one of the new lots. The selling price was $10,000 plus a $1,200 obligation for a street bond. It was a very nice lot on a nice street. We had real qualms about dropping an older, smaller moved house on a street of this quality.

1. It was shortly after we bought the lot on Christine Drive that a realtor who had been looking for lots with us called and said that he had found some lots that had just opened up on Wintergreen. We looked at the street and it was perfect. A creek on one side created shallow lots, maybe only 50 feet deep, but across the street the new lot we were looking at was normal size and it backed up to some older homes that were a good match for our moved house. We bought that lot. It is hard to get through the red tape and permits to build a house, or anything else in Palo Alto, but moving a house within the City is ten times

The moved house in its new location on Wintergreen

worse. Hearings, public notices, variances, council meetings, detailed plan reviews, it was a nightmare. But it finally got approved and the house was moved so that we could fix it up and landscape it.

Our family home built on the "extra" lot on Christine Drive

After it was moved we found renters for the house. After about a year it became clear that I didn't have time to be a landlord. Work at HP, church leadership assignments and family used all the time I had. So we sold the moved house for just about what it had cost us. Lockheed, who was a huge employer at the time, had a big layoff and we were lucky to break even on the sale. So we didn't get rich as we foolishly expected, but we did end up with the lot on Christine Drive, where we built a new home in 1964 that would hold our 4 children and the 5th that we were expecting and eventually four more.

My Managers While In Materials

While in Materials Management I reported to three different managers. First was Noel (Ed) Porter. He was great and almost never bothered with what we were doing. Occasionally I would get a little 3 inch square note, typed on his own personal, manual typewriter, which would have a comment, or request and was always signed N.E.P. That was about it.

Next Manager was Bruce Wholey who managed the Microwave Division (before he moved to Waltham Division). Bruce was very interested and attentive to what we were doing. He would come by a few times a week and share any news, or instructions that he wanted to pass along. When he was done he would sit a bit longer and look at me with steady blue eyes and say nothing. This would start me scraping for other things that I could tell him. I always gave him more information than I intended. It was an interesting silent interrogation method.

My Last manager in Corporate Materials was John Young. He had taken over from Bruce as the manager of the Microwave Division. He was good; insightful and like Ed Porter we didn't see him too much. It was John who sensed when it was time to give me a new challenge as I had finished the things that I felt needed to be done in the Materials area. One day he said to me that Gordon Eding would like me to come with him to Datamec. I was very happy to work with Gordon and get some first hand Division experience.

Datamec Division

Datamec was a small computer tape drive and disk drive manufacturing company that HP had just acquired. The disk drives were more in development than in production at the time they joined HP. Some of their managers left shortly after the buyout and Gordon Eding was chosen from HP to be the Division General Manager. He asked me to join the division to be the Finance Manager. In most companies this position would be called a Division Controller, but HP had no controllers, because Dave Packard didn't think that a finance person ought to be exercising much control in a technical

company. After Packard later gave up the reigns of the company a few controllers did creep into the landscape, but I don't think the substance of things changed.

As sometimes happened when HP bought a company, the acquired company got hit pretty hard with corporate overburden. First of all, most of Datamec's tape drive sales had gone to Digitial Equipment Corporation (DEC), a successful mini computer manufacturer but a direct competitor with HP computers. So a big part of Datamec's customer base pulled away after the acquisition. Secondly, HP's corporate surcharge and HP Lab overhead, plus more elaborate employee benefits were crunchers for the small company. Thirdly, they had to bear part of the expenses of part number conversions and changes to HP'S quality, engineering, accounting and production standards. This was a new perspective for me to see how heavy these burdens felt from the divisional perspective.

I traveled around the U.S. with Tom Tracy, Datamec's marketing manager, to work out termination agreements with all their Sales Representative organizations and then worked out the transition to HP's sales force. We also negotiated with HP Sales Region managers for slightly more accommodating selling terms for Datamec. Over a few months we worked out all the accounting and financial changes that had to be made to match the HP systems and standards, including forecasting and reporting processes. All this change made sense to me but the poor guys who had been with Datamec for a while were in a state of confused agony.

One day I was in the Marketing Department and I noticed that Fred Waldron, who had also transferred from HP, was looking grim. He said HP Corporate has required us to do a 5 year forecast and I don't even know what's happening next week. He showed me the areas he had to cover. I told him it was no problem. Corporate is going to add this forecast like a small drop into a large pool. Just take last year and add 10% per year, ask the labs if we can ever ship any disks and add a bit more in for that, take a stab at market trends, then do a little creative writing for your narrative and you're done. If the field sales force doesn't like it they'll tell us. He said, "Are you sure?" I told him that for us, right now, that will do. He looked relieved and said, "This may not be as hard as I thought." It turned out that in actual fact his forecast was pretty close.

After a year or so HP's external auditor came to do a full audit of the division. Spending a few weeks with CPAs was not really my idea of a good time. We got through it and with a little requested touchup we passed their scrutiny.

The Datamec manufacturing manager was courageous guy who was fighting off cancer. He worked nearly to his last breath. After he died, Ray Smelek joined the division to assume that role. Gradually the little division got on its feet.

Corporate Finance and Accounting

Wayne Briggson had become the top Accounting/Finance Manager in HP. He was a no-nonsense, kind of leader. He kept at his desk a big red rubber stamp that said "BULL SHIT" which he used on memos and proposals that didn't make common sense. During this time HP was struggling with financial accountability. John Young was proposing a matrix system which gave product line managers worldwide responsibility for a cluster of related products. This responsibility cut across countries, sales offices and factories. It was far more complex than our old divisional model. The matrix demanded two complete sets of books, one for traditional and one for product line accounting.

This didn't match Wayne's idea of a simple straight forward business management. I think he fought this complex approach for a while and eventually left the company. (I was not close to this and I'm

not the best one to report what happened, except to say the Product Line accounting was adopted and came back to haunt me later in the Heart System.)

Finnigan Instrument

By 1968, I wasn't looking for any changes in employment. I loved HP and for the greater part had enjoyed most every assignment that I had been given. Then one day out of the blue I got a call from my friend Roger Sant who had worked with me in HP's Systems department, asking if I would consider taking a job in his current company, Finnigan Instrument. I told him I was pretty happy where I was, but that I would talk with him. Their offices were in the Stanford Industrial Park, near the fire station on Hanover. I stopped in after work one day. Finnigan made quadrapole mass spectrometers. This was a significant breakthrough from the huge, expensive magnetic spectrometers that could wipe out all your credit cards if you got too close. These products were used for: environmental testing, such as measuring pollutants in fish livers; medical measurements such as cholesterol levels in the blood stream; crime labs for the breakdown of substance traces on crime evidence; drug testing for athletes, horses, etc., and other analytical diagnostics.

They wanted me to be the General Manager of the little company, with a sizeable salary increase and an appreciable stock equity position. Colette and I deliberated long and hard. By this time we had 8 children and a high risk situation like Finnigan didn't make a lot of sense for us. On the other hand it was a rare opportunity to work in a very small startup company and help it to grow and mature. I took the offer and bid a sad farewell to a lot of HP friends and mentors.

The Finnigan challenge was exciting, but one of the first things I noticed was that just about all 30 of the employees were very distrusting. It didn't help that I had come from the outside. The prior leaders of the company, some of whom were still around, had not always been consistent, or straightforward with them. To try to work our way past this I set up a profit sharing plan and a retirement program with some company matching. The company's contribution was not large to either of these, but it was about the best we could do with limited resources and skimpy profits.

Finnigan hit a period when the production folks could not make a single functioning spectrometer and consequently could make no shipments and hence we had no income. To resolve this critical problem I sent our best quadrapole engineer to Coors Corp. in Colorado, not to drink beer, but to work with the Coors' exceptional precision ceramic machine shop. The quadrapole was the heart of the spectrometer and consisted of 4 molybdenum rods held by 2 ceramic end pieces. We had only one quadrapole left in our lab that worked. That one unit worked well in any of the unshipable units that were sitting in production. I had Mike, our engineer, pack up this last working quadrapole and any test equipment he thought he might need. I told him he should not come back until he could repeatedly reproduce a good quadrapole. After 5 working days he called and said he had the solution. The key was one critical dimension in the ceramic machining. He brought back a bunch of good ceramic end pieces which held the four rods and we were off and running again.

The valiant, but shorthanded engineers at Finnigan had worked hard to come up with a new product or two. One new design got pretty well functionally, but it looked like a lab bread board so I called Bob DeVries, a friend at HP, to ask if he would consider a small project after hours. He graciously agreed to help design a product package that would look like it had been made in a factory. When he got through it looked great. Unfortunately it never developed a great market to match its looks.

Many of our customers were interested in more sophisticated measurements. This could be done if a gas chromatograph was coupled with our mass spectrometer. With some effort that integration was accomplished, and Finnigan did successfully offer a GC/MS which was well accepted.

After I had been about 2 years with the little company, Federal funding was cut off for many of the agencies that funded the purchase of our product. NIH, scientific grants, environmental projects and more were all slashed. Orders dropped like a stone and it was necessary to lay off a good share of our small crew. I decided in the process to lay myself off. There were original investors that could manage what had to be done in the company. They were good skilled people and better able than I to help the company weather the storm.

I learned some important things during those two years: I had taken for granted the people of HP with their loyalty, trust and somewhat selfless collaboration. It was clear that was unique and hard to replicate. I was also uncomfortable at Finnigan when I could not pay bills and keep financial commitments in a timely manner. A single product company is riskier and less stable than one with multiple products areas and being dependent, directly, or indirectly on government funding doesn't make for stability. Also, small companies had no central support services, of the kind I had come to expect at HP. Nearly everything you needed you had to do it for yourself.

Return to HP

Not everyone was happy to see me come back to HP. One fellow in the Materials Department had felt that the changes I had initiated were too severe and not people oriented. He went to Ralph Lee, who had replaced Ed Porter as VP of Manufacturing, to see if he could stop my return. In spite of these objections, Cort Van Rensselaer, with encouragement from Matt Schmutz, made me an offer to return to a job in the Manufacturing Systems Group under Cort. I was very grateful for their support. At this time each major function, Manufacturing, Marketing and Finance had its own Systems group.

Matt Schmutz, the EDP Manager, with Cort's approval, told me that I should work in his computer room to get a feeling for computer processing. This sounded like a good idea. My first assignment was to do the card sorting for a bill of materials explosion. Products to be built had to be exploded into its component parts to be purchased or manufactured. To do this explosion the quantity of each product scheduled to be built was multiplied times the component parts needed in each unit. There was a deck of cards for each instrument to be built with the component quantity needed. Now the task was to re-sort all these instrument decks by part number and assembly number to give the total quantity of each part to be purchased, or assembly to be fabricated. When every deck for every product was re-sorted into component part number the computer could tally and print out a quantity of every component for all the planned production runs. This was essential because HP products used so many components in common.

The cards to be sorted made a pile well over 20 feet high, but only a foot or two at a time could be loaded in the sorter. Part numbers were mostly 8 digits and a few fab parts were longer. This meant that the entire deck would need many passes through the sorter to put the cards in their final part number sequence.

I started in the morning and had been sorting for several hours when there was a distraction. When I returned to continue sorting, I grabbed the wrong pile of cards and instead of continuing the sort I had instantly suffled the deck. Ugh! Matt came in to see how I was doing and I told him what had happened. He smiled and said, "You've done quite enough for the day. We'll clean this up." I was never invited back and I never asked to return.

Cort asked me to develop a system for HP to HP orders where one division, or entity buys from another. There was a high volume of these internal orders and yet there was no systematic way to place these orders or to get credit back to the selling division. The high volume of these internal orders was spurred by the creation of new divisions who took product lines from established

divisions to new division locations, both domestic and foreign. Cort saw the rapid growth of this activity and knew that we needed some systematic way to take care of the need. He suggested that I talk with Bill Johnson who headed Marketing Systems as he was working on a new sales order processing system called Heart. Learning what processes he was planning to use for moving orders from customers to product divisions might be helpful in handling these internal orders.

Bill gave me a detailed description of the Heart system and the sales order format and flows that they planned to use. With some adjustments I employed that order system for internal orders and then initiated it within the company, globally. This IOS (Internal Order System) initially used multi-part forms and the company's teletype transmission system, but was designed to use the computer based data transmission system (later to become Comsys) which was in the process of development.

With the IO System design completed, Cort asked if I would go to the Customer Service Center in Mt. View, CA, from which all customers and HP repair centers could buy replacement parts. He said they were in need of a computerized inventory management system. I was there for about a year working with Clyde Francis who had a fantastic knowledge of how their manual parts systems worked, and also the parts of the inventory system that needed to change. That system got designed, programmed, installed and was working quite well at the end of the year.

This is a demonstration of the new Customer Service Center computerized inventory control system to Dick Wilson, Chuck Ernst, Clyde Francis, Bob Boniface, and Dick Arey.

Packard Returns from DoD

I remember David Packard coming home from his service in the Pentagon as Deputy Secretary of Defense. As he came through the Customer Service Center where I was working, he had a friendly greeting and I asked him how it felt to be back. He said, "It's nice to be back where you can get something done."

In Packard's time away in the Department of Defense, speed bumps had been built into the parking lots and perimeter roads all around the HP Stanford Park complex. They were a pain. When Dave saw these he ordered them to be taken out and said, "These are physical symbols of lack of trust in our employees. We do trust our people and we are not going to have these damn bumps everywhere."

Another thing that had developed while Packard was gone was a gradual buildup of our short-term borrowing. This was short-term debt built up primarily to finance the cost of our operations: handling rapid company growth, purchasing materials for manufacturing, financing our accounts receivable as sales grew. Our leaders concluded that it would be cost effective to replace this short-term borrowing with proceeds from an HP Bond issue. All the work had been done for the issuance of bonds and a prospectus had been printed and distributed. We were just days away from the market placement of the bonds.

This troubled Dave. He didn't like debt and didn't feel this was the right way to finance Company growth. He stopped the Bond issue dead. Then he scheduled the "Give 'em Hell Tour" to every major field sales office and every factory. His messages were simple. To factories it was "Cut your

inventories back to a reasonable, well planned level." To the field offices, which created invoices to our customers for goods shipped and then collected the receivables; his message was "Tighten up your collection processes. Bring in the money owed to us faster." He added the exclamation point to both field and factory that if they couldn't do this, he'd find someone who could. He was very direct and forceful and when local managers saw him coming, they would murmur to their team, "Here comes the old charmer." After the first couple of visits the word was out and things changed dramatically. Short-term borrowing virtually vanished overnight and there was no more need for a bond issue.

Cort Van Rensselaer & Matt Schmutz

Working in Cort's systems group was a great experience. He had a rich background in HP and most recently had been in Colorado Springs where he was the Division General Manager. He came back to Palo Alto to head the Information Systems and EDP functions. As the Senior systems manager in the company and had the experience and vision to move HP's processes forward. Matt Schmutz, who headed HP's EDP department under Cort, had been hired back into HP by Bud Eldon, the immediately prior Systems Department Manager, to direct the conversion from the SS90 to the IBM 360. This decision to switch computers was a good move on Bud's part as our processes were becoming more complex and skilled support from our vendor was more critical. Matt was a good friend that I talked to often. One time we were talking about an upcoming party for the group. I mentioned that I had a conflict and couldn't come. Matt said with a smile, "That's great. It always makes me nervous when I'm slipping away into incoherence and I know you are going to remember everything in the morning."

Later Matt moved to the Business Computer Group and took on some major responsibilities for them. Sadly he developed serious cancer. I visited him in the hospital near the end and asked if I could do anything for him. He said, "Watch out for my son." His son Bill was a great young man, but had taken longer to find a direction in life than Matt would have liked. He came into my Communication Department under Luis Hurtado-Sanchez. He established himself there quite well and found some work areas that he really enjoyed.

Comsys Implementation

Bill Johnson, who succeeded Bob Puette as the Marketing Systems Manager and Heart System development manager, talked to Cort and asked if he could recruit me to his department. I had worked with Bill when I was developing the Internal Order System. Cort agreed to the transfer as the inventory system at the Corporate Parts Center that I had been working on was up and running. Johnson felt he was having some challenges in his telecommunications area and asked if I would manage it. This was a small group of about 6 people but their work was to be the backbone utility of the order information flow within the company. The Heart system was still under development, but before it could

The HP 2116A started life as an engineering computer, but was adapted for Time-Share data handling, which made it ideal for our data transmission service.

be deployed it was going to need a superior data transmission capability in order to function. The Internal Order System that I had worked on was designed to use this data transmission capability as well.

An interesting historical note: Bud Eldon, as Information Systems Manager, suggested the possibility of transmitting sales order information between 2116 computers to replacing the ASR 35s which he had deployed. There was some management skepticism about this possibility. Bud also, before he left the department, hired Bob Puette and a number of others to do Operations Research. Dick Hackborn was hired into this group on a part-time basis while he attended Stanford. Out of this the seeds of the Heart System and Comsys were planted.

The invitation to work with this group looked very interesting and I had had some exposure to the planned data transmission system already. I liked Bill Johnson who would be my boss, as well as Rich Nielsen, Gene Doucette, Bill Taylor and the people involved with the Telecommunications group, so I readily agreed to the move.

Bill Taylor and Gene Doucette were working with telephone companies and telephone equipment manufacturers. They looked for ways to lower our telephone line charges and negotiated telecommunication equipment contracts. They were responsible for PBX selections which were complex devices made by AT&T, Northern Telecom, Rolm and others, used at each HP site to receive and reroute inbound and outbound telephone calls.

Paul Storaasli in the Telecommunications group was working now with Rich Nielsen who had joined Howard Morris in Programming. Rich had then taken over the project when Howard transferred to Cupertino. Rich was working on the HP 2116 coding to give HP a better, faster and more accurate method of transmitting data with the use of computers rather than teletype machines. With some hard work Rich developed software to generate fast, reliable data transmission between two 2116 computers. Testing showed that this was much faster than the teletype machines we had used and was free from bad line errors which we got with teletype. We did some calculating and determined we would need well over 100 computers phased in over time to set up the network. This was a very large investment, even though it was HP equipment. We also needed to buy modems from an external vendor and these in total were quite costly as well.

I took our investment analysis to Bill Johnson and he said, “Let’s go for it.” He and I talked to Bob Boniface who was now the Exec VP over HP’s worldwide marketing. He thought it looked good, but said it was a large enough investment that we should get approval from the Management Council. I got out the paper pad and felt pens to make a few panels to explain what we were doing and what the investment looked like. There was an offset in cost from the replacement of the slower teletype machines and their relatively high transmission cost.. In addition the new network opened the possibility of transmitting additional kinds of information through the HP computers. We got quite an enthusiastic approval from HP’s managers. Packard said this should be a product. It was a different and interesting use of HP computers which up to that time had been used mostly for technical engineering work and very little for business applications. We placed orders for the HP computers and scheduled them out at the pace the Cupertino Manufacturing Division could sustain and still serve paying customers. We matched this shipment schedule to our installation plans.

Later the Comsys data transmission system did become a product, the HP 2026. Some systems were sold but it never became a big seller. Other companies found it difficult to deploy and manage the system in the way that HP had done.

Transmission Lines

Commercial telephone lines at that time were very expensive compared to the current time, 2012. We could not broadly afford the expense of dedicated leased telephone lines. As a result our data transmission was planned for the use of dial-up lines. This meant you had to pick up a phone, get dial tone, dial the remote number, get a confirming modem tone and stick the telephone hand set into the modem and start computer data transmission. Standard modem speeds were 1200 bps. We were testing our transmissions with a 2400 bps modem and it worked OK over dial up lines.

Just as we were about to order more than 40 of the 2400 bps modems, Gene Doucette and Bill Taylor found a reliable vendor, Paradyne, who offered a brand new 4800 bps modem at about the same unit price as the ones we had been testing with. A modem which was 2 times faster was like gold. We could get our data through faster with lower telephone line cost, which was charged by the minute. We ordered the faster modems. The Paradyne modem also had a slow speed reverse that could function at the same time a full transmission was going forward. Rich Nielson included a clever error detection and correction scheme using this reverse channel.

Data being transmitted was assembled into packets (a set of a couple of thousand characters) and at the end of each packet the sending computer calculated a sixteen bit check sum. The receiving computer read the incoming packet and did its own calculation. If the sending and receiving calculations matched the receiver would send back over the reverse channel an acknowledgement (ack) that the transmission had been received correctly. If the calculations didn't match because of a line error, the receiving computer would send back over the reverse channel a non-acknowledgement (nack) and the sender would send that packet again. This gave us virtually error free transmission, even over marginal phone lines. Using the modem's reverse channel avoided having to stop the main transmission to send back confirmations or error messages. This was another important transmission speed advantage.

Because dial up lines for transmission were available everywhere in HP's worldwide organization we could move ahead quite quickly. As we received equipment we started up the first Comsys transmissions.

When data was entered at all the HP locations the teletype machines were still what we used initially to capture data on punched paper tape. The tapes were very awkward to label, store and handle. In all computer sites, the walls were covered with hanging tapes and in many sites clotheslines were installed to create more hanging space. In at least the larger sites, the paper tape was input to the 2116s where the data could be stored on magnetic tape in preparation for faster computer to computer transmissions.

Comsys Becomes Operational

Our computer data transmission system was given the name of Comsys, short for Communication System. As Comsys became broadly deployed, a key bottleneck was the entry of data to paper tape and then feeding the paper tape into the HP 2116 computers. Teletype machines which produced paper tape were so awkward that Paul Storaasli and Terry Eastham were determined to find a manufacturer who could supply a terminal with a keyboard and a CRT display that could input directly to an HP 2116A. Direct terminal entry to our computers also offered the important possibility editing input, making possible immediate error detection and correction on the data entered. Teletypes could not do this.

Finally we found a small company in Salt Lake City, called Beehive Electronics, that made something very close to what we needed. They accepted our requests for modification and slowly began to deliver computer terminals to us. These new terminals eliminated the teletype machines and the punched paper tapes. The Beehives were deployed in the HP computer rooms around the world. The Beehive terminals were a huge step forward, but getting worldwide support from this small startup company was a real issue. Terry often woke up at night with nightmares about Beehive support. Field reliability was improved by burning in the Beehive terminals before they were deployed.

The Beehive terminals were replaced by the much more reliable HP 2645A. This photo shows these HP terminals assembled to demonstrate that one Comsys computer could support 64 data entry terminals as well as all transmission activities. The demo was for the people working on HP 2026, the Comsys Product. Pictured L to R are Hank Taylor, Rich Nielsen, Terry Eastham.

It was a couple of years before HP developed a full featured CRT terminal, the HP 2145, which could replace these Beehive terminals. The HP product gave us significantly higher quality and much greater reliability.

The implementation of computer to computer transmission with keyboard to computer data entry started in 1972. The network was near completion and functioning quite broadly in 1973, even though the CRT terminals for input and printers for output were still restricted to the computer rooms, just as the teletype machines had been. An article in the April, 1974 Measure, "The Penny Post Rides Again" describes the broad use of Comgrams throughout the company. Comgrams were internal messages which could be transmitted over Comsys from and to any point in the company for just a few pennies. These messages were entered into Comsys in computer rooms, which then sent them forward in batches. In the receiving computer room they were printed out and delivered by the office mail system. It took one to two days to get from desk to desk. Nevertheless at this very low cost it was extremely fast for the 1970s. Downloadable copies of all Measure Magazines are available from the HP website.

Fast as a speeding electron...

THE PENNY POST RIDES AGAIN!

Measure article

An interesting side note occurred during the time that we were up to our ears in paper tape. All over the company in computer rooms, paper tapes with order numbers written on them were hanging around the walls and on clotheslines. When shipments from factories took place these tapes were retrieved to create invoices for the items shipped. This often required cutting and splicing the paper tapes and had to be done pretty accurately or the spliced tape could jam the tape readers. Gene Doucette designed a simple aluminum block with a cutting guide and pins which matched the paper tape sprocket holes. One or two tapes at a time could be cut on this jig and then spliced to another tape with excellent precision and this prevented tape jams in the reader. Gene asked an HP traveler, probably Greg Garland, to take a couple of these splicing devices to Europe. A Swiss security agent

grabbed the hapless messenger out of the customs line. They held him while they X-rayed the aluminum jigs and questioned the poor guy, threatening to put him jail for carrying secretive devices. With careful explanation he was finally released with his aluminum blocks. It was good in many ways to be rid of the paper tapes.

International Transmission Issues

Outside the US, the governments of each nation kept control over all telephone equipment and transmission lines. Some countries were more cooperative than others. As we established dial-up connections to the tougher locations, their restrictions were painful, allowing only 1200 bps modems which were manufactured under their direct control. Geneva, Switzerland was a primary hub for all of HPs Europe's transmissions and was a very high volume location, but the Swiss PTT was very restrictive. We negotiated with them for some time to install a faster non-Swiss modem and their answer was always no. Finally in exasperation I told them that unless we could install a faster modem that we would move our European Headquarters to another country that was more cooperative.

I almost certainly never could have persuaded HP to do this, but the comment was heartfelt and caught their attention for the first time. They said, "Give us a minute." They came back and said that we could install a faster modem, but that it would have to be called a test installation and they wanted it located underneath the raised computer floor so as not to be visible. I asked how long the "test" would be allowed and they said indefinitely. Essentially they were saying you can have it, but don't flaunt it. We said, "Done!"

In Taiwan we were having a similar struggle with their government. As we lobbied hard for more speed they said this would be inconvenient as they were monitoring every transmission. We protested some and pushed for a trial at higher speed and they responded, "We shoot spies." We lost that round.

Mark

Bill Johnson mentioned to me one day that he was going to hire an ex-convict to help with sales statistics. The combination of sales stats and ex-convict struck me odd and I asked if he thought that was a good idea. He said he had talked to Mark's parole officer and that there was zero chance of any problem working with him. Mark had been addicted to heroin and run into some trouble with the law, but he had been rehabilitated using methadone. He was bright and fully reliable. So he came on board. There were many requests every day for special information from the Sales Stats files and Bill got the help he needed to produce the special reports

Mark learned fast and did his work well. He looked a little different than the typical HP employee with a wild hair style, a full beard and tattoos all over, but people really liked him. After he had been around a year or so he was talking to Johnson about his love of motorcycles and when he rode one he felt absolutely free and happy. His problem was that he hadn't saved enough money yet to buy one. Bill said "Go try the HP Credit Union they'll help you." In a few days he came to work with a helmet under his arm and he proudly took us out to see his new cycle; a powerful Harley.

He loved to tell of his old days on a cycle and the trouble he had, especially with women drivers. He swore that there was something genetic that made motorcycles invisible to a woman. In one of the many stories he told, he was riding on 280 when the freeway was very new. Not too many cars were on the road and he was sideswiped by a woman in a large car. The impact tipped his bike and as it fell he eased himself onto the up side and sat on it like a sled. He was going well over 60 mph and the bike, riding on its side, spewed off a 100 foot sparks plume, while he sat on top. By the time the

bike stopped sliding he was well off the highway on a grassy shoulder. The lady driver had kept going, completely oblivious to his near death experience. With some minor adjustments and repairs he was soon back on the road.

Several years after he came to HP and had his new motorcycle, he was riding a country road on the Fourth of July, hit some unexpected loose gravel, spilled his bike and was killed. It was a sad day for all of us who worked with him. It was instructive to us managers that we could help rehabilitate a motivated person, with high expectations and careful encouragement.

Heart

While the Heart System (for sales order processing) was in the late stages of development Bill Johnson decided to leave his Corporate Marketing Systems management spot. Jack Petrak was now Bill's boss. Jack, who worked under Bob Boniface handling marketing administrative activities, asked me if I would take Bill's job and oversee the completion of the Heart development and implementation. Comsys was now fully functional and was starting to transmit some of the Heart system's data. It was also transmitting other data such as reports, data files and the company's general message flow. I accepted the new assignment.

Our IBM Computer Room where Heart was originally processed

Heart was a massive project. Chuck Sieloff who was the programming manager for Heart software as development was nearing completion said, "HP had never undertaken anything of that scale before." Over 5 or 6 years it had ground down three generations of Marketing Systems Analysts and a few generations of programmers. It used true database management that we had never used before. It had more than 100 modules all written independently that had to be made to fit together. It was so large that testing had to be done at an outside service bureau until HP bought a much larger mainframe computer. Chuck Sieloff observed, "When implemented, Heart [with its tentacles reaching into all parts of the company] became the de facto enforcer of companywide data standards, making it possible to build other applications around its periphery. Once Heart was fully implemented, I think it was viewed as a major competitive advantage for HP."

As the Heart modules moved toward completion the most demanding thing that the Corporate Marketing Systems group had ever done was to document the system for users, train them office by office, factory by factory and also train the Corporate users. This included activities like Accounting and even the data processing center where invoices and acknowledgment were now created and mailed and sales statistic reports were generated. They all needed training and new procedures to be put in place. All told it was an overwhelming project.

In over-simplified terms the Heart system created new field office and factory systems and used our IBM mainframe computer which held the files and did the processing as follows:

Customer File: Contained information for all of our customers. Every order was passed against this file to assure correct customer number, shipping, billing addresses, tax coding and so forth. It

verified the Field Sales Engineer assignment to the customer and provided coding for commission credit..

Product File: Had every HP product and option listed. It provided consistent product description and current pricing each order passed against it. It also provided approximate delivery availability. This file was also used to create quotes for customers and to produce and manage the Company's Price List. The product file had an accompanying file of configuration rules. It also had coding for worldwide product line accounting.

Sales Order Processing: Took the order from the field and accessed the customer file and product file to assemble all the correct coding for each order and provided the coding that allowed sales to be tallied by field engineer for commission payment, or by office or region, or country, or by manufacturing division or by product line. These sales orders were split to the appropriate manufacturing division for shipment. The system produced an order acknowledgement to mail to customers which verified pricing and approximate delivery dates which were taken from the Product file.

Open Order File: When items on an open order were shipped by the manufacturing division a shipment notice was sent to the Heart Open Order file and an invoice was created for the items shipped which could be sent to the customer. The data for all these shipments was passed on to HP Finance who tracked shipments to help produce HP's Profit & Loss statements and also created Product Line account for all of HP. From this processing, sales commission were calculated for field sales engineers. Information for sales tax accounting by state was generated. Unshipped orders gave an automated view of backlog by product division and product line.

Sales Statistics File: This file held all historical sales information and was broadly used for analyses of current month's sales activity and analysis of historical sales information and trends.

Sometime later, Heart was painfully converted to run on HP 3000s. As the HP operating system became more capable and the processing power increased the HP 3000 provided an excellent computer system for Heart.

As the HP 3000 computer gained in power and capability, the Heart system was transferred from the IBM to HP 3000s around the world.

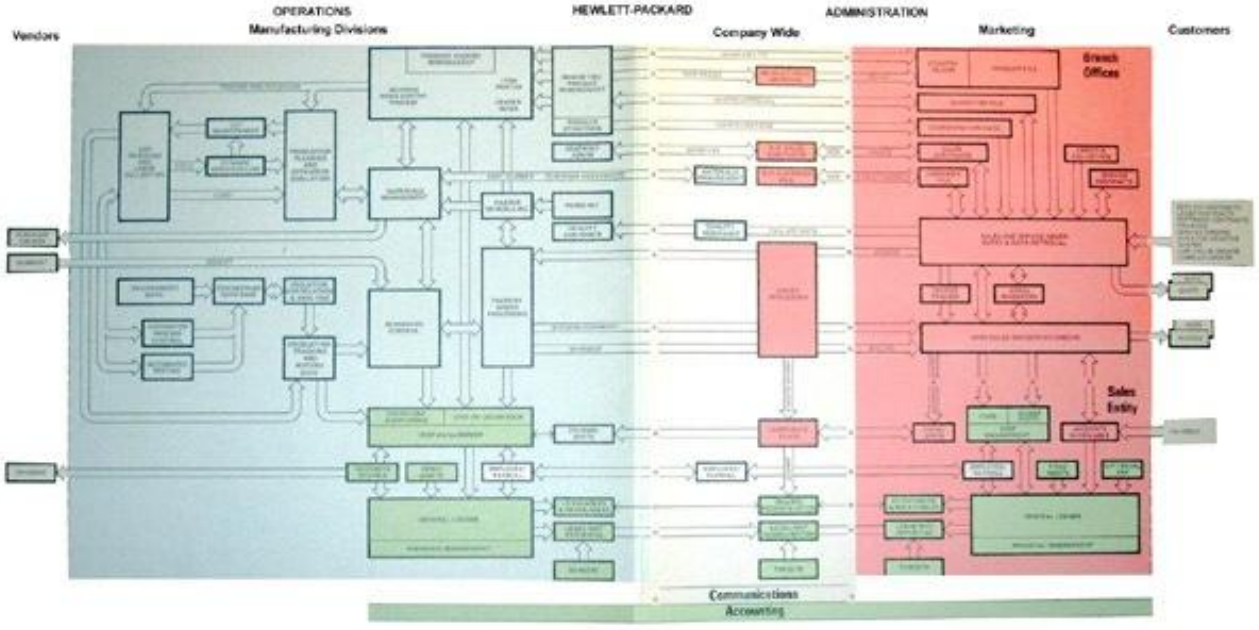
Comsys Applications

With Terminals now connected to our HP 2116s it was possible to create some applications for use in our local sales offices to help with the processing of orders. Rich Nielsen helped prepare the way and George Radu and team prepared software for the entry of orders and preparation of quotes, inventory management of local repair parts, sales and repair order status, delivery information, and other useful utilities. Copies of HP's product file and customer file were down loaded from the master files in Palo Alto, to the offices each night to provide data for these local programs. These valuable tools greatly increased the accuracy and efficiency of the key entry of orders in the offices and speeded the preparation and accuracy of customer quotes. When early versions of these

programs were ready, Bill Hewlett looked in on one of our demonstrations and with some delight he said, “It’s about time we had this capability.”

Explaining Heart

For some time Al Olivario was the Executive Marketing leader over our Heart/Comsys activities. This was interesting because he didn’t like to read memos or reports. He didn’t like to write them either. He didn’t like phone calls or desktop computers. The pink telephone call slips left on his desk by his secretary were 90% crumpled into a ball and shot into the waste basket. When we met face to face he didn’t like to listen. When you needed to convey an idea you pretty much had to wait until he rambled onto your topic and then you had to quickly seize the point with agreement and adjust it as quickly as possible and then leave. One day he asked me what the heck the Heart system did. I thought there is no way I can get through this with him, so I asked him to give me a couple of hours and I would be back to him. I made a simple diagram to show the integrated workings of the Heart System with its interfaces to the Field, Accounting and Manufacturing. The chart worked! He kept my simple hand drawn diagram and later I saw him explaining the Heart System to a visitor at his desk.



HEART information flow diagram combined with Manufacturing and Accounting.
For details, see the Taylor article at HPMemory.org.

I added some more detail to that hand done chart and Carl Cottrell, my direct supervisor at that time liked it. Carl, in talking to Cort Van Rensselaer, decided it would be a good idea to add the integrated factory systems that Cort’s team had been working on for deployment to HP divisions. Accounting systems were also added. The combined diagrams portrayed the major information flows for the whole company and was used for customer presentations.

With the very able computer programming direction of Chuck Sieloff and Sally Dudley we completed the last elements of the enormously complex Heart System and continued to roll these elements out to field and factory locations and placed them into full operation. European and Asian versions of Heart were completed shortly afterward and processed in Geneva for Europe, Middle

East and Africa and in Tokyo for all of Asia, thus giving complete global processing. Cochise in Europe and Yamamoto in Japan were the parallel processing systems to Heart.

The Heart System plus the Comsys transmissions meant that sales orders were processed on a very timely basis and every HP manager could look each morning at the sales orders received from all over the world the next morning. This was a remarkable capability for any company to have in the mid 1970's. Chuck House, in his book *The HP Phenomenon,* makes note of the "treasure trove" of information that "showed up at every general managers' desk three days after month-end, starting in 1974." This was possible because of Heart, its companion systems and Comsys.

Paul Ely

Paul was a marvelously energetic and forceful leader for HP. While he was still in the Microwave Division he very kindly came and spoke to our group and delivered the most enthusiastic endorsement of HP that I had ever heard. He compared it to his experience in other companies. It was a real morale booster.

By the late 1970s, Paul was head of the HP Computer group. Late in1977 was about the time that we were moving out Comsys applications to the field offices. These were really substantial productivity tools and were very well received. Paul;s group had released a new small business computer. It was called Amigo because it was intended to be very user friendly. Paul was eager to remove all the 2100s from the field immediately and install Amigos. Some said his management style was, "ready, fire, aim." He asked for a meeting with me and all levels of my marketing bosses, Bob Boniface, Al Olivario and Jack Petrak.

In the meeting Paul loudly and forcefully dominated a major portion of the time explaining that we should move the entire field processing from the 2100s to the new Amigo. He finally gave us a little gap for response and I told him that I understood the Company's need for an Amigo show place and that there couldn't be a better place than the field offices. In spite of wanting to help, we had looked at the Amigo's processing speeds for data transmission and the ability to connect relatively large numbers of terminals and process their transactions concurrently and it was just not possible to match the 2100's. I briefly laid out the pertinent technical details. The room fell surprisingly quiet and meeting ended. On our way to the cars Al Olivario, said, "How did you do that? I've never before seen Paul go quiet."

Eventually we were able to convert the field computers to improved HP 3000s located just in the large offices and Region Headquarters with terminals going to the smaller offices, just as if they still had their own computers. This was on the route to consolidated processing centers described later in this narrative.

At this particular time even our upgraded IBM mainframe was having difficulty processing our orders each day. The sales order files became so congested that we almost could not complete the order processing for a single day. Allan Imamoto and Donnie Foster worked out a solution by transferring our order files from random access disks to sequential tape files and this made our processing much faster. The size and speed of our order processing was an ongoing concern, but the value and contribution of the system to HP was immense.

Corporate Telecommunication Services

In the late 1970s it became clear that the Government was determined to break up AT&T. It was hard to predict the exact results of the breakup, but the intent was to promote competition in the Telecommunication Industry. Meanwhile the Comsys team activities had grown. Satellite video

broadcasting was moved to this group. This provided a marvelous training tool that could reach a complete HP audience. It was used most actively for new product training for field engineers, but had many other uses as well.

Comsys had grown as well. The terminals that were attached to the local 2100 computers had become significant information processors. The effect of creating these robust systems was to establish almost 200 small HP data centers around the world. Central support for these was coming from the Comsys group and Rich Nielson's technical support team. With all this data transfer back and forth our transmission volumes began to climb rapidly. Nevertheless our dial up computer transmission capability was carrying the load very well.

There appeared to be many unexploited opportunities in the telecommunication area with even more interesting things on the horizon with the breakup of AT&T. I talked to Carl Cottrell, my Marketing Manager and told him that with Heart operating quite smoothly it would be a good move for the company to let me leave Heart and focus on the company's telecommunications. Allan Imamoto was working in the Heart group and was the natural leader to take over all the Marketing Systems.

I got a pretty lukewarm reception to the idea of my leaving Heart. The very long development cycle, difficult implementation and companywide training and learning curve combined with turnover among key Heart people made my departure from Heart almost too painful to contemplate. But with persistence, and in due time, Carl sent me to talk with John Young, who was at that time the HP CEO, to explain my proposal. I described to John some of the areas to be explored and he agreed that with the changes coming to the US telecom industry that it might be a good idea to have a group to exploit telecommunication opportunities. But he wanted me to talk to every group manager as well as major division managers and get their opinion. This took a year in my spare time, but the overall reaction was very favorable.

Part 4. HP Stays Ahead of Communication Technology

New Chief Information Officer

By the time I had made the rounds through the Groups and Divisions with the telecom proposal, Lloyd Taylor had been selected to be the new CIO for HP and he was my new boss. He was quite reluctant to make the change I had proposed, but with the broad endorsement I'd received he ultimately agreed. As suggested he did chose Allan Imamoto to take over the Marketing Systems management and Allan did a great job.

CTOS Sets Goals

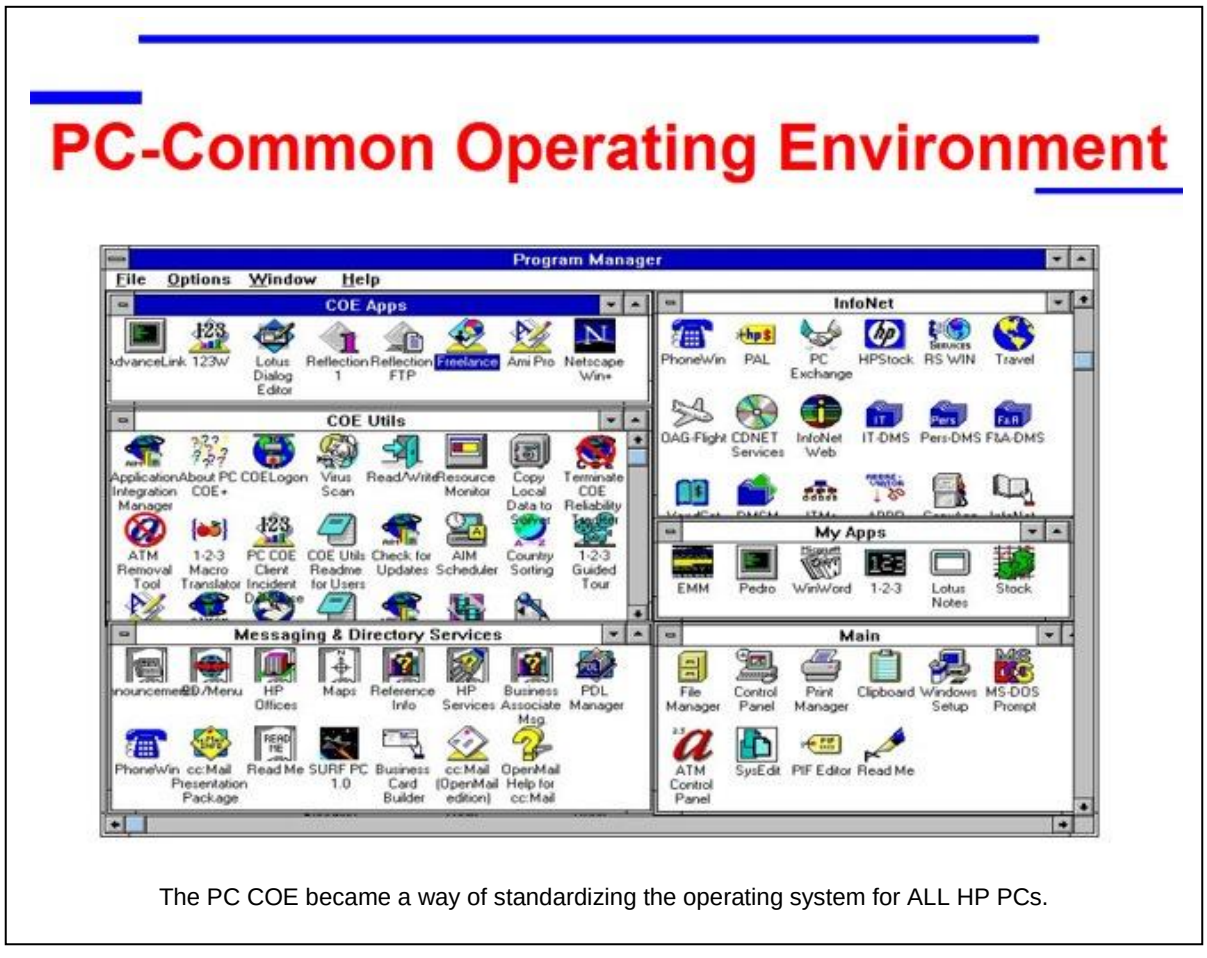
In about 1980, as the new communications department was established, and as communications separated from the Heart and Marketing Systems Team, the Office Utilities Group, headed by Luis Hurtado-Sanchez was moved into the communications group to join Comsys, TV, Voice and telephone equipment. So the original Comsys group had grown in size and scope. The group took the name: Corporate Telecommunications and Office Systems (CTOS).

In CTOS, the newly assembled staff set to work defining the projects we wished to undertake. Our general guideline was that any new capability developed should either pay its way directly by replacing existing higher cost activities or facilitate new capabilities for the company that enabled better overall operation that could save money in other areas. Here are some of the goals, or activities that the team established:

Office Utilities Group: Personal computers had just recently been developed and were becoming available from an HP product division, at reasonable prices. With these personal computers a rich set of office systems began to be available. Personal computer software could generate spread sheets, word processing, overhead slides and charts with digital projection, along with other helpful efficiency tools. The office systems group under Luis worked to standardize and facilitate the entry of these capabilities into HP as personal computers began to creep into HP offices.

I recall a meeting that Luis's group had arranged with Bill Gates and Steve Balmer where we were asking them to consider a suite of office systems that could run on our engineering work stations using the UNIX operating system just as they did on the Microsoft operating system. Bill thought about it for a minute and then said, "I don't see much of a market developing in the UNIX world," and made it clear that Microsoft didn't want to go there. [I'm not so sure it was bad decision for M/S. They had a clear focus and felt that was their best direction for very high volume marketing.]

Eventually the standardization of software for the PC desktop was transferred to Chuck Sieloff. Susan Green who had worked under Luis transferred with her small group to work under Chuck to develop a Personal Computer/ Common Operating Environment (PC/COE). This saved money on the acquisition and support of new PC software and gave HP PC users common capabilities. Perhaps more importantly PC/COE facilitated the transfer of PC information throughout the company because of the common platform. Another key advantage was any special HP software developed could run on any PC system in the company. For the Users, the benefit was that the standard office desk PC became easier to troubleshoot and maintain because they were all identical. (Slide below shows the more fully developed desktop of PC/COE under Susan Green and Chuck Sieloff.)



The PC COE became a way of standardizing the operating system for ALL HP PCs.

The Office Utilities Group was also programming an electronic mail system called Norman for use by HP employees who had PCs. Email could give HP a rich communication tool with person-to-person, on-screen connectivity, where Comsys was a site to site communication tool with hard copy paper at each end. While Norman was still in test deployment, an HP Division in Pinewood, England began development of HP Desk, an electronic mail software product. The Office Utilities Group used their experience with Norman to assist the Pinewood Division in the development of their product and committed to help deploy HP Desk within the company.

This HPDesk effort went very well and the fairly rapid implementation of email within the company helped to explode the deployment of PC workstations throughout HP. (See the HP Journal article) This article describes the remarkable expansion of email from no users in 1982 to nearly all HP employees in 1985. Comsys had been the primary transmission carrier for Comgram messages and was also the first transmission carrier for HPDesk.

When HPDesk was implemented, Comgrams went away and a major cultural shift took place. We each became responsible for our own typing and all of our own electronic filing. This combined with voice mail and the personal computers to make spread sheets, overhead slides and text processing spelled the end of the traditional secretarial position. Computing power had moved out of the computer room directly into the hands of Users. This was a big cultural shift.

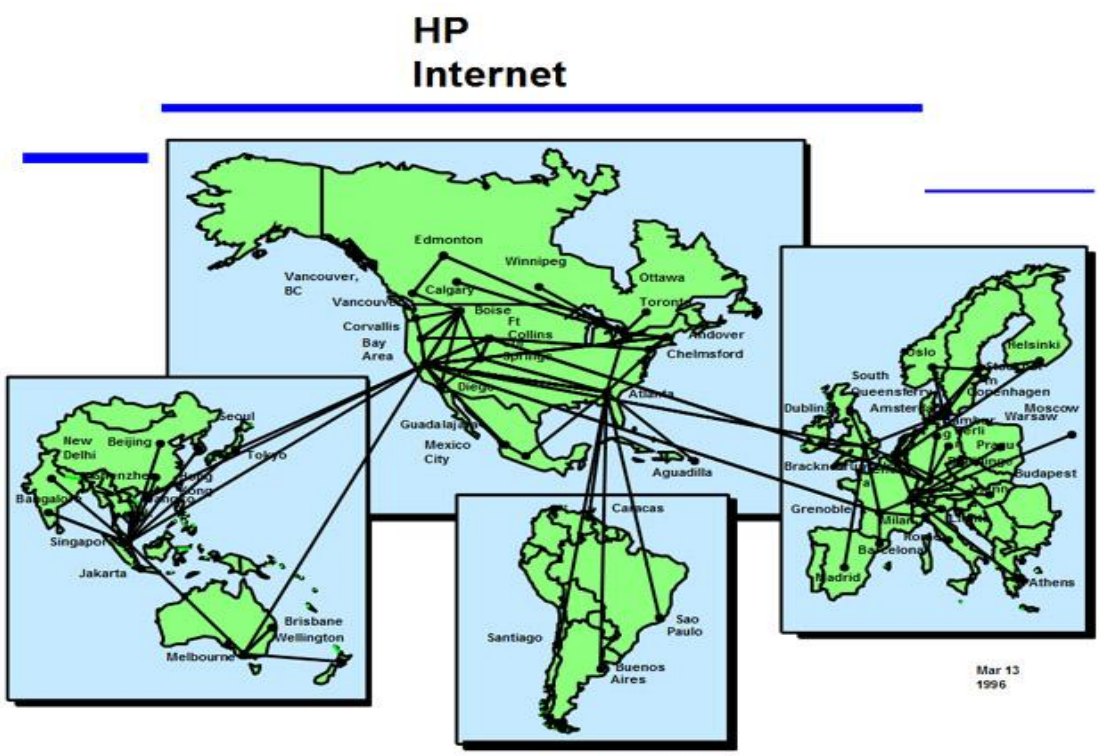
The HPDesk system was described in the HP Journal for Sept, 1986.

Read the complete story in the HP Journal for Sept, 1986

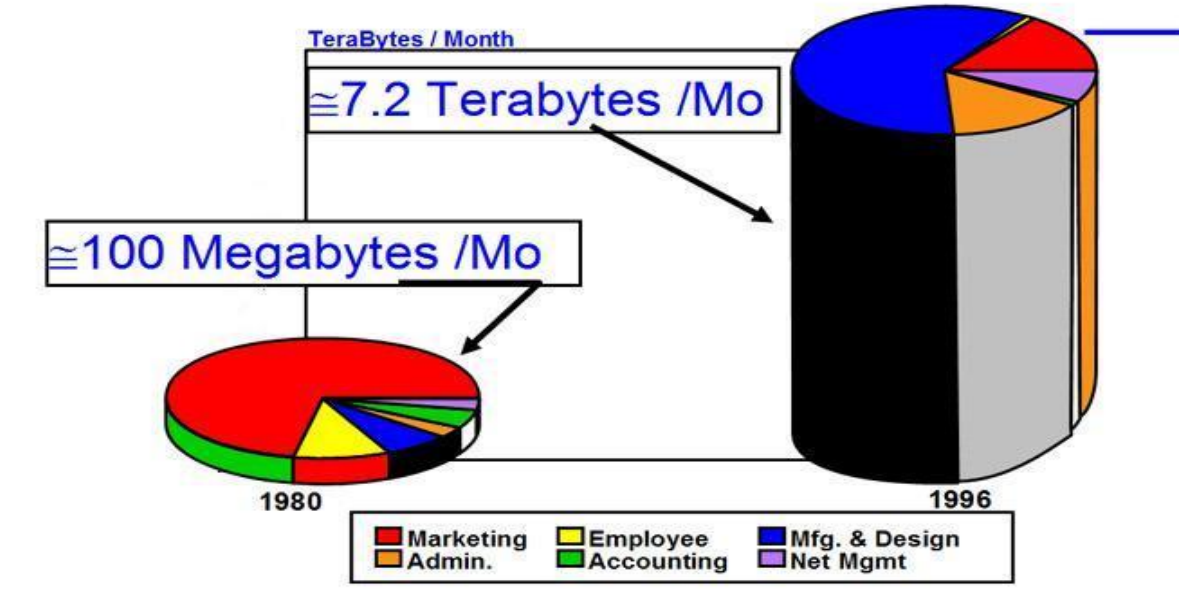
Data Networking: The 2100 computer and Comsys transmission had served HP incredibly well for 10 years but by the mid-1980s the commercial world was beginning to catch up. An international data transmission standard, X.25, had finally been approved and several manufacturers were producing products to this standard. We set about, under Doug Avery's supervision, to implement an X.25 network for HP and bought Dynapac switches to connect to GTE Telenet backbone. The small Dynapacs had low switching power and were not fully reliable and they were replaced with carrier grade M/A-Com X.25 switches which had more capability and better network management capabilities. This process began a gradual move of our data transmissions from Comsys to the X.25 network. We quickly learned that this standard, set by a multi-national committee over many years of debate, was expensive and cumbersome and not too much faster than Comsys.

I asked Dell Fischer to go up to HP Labs and Corporate Engineering to look at the XPN and TCP/IP networks they were using to connect some HP Engineers to each other and to universities and government scientific sites. Of all the really bright people in our group, Dell was the one most interested in new technology and was very quick to understand its potential. He spent time with Zvonko Fazarinc and Walt Underwood reviewing their projects. After several meetings Dell came back with a very encouraging report on the Internet capability. It was trim, efficient, flexible, economical and really fast, but the engineers were struggling with the network support and the lack of management tools. As meetings with Walt continued Dell proposed to him that CNS take over the further development and support of the HP internet. Corporate Engineering would be our lead partners. They quickly agreed. Dell's group with a couple of his engineers, Vikash Sachania and Peter Wang, took on the network R&D and support.

Corporate Engineering in the Labs had worked with a little company called Cisco (Yes, the same Cisco of today) in Menlo Park who had a dozen, or so engineers making routers and other related equipment needed to build an Internet network. Some of the first Cisco equipment was prototype stuff. As CNS took over the Internet project we bought more of this equipment and built a small test network up and down the West Coast of the U.S. It worked well and was inexpensive compared to X.25 so Doug Avery, Bill Lund and Hugh Tebault diverted their X.25 efforts to Cisco equipment at a much lower cost and much greater the speed. Both X.25 and HP's Internet replaced 2100 based transmission. Comsys got a new backbone internal network which gave connectivity to all of HP, and in addition, had the potential to connect to the entire outside world as the world became internet capable. It also gave us the potential to access remote databases and processors in real time if they were prepared for this purpose and if we could make the network secure.



This chart, when shown to our customers, gave a quick glimpse of the geographical spread of HP and the network that connected it all together



Illustrated here is the enormous growth of our data flows, Transmissions were initially dominated by marketing information which drove the establishment of our earliest networking. Marketing volumes continued to grow over 16 years, but engineering information grew much faster and became our dominant information flow.

More than 35 years after HP's internet became operational, on a flight to Phoenix, I ran into Hugh Tebault who worked on these projects. He was now the President of the Latham Foundation. Shortly after our visit he followed up with this message: "It was great to see you again, albeit briefly, on our flight to Phoenix from San Jose. This gives me an opportunity to thank you again for your leadership at HP. Working on the new HP network with Bill Lund, Yves Lubino [from Europe], Dell Fisher and Doug Avery was a very instructive and enjoyable time in my career. Your providing us the ability to operate as a virtual startup within HP was key to the success of both the initial X.25 packet network and IP internet that allowed the ROUTS systems to deliver the business information days earlier for HP."

Transmission: Our heaviest data and voice traffic was in the local Bay Area. We found that we could make huge savings by withdrawing from the telephone company and carrying our voice and data traffic over our own microwave network. In 1984 we installed microwave dishes that gave transmission from Palo Alto to Wolfe Road in Cupertino and hit all of our Bay Area sites. This gave us broad bandwidth at a low cost. The microwave network carried all of our voice calls and most of our data volumes.

To complete this installation we needed a Microwave repeater in Mt. View because line of sight transmission was required. The City would not let us erect a microwave tower on HP property in Mt. View, but finally with the help of a Mt. View city councilman who was a friend, they got us a repeater rental spot on top of their tallest downtown building. This was a much better solution than our own tower would have been.

Both we and HP Labs were interested in fiber optic transmission, so we obtained right of way and buried three conduits, two with fiber cable and one with copper cable that connected all of our Palo

Alto sites. This took us completely out of the local phone company charges. The savings from our own microwave and fiber cable quickly paid the investment and returned large savings thereafter.

As the telephone company competition increased, the rental costs of dedicated circuits began to become attractive over long distances. So we began to lease dedicated private circuits from phone companies, between key HP sites yielding even further savings on our voice and data traffic and at the same time allowed us to increase our speed and capacity over the dial-up lines we had been using.

Voice and the Development of TELNET: We felt that we could lower costs and increase functionality of our telephone service if we could standardize our PBX equipment throughout the company. After some evaluation and some selling effort to the field and divisions, we cut down the variety of manufacturers that were used, but we never succeeded on a worldwide basis in getting to a single standard.

The same competition we found in the US began to be felt on international long distance transmission lines. We began to see a dramatically-lowered cost of using private, dedicated lines to connect our sites around the world. Linking our domestic and most of our international sites with HPs own private lines, became very attractive.

This paved the way for us in the early 1980s to have desk-to-desk telephone dialing almost anywhere in the HP world over these private lines. We also produced a global telephone directory about the size of a public phone book, which gave an internal 7 digit numbers needed to dial virtually any other HP employee directly at his or her desk. This worldwide TELNET service not only made connecting to other employees around the world faster and easier, it substantially reduced our telephone costs. Mickey McNamara who reported to Bill Taylor had the responsibility to put together all the names and phone numbers for the printing of the Telnet directory.
The directory production was a big job and took a lot of proofing. Mickey decided one day to make her job a little more interesting, so she took her current print ready pages to the printer and had them run off and bound. Before the last book was bound she asked the printer to assemble the last directory with one page changed. That page had Bill's name and phone number. In that last directory Bill's line read Bill "Hot Lips" Taylor. The boxes of 70,000 – 80,000 good directories were already shipped around the world and Mickey delivered her special copy to Bill's desk. As most of us tend to do, he looked up his own name to see if it was correct only to find **Hot Lips**. He nearly had a stroke as he envisioned 80,000 directories with Hot Lips all over the world. He only calmed down after he had checked half a dozen other directories and found them to be OK. It takes a confident manager to take a joke like that, without any kind of retribution.

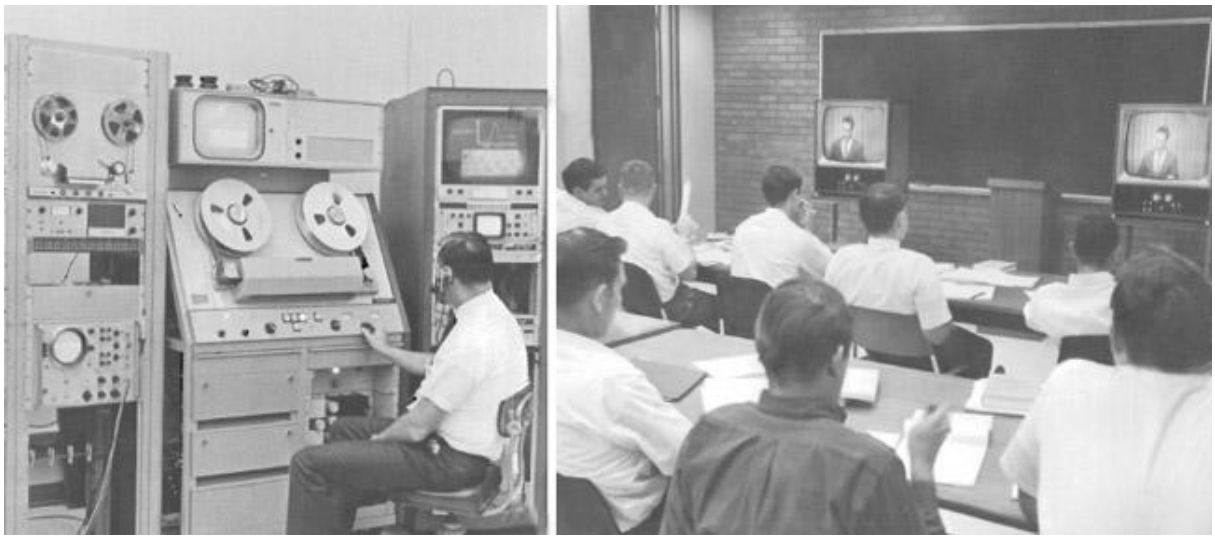
Voicemail: By the 1980s HP had begun to make use of voice recording machines on the desks of many individuals. The huge time zone differences around the world made leaving voice messages an efficient way of dropping off information and getting timely replies back. In the mid-1980s Octel, a small company in Milpitas, had developed a product that connected directly to most any PBX which offered the same answering service as a desk top recorder, but had many additional capabilities and would cost less per person than continuing to buy individual recording/answering machines.

Tests of the product proved to be very positive and we gained approval to begin deployment of these throughout the company. In addition to answering and recording incoming calls, it allowed you to respond to a recorded message you received and send your recorded answer back to the caller's in-box. Voice mail also allowed the caller to send a recorded broadcast message to a list of voice mail boxes or simply send a message to a person without calling them. This was very helpful when the time zone difference was great. It also allowed you to manage lists of frequently called people and easily send a message to that list. This was a very useful set of capabilities, especially for teams of

people who worked together frequently, but were scattered over many time zones. Voice mail was deployed worldwide over a short time span in the late 1980s.

Teleconferencing: Also in the early 1980s, satellite TV broadcasting was established in HP when satellite transponder time became available. HP already had excellent TV studios where training films were created. They added the ability to originate broadcast TV programming to North America and then a little later to the whole world. Jim Hodel worked out the installation of receive-only satellite dishes at about 50 of HP's major sites around the U.S. Over time this was expanded to 131 receiving points world wide by 1997. This video network made possible live broadcasts which introduced new products, gave training to our field support people, allowed Honors Coop courses taught by Stanford faculty to be broadcast to HP engineers around the globe and facilitated other kinds of training and announcements to worldwide HP audiences. The TV broadcasts were outbound only, but arrangements were made for telephone links back to the studio which allowed questions to come back to the presenters from the entire audience, with the questions and answers heard by all.

This is a typical studio origin point of a worldwide video training broadcast.
Courtesy of the Hewlett Packard Company



(L) Back Room monitoring of a video broadcast (R) This classroom scene is typical of a Stanford Coop Engineering course made available worldwide by Video Broadcast.
Courtesy of the Hewlett Packard Company

Audio Conferencing: During this time frame voice teleconferencing became common at HP. High quality speaker/microphones were used in conference rooms to allow meetings with participants around the world.

Video Meeting Rooms: Then in about 1989 six conference rooms were equipped as two way video meeting rooms. We developed some software to simplify the controls on the HP 150 desktop computer which allowed camera positioning to be adjusted by the moderator from a touch screen computer.

This is a two way video meeting room with an HP150 touch screen PC programmed to control cameras at the moderator's touch command.

When my children were asked, "What does your dad do?" their standard reply was, "He works at HP." If questioned further, they always said, "I don't know." I thought this was a little troubling so for one of our weekly family meetings I hauled the whole family up to HP at 3000 Hanover, in the Stanford Industrial Park and took them into this video conference room. There with slides, hand-outs and illustrations I went through my most understandable projects and invited them to ask questions. They were attentive and I thought at last they had some grasp.

The next time I overheard one of them asked, "What does your dad do?" the answer came back, "He works at HP and he's a manager or something." So much for my fancy conference room briefing.

Desk to Desk Video: Early work was done on desk-to-desk video and testing was done at a number of HP sites. It was useful, but never proved to be very economical in the early days. 30 years later Skype did successfully what we were struggling to do.

Cell Phones: In the early days of cell phones Bill Taylor saw the proliferation of cell phones, especially with our field sales people and the attendant rise in telephone expenses. Mike Lovell in the field organization wanted to get better control of cell phone costs. He worked with Bill to negotiate agreements for the hand sets at very much better prices than the individual offices were getting before and then worked out carrier provider airtime services also at deeper discounts.

Chuck House, again in his book, notes, "Roxanne Hiltz (of *The Network Nation*) had already proclaimed HP's email network, to be the second largest corporate communication network on the globe (1981); with these voice and video connections, it had arguably the most comprehensive network in the world, amazing for a company ranked Sixtieth in revenues in American industry."

Sonoma Management Meeting and the Board of Directors

When our telecommunication plans were quite well developed and some early implementation had begun I was asked to make a presentation of our plans to the annual HP off-site management meeting, held this year in Sonoma, CA. The Group Managers and Division managers that I had talked with about the idea of establishing a Telecommunications group were there along with many other Company leaders. The presentation of the plans was very well received and when the boisterous applause settled down David Packard rose to his full height and said, "These are good tools, but I hope we don't forget that personal contacts are the important thing." Suddenly I flashed all the way back to the old pneumatic tube proposal, a lifetime earlier. This time however I knew that

personal relationships were the primary key to a successful organization and all the planned communication tools were just supplements.

Shortly after the management meeting I was invited to make a presentation to HP Board of Directors. Packard was still the Chairman and Hewlett was Vice Chairman and John Young was the President and CEO. The presentation went well and the board was favorably impressed with our direction. During the presentation the Board members were very attentive, but Packard looked sleepy. He caught me afterword and explained that he had just gotten back from China late yesterday and his internal clocks were still off kilter.

Because we were making a number of strategic investments in equipment and infrastructure the Board review was needed and we were happy to have their support.

Management of Our Global Services

By the 1990s all of the activities described above had extended to virtually every HP location around the globe, which presented some problems of consistent, seamless operation of these services. After some evaluation we formed a global organization to manage and operate these services with about 400 people in all of our key sites reporting as part of Corporate Network Services. With excellent people throughout the organization things ran smoothly. Serge Guibout-Riboux in Geneva managed CNS people and activities in Europe and reported to me with full support of Dominique Courcoux, the European IT Manager. Similarly Bessie Mok in Hong Kong managed people and services in Asia with the full support of Rick Bergan, the Asia/Pacific IT Manager. One of the very simple things that we did was to make a T-shirt with everyone's name imposed on a world map and gave one to every person in the organization. It was an inexpensive gift but turned out to be a unifying symbol of global teamwork.

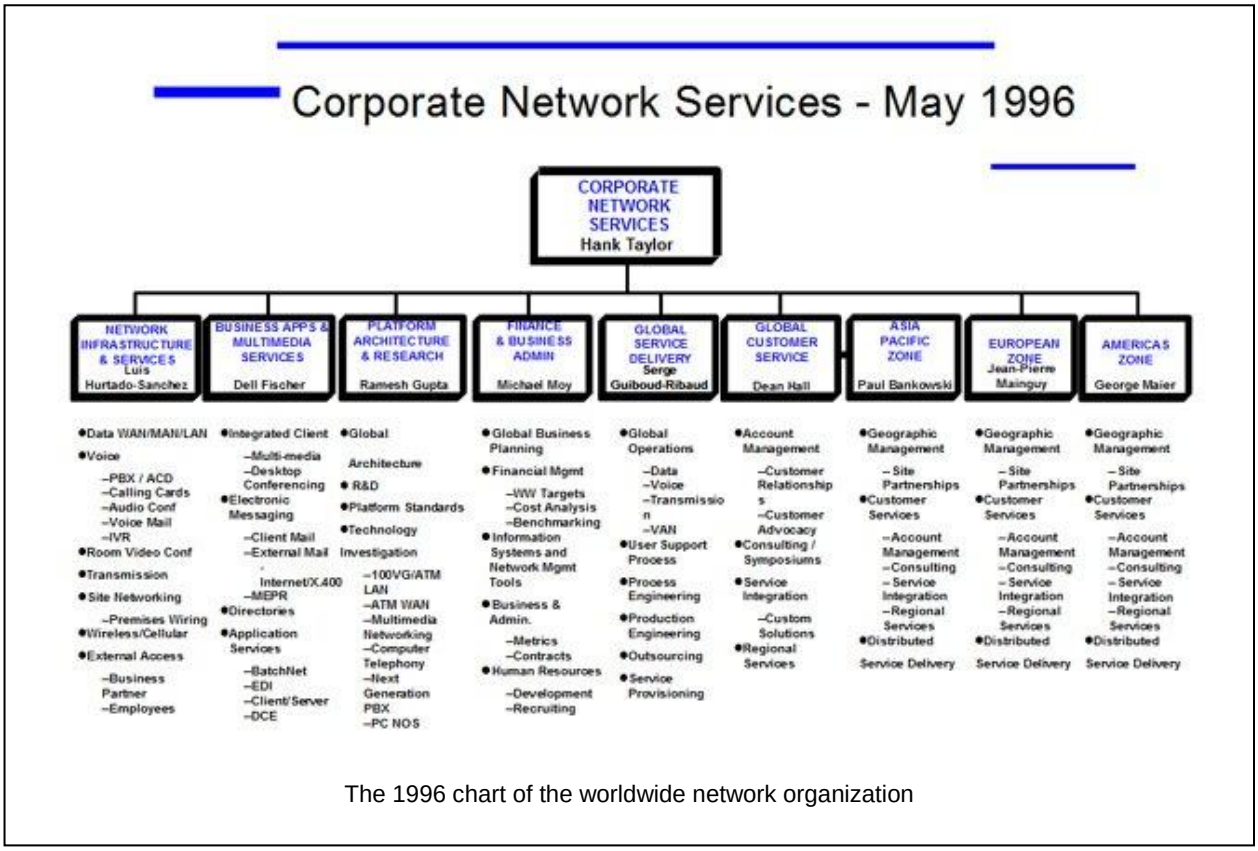
All 400 names were printed on the team's T-shirts

Dean Hall in our Palo Alto CNS Staff spent a great deal of his time traveling in Europe and Asia to keep our far flung organization tightly linked. He did an amazing job at this and provided an important two-way organization information conduit. Dean loved to travel and I didn't, so he went often, and thereby filled a critical role. With all his travel he was a student of frequent flyer deals. Phil Wilson, who managed Bay Area EDP was also a travel guru, having supervised the HP's travel department for some time. He and Dean came across a bargain they couldn't pass up, so they took a whole weekend day and made a seven leg, airline circle tour around the Western U.S. to get some amazing flight reward.

This is a picture of a Corporate Networking Services meeting in Singapore including local networking and IT people. Early 1990s

To help the group function as a single unit we used a lot of own communication tools with good results. Periodically however it was important to have personal, face to face meetings; so a small group of key network managers traveled to Geneva, Grenoble, Boeblingen, Atlanta, Tokyo, Singapore, Hong Kong, etc. While

there we worked on problems and set future directions. When in these remote locations we included as broad a group of local Networking and IT people as was practical.



The 1996 chart of the worldwide network organization

A Focus Group

In the early 1980's HP had developed a solid reputation for pushing the telecommunication activities of the world forward and as a result I was persuaded to participate in an external focus group. The sponsor was not made known to us, but was likely a telephone company. A number of topics were covered, but the key issue was to determine what the use of high bandwidth transmission would be after it could be deployed. They defined" high bandwidth" as something just over 1 mb per second; they called this T-1 service.

The group fumbled around for a while trying to imagine how businesses or individuals would use this much bandwidth. When I couldn't stand it any longer I raised my hand and said that, "T-1 service is barely at the low end of high speed transmission and the activities which will drive bandwidth requirement well beyond this are in the entertainment area: pictures, videos, movies, games, music, etc. That day will come soon and when it does T-1 bandwidth will be almost uselessly slow." The moderator became very uneasy, quickly changing the topic and was unwilling to call on me further during the remainder of the session.

HP 3000s

As the HP 3000 became a stronger and stronger processor, Cort Van Rensselaer had the vision to see that developing manufacturing systems on this platform would have several advantages to the company. It would give us a show place for customers to see our computers in action. Secondly, with just one computer system instead of many, it would give us a common development platform

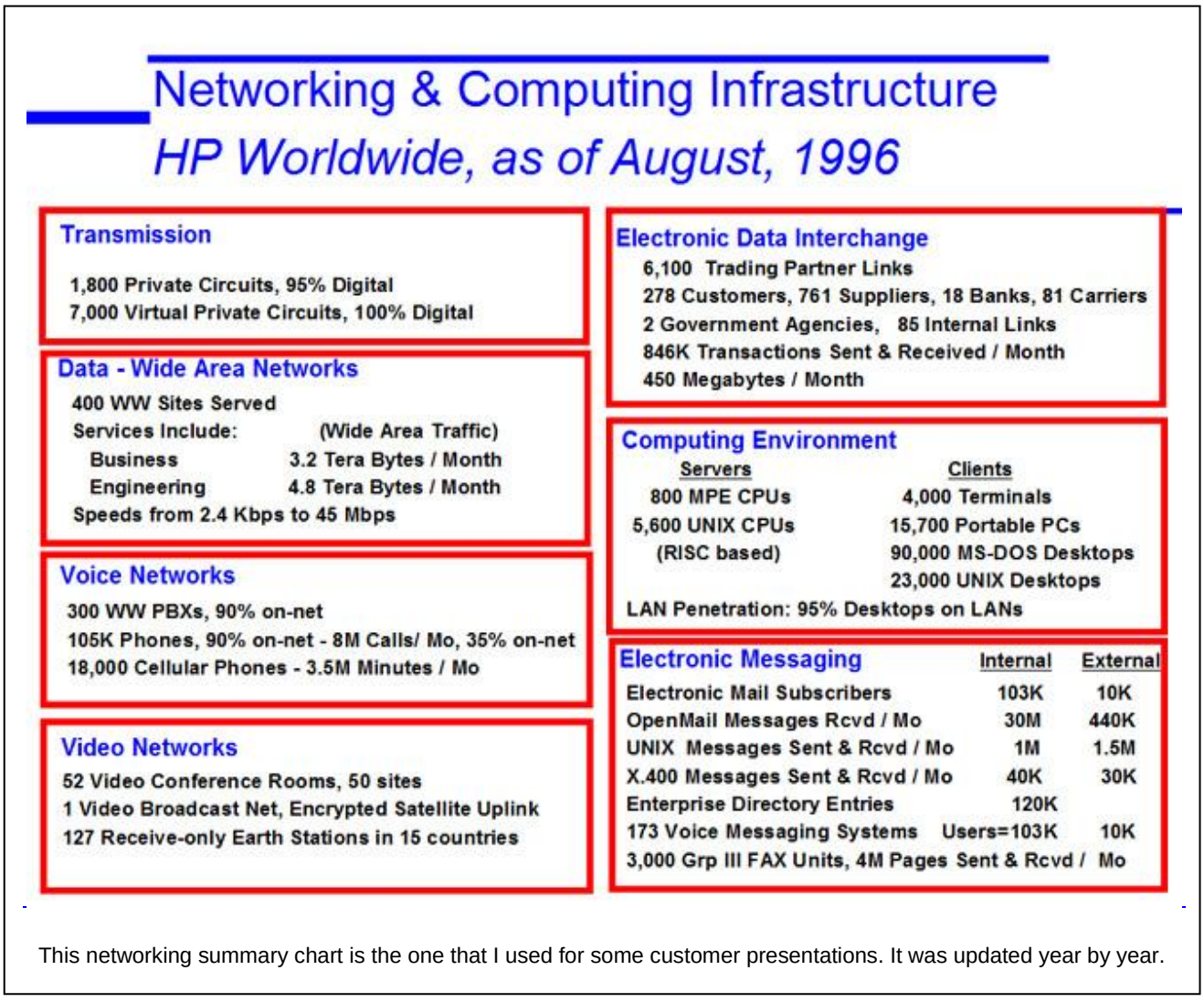
for internal system development. Prior to this divisions had a variety of computers to run their manufacturing systems and even a greater variety of software.

It took a good deal of effort, but Cort's group developed a set of systems for manufacturing divisions on the HP3000. These systems were broadly accepted by divisions and HP became more standardized in our computer processing, systems development and support became much more efficient.

It was a bit later when Allan Imamoto made the leap of faith and with his team worked out a way to process Heart on the HP 3000. All these conversions turned out to be a very good thing for the company.

Customer Visits

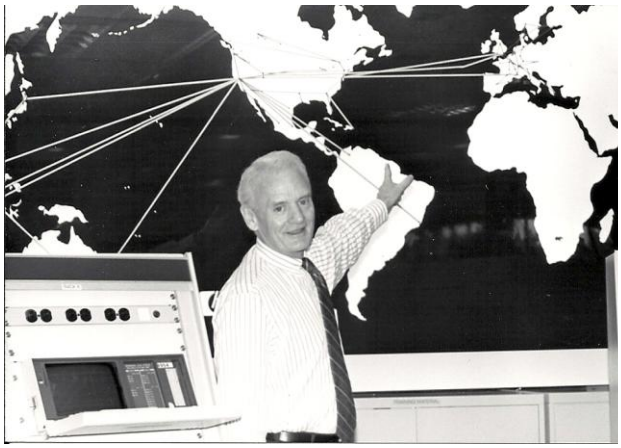
During my years with Heart and Corporate Networking Services HP was expanding from the manufacture and sale of engineering products into the business computer market. John Young, the CEO of HP, said "It was hard work; believe me, just getting customers." We were selling to people we had never sold to and at the highest levels in their corporations where we had seldom made contacts before. John said "IBM owned every company outside of the lab or the factory floor."



This networking summary chart is the one that I used for some customer presentations. It was updated year by year.

The solution to breaking into new companies turned out to be bringing high level executives to Palo Alto to attend HP management seminars where they were introduced to our actual information systems processes. It seems like I was making a presentation, along with many of my fellow IT workers, weekly. These presentations had the credibility of hearing from someone who had actually done the things the customers wanted to do. Heart, Comsys, Manufacturing and Accounting systems were all very impressive to our visitors.

John said, "We had a lot of great data. That was one of the most powerful selling tools ever [in selling to high level manager] because we had zero credibility in big corporate IT places." John went on to say, "On a daily basis HP could get sales [data] from around the world—product by product, office by office, the next morning. The notion that you could get that in 1975 was crazy for any other company. We had the order processing system, the order transmission system, and email that layered on that. It was the leading-edge worldwide system. It was remarkable. We absolutely had great control of our business." (From a Chuck House interview with John Young; from his book *The HP Phenomenon*)



Hank in the Comsys Network Control Center

As we began talking to customer regularly John explained that we didn't have to be excessively careful about revealing our administrative processes or performance data. His observation was that HP's organization, people and processes allowed us to do things that most customer organizations simply could not duplicate.

The High Priority of Customer Needs

Sometime in the mid 1980s, Dave Packard who was still the Chairman of the Board said that he had a very unhappy customer contact him and he asked me to solve her problem. She had purchased one of HP's early personal computers and integrated its text processing into her little business. The operating system and text processing program had become corrupted in a partial crash and needed to be restored. Both her hardware and software had been obsolete for some time and HP's service organization had retained no obsolete software copies that could restore her system. Because of her distress they even offered a new PC with upgraded software. She wanted no part of that solution. She liked her system just as it was and simply wanted it back. When I talked with her it became clear that no other solution was acceptable.

I talked to dozens of IT and Lab people to see if they had any ideas for a work around, or other solution. Finally someone mentioned Ainsley Frederickson, the assistant to Jack Brigham in HP's Legal department who, to the best of their knowledge had never thrown anything away. She was a stately woman and graciously took the time to listen to my problem. "I might be able to help you," she said tentatively. Next thing I knew this dignified woman was crawling under her desk where under the right pedestal was a fair sized cardboard box. She pulled it out and we sifted through the contents. There were dusty manuals, a cable or two and old floppy disks. In the bottom of the box, like a hidden treasure, was the obsolete operating system on a small disk, along with the text processor software. She allowed me to take it to make copies. I sent one disk to our customer and asked her to keep it safe for backup. She was thrilled to have her problem solved.

It was impressive to me that a very small customer who would never even show up as a blip in our sales statistics got Packard's personal attention.

Benchmarking Our Services

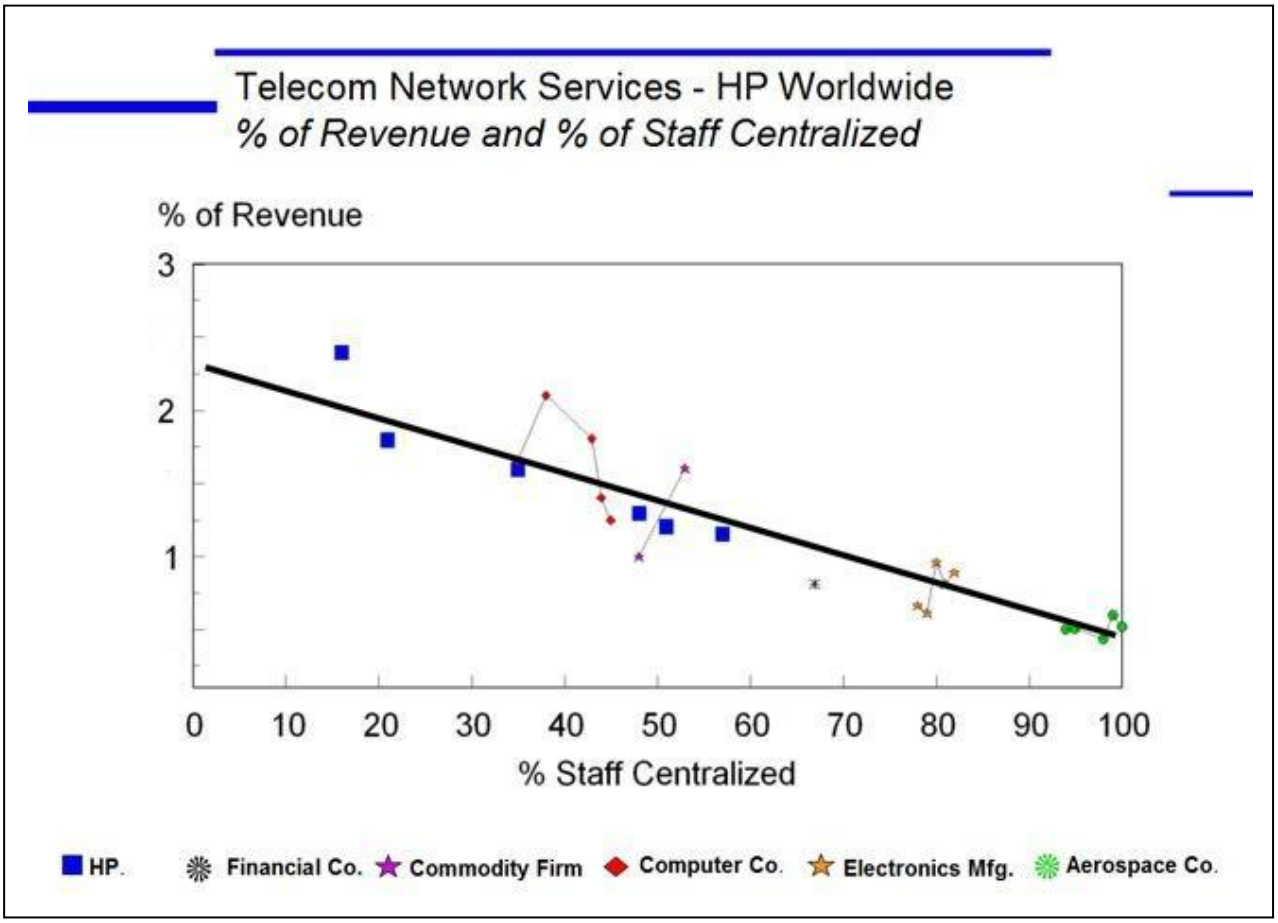
One of the ongoing problems of any corporate group is to be able to demonstrate to itself that it is providing value, and further, to be able to demonstrate this to the profit centered divisions of the company who must bear the cost of those services. I remembered clearly my feelings of bearing the weight of corporate overhead charges in a small struggling division. With this in mind I told our group that if we couldn't prove to ourselves that we provided a needed service, giving tangible value to divisions at a lower cost than they could get elsewhere, then we should be disbanded. We did not allow the cost of our services to flow into the corporate overhead charges, but rather billed our charges directly to divisions as a specifically measured service usage, such as telephone voice minutes used, TV broadcasts hours used, mb of data transmitted and so forth. This allowed divisions to check outside alternatives for cheaper or better service.

To make the CNS effectiveness very clear to ourselves, as well as to our divisions, who paid the bills, we decided that we should benchmark our services with the best-in-class companies who would be willing to compare the cost of services with us. I asked Chandran Sankaran who worked in our group (and later became an outside management consultant) to see if he could set up a benchmarking meeting with other companies and asked Bill Taylor to supervise the process. With some excellent work Chandran found a number of companies who were as interested as we were in benchmarking. The following were some of the first participants: Boeing, DEC, IBM, 3M, Motorola, Cargill, Lexmark, Control Data, a couple of banks and others, about 10 in all.

What we found was that our cost per mb of data transmission was significantly below most of the other companies in our benchmarking group. Normally we were the lowest, unless there was a company that had very centralized functions, or restricted geography to cover. Our worldwide voice costs per minute were quite a bit lower than the others, except for Boeing whose telephone traffic was primarily on two major U.S. campuses and almost no international voice traffic. Our email costs per message were well below others in the study group and so on.

The result of the benchmarking was very positive. All of us who participated picked up new ideas and for HP. It was gratifying to learn that our telecommunication services were by far the most complete, best measured and providing strong services to users. It was helpful to be able to talk with our divisions and business groups and show that our costs were nearly the lowest of the participating companies in every area. There were a few exceptions for very centralized/geographically limited companies as in the case of Boeing's telephone cost per minute and a few other similar cases.

One important thing that we learned from benchmarking was that the fewer geographical places a company performed a function the less that function would cost. This was true for all companies who benchmarked with us. This concept was important to HP as expense controls became aggressive.



This chart shows several interesting things: First, HP's total Telecom costs as a percent of revenue were the highest of the companies who benchmarked with us. There are three main reasons for this:

- HP's services were by far the most complete.
- Our common chart of accounts and location code scheme allowed us to collect all of our worldwide costs—for common carrier charges, labor, material, depreciation, maintenance costs, etc. The other companies could not do this.
- HP's decentralized organization had far greater geographical spread than those companies we compared to.

While our total measurable costs were higher than the other companies, the cost of each of our services was generally the lowest of those in our benchmarking group.

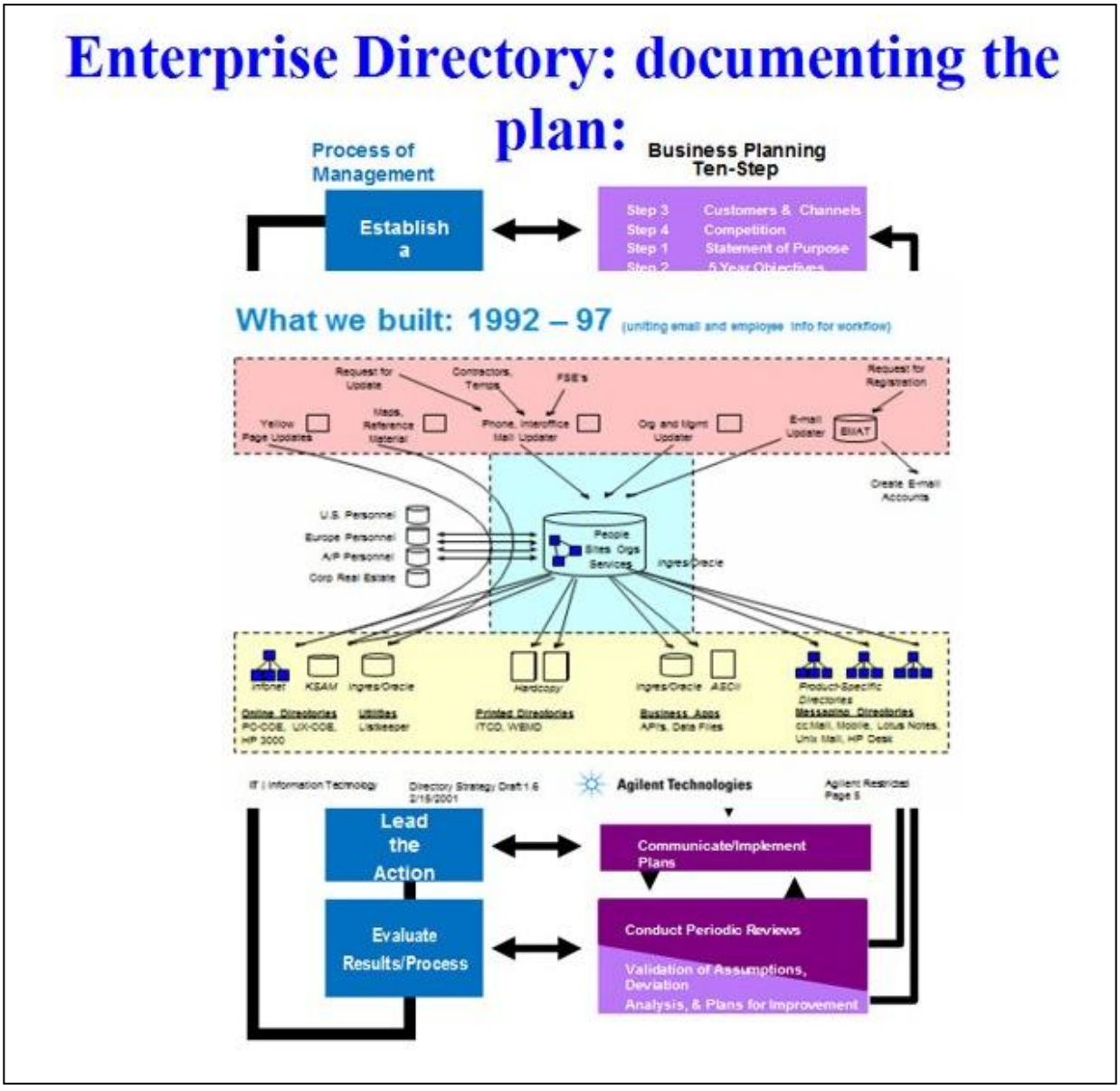
Another significant thing was confirmed in our benchmarking. It was that whatever we could do over time to centralize our telecom management thru the use of network tools did lower our costs. The blue squares coming down show the effect of our centralizing efforts over time. Also the most centralized companies had the lowest costs and even these came down as they centralized functions more.

Bill Taylor continued this bench marking activity after I retired from HP in 1997 and the process continued even after Bill Taylor left in 2002. I don't know if benchmarking is still in use.

Enterprise Directory

In the late 1990's, HP came under even more severe competitive pressures and began a long, intense siege of cost cutting measures. Lloyd Taylor the Chief Information Officer was looking for ways to make significant cost reductions in HP's total information processing. I recall one budgeting session where Lloyd asked us to terminate a global directory project that we had just begun and remove the costs from our next year's budget. We did take out the cost from our spending plan, but quietly and more slowly continued the directory development. Lloyd was somewhat aware that we were bootlegging the work, but never said anything. It was sort of a tacit acceptance that it would stubbornly go forward.

The project under Bob Horowitz, was to create an on-line directory which would contain information from multiple sources and make that information available to our people and to related computer processes. We recognized that printed directories were out of date as they rolled off the presses and drifted as much as 10% per month. The project was to create a repository for names and phone numbers to replace the printed Telnet directory, and also list global email addresses, employee numbers, maps, organization charts, distribution lists, fax numbers, mobile phone numbers and more.



In a central database this would be updated twice a month rather than once or twice a year. In addition to providing user look-up, this directory became an integral part of the IT infrastructure as programs accessed it for authenticating parts of their process or for automated routing etc. For example if you had an analytical output from a computer process and wanted it to go to all finance managers of a certain level, the directory would tell you who they were at this time and apply the routing information to distribute the reports.

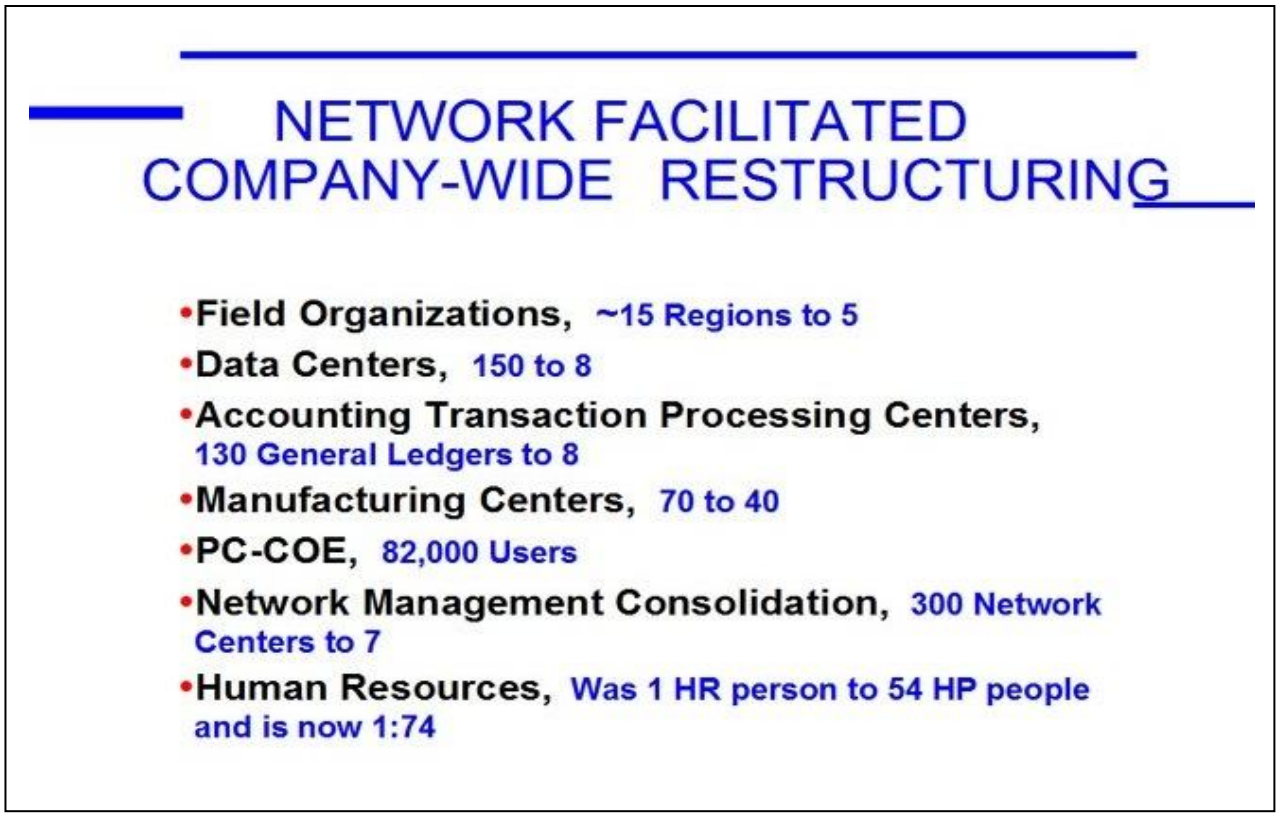
Much later, after Lloyd left HP to take a top management job at Cargill he hit some people tracking problems. He called and asked if we ever completed "Our doomsday directory." I said, "Yes, certainly enough to be very useful." He said, "Good, can I send a couple of people out to talk to you." Bob Horowitz hosted a two day meeting with a couple of Lloyd's managers. Bob said it was somewhat discouraging for them because HP had so many of the building blocks in place to start with, where Cargill was starting near ground zero with significant organizational barriers.

Centralizing Our Data Centers

The cost squeezes in HP continued. By this time our internal internet was robust and fully deployed and fairly manageable. Within the company we had access from any desktop to virtually any computer processor anywhere in the world. Mike Lovell in the management of the field sales operation caught me one day and asked, "Will the TCP/IP network allow any PC in any field office to access a computer room in a remote location? If so could I replace 60 small computer rooms with one larger one?" I said, "Absolutely, that's why we built the network." He said, "Great, I want to do it." Atlanta became the U.S. field data center and all the field desktop computers could connect to that center. The small computer centers in the scattered field offices were closed yielding great savings and better service.

Lloyd continued to be concerned about cost reductions and had pressure from upper management to keep cutting. I went to talk with him and suggested that we could close all of our factory computer centers except for 1 or 2 and provide as good, or better service to the company than we had now, much as the field had done. At the time of this proposal almost every division had its own data center. These were larger and more complex than the small field office data processing rooms. I believe there were around 50 factory data centers at that time. Reducing the number to one or two would have massive savings to the company overall. I explained to Lloyd that this was a perfect use of the network and that our processing would be more reliable and better managed.

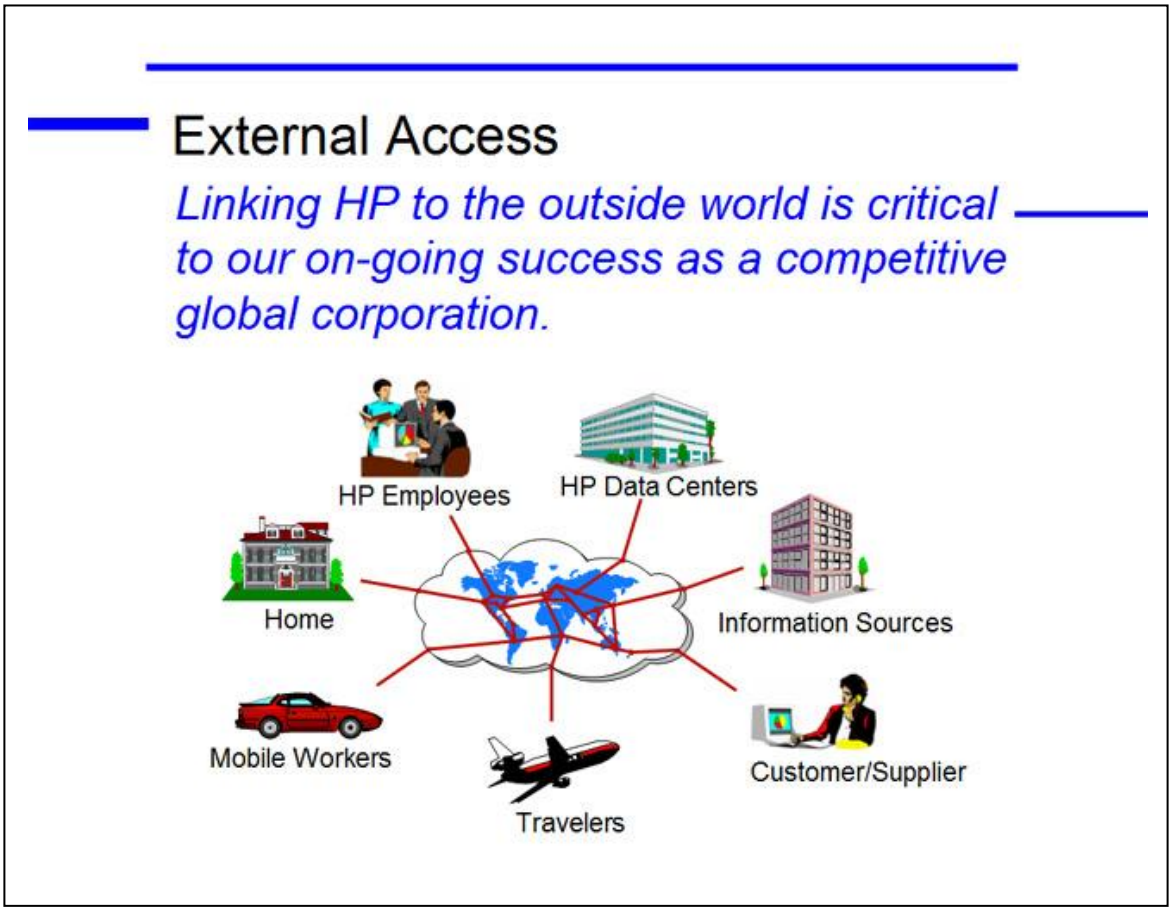
Lloyd listened respectfully, but showed no immediate sign of moving forward in this direction. Because it was a huge takeaway from sovereign divisions, he hired McKinsey & Co to come in and do a general study. I talked at length with the McKinsey people about the idea of data center centralization. They were shown the capabilities of our worldwide network and I gave them my rough estimates of very large cost reductions, probably on the order of $150 million per year. McKinsey interviewed many other IT people and line managers. Their study concluded that the centralization was indeed the right direction for HP to get significant cost reductions with better, more secure and reliable computer services. Of course their proposal was thick, nicely bound, had charts and graphs and they made a number of management presentations. Management approval was given and the consolidation was successfully made. I'm sure that Lloyd felt that the weight of expert analysis was needed to pull this off. McKinsey's credibility may well have justified their pricey billing. By 1995 HP's networking facilitated other structural changes as well.



External Access

The last major project I asked CNS to undertake was to create a network gateway to allow HP, as a company to connect broadly to the outside world. We needed to address a myriad of security issues, but the intent was to provide specific kinds of access from and to our customers. We also needed to connect and interact with our distribution channels. Similarly we would need access to our vendors and they to us. Employees would need access from their homes to the office. We would have outside business partners and service providers with whom we will need two way access. There will be information sources that we need to access. This was a daunting task, but with the work of Dell Fischer and many others in CNS gateway services were established to create a rich set of connection that were adequately secure.

With the advent of networking beyond the boundaries of a company, substantially more dramatic changes were in store. See the slide that laid out the objective.



Giving Back

I always felt generously compensated by HP for the work that I did. Because it was a joy to work in this environment, among outstanding people this feeling was even more intense. Because we had been treated so well, I felt the obligation to give something back to the world community as Dave and Bill had done in such an exemplary way. As a result Colette and I established a trust to benefit the Universities we attended and then specifically to give support to two organizations. These were the Boy Scouts of America and the LDS Church Perpetual Education Fund.

BSA: Our 5 sons were all Eagle Scouts and our foster son who came to us a little too late to reach Eagle still advanced well into scouting and his life was enriched by the experience. Our three daughters have raised and are still raising eagle scouts of their own and our sons are as well.

The Perpetual Education Fund: is established to help younger people in less developed countries to gain an education and employable skills. So far it has helped 53,000 people in 52 countries to substantially increase their earning power, lift them out of poverty and improve their ability to support their families. The assistance received is treated as a loan and is paid back into the fund to help others. Most all of those helped are current with their loan repayments and their repayments are immediately available to help others. Because much of the administration of this program is volunteered the administrative costs are near zero.

Gift of Land. I was the managing partner of a group that owned 160 acres of virgin redwood land in the Santa Cruz mountains. As the partnership came to a close I was able to arrange a transfer to Save the Redwoods who in turn gave the land to Portola State Park. A significant portion of this transfer

was a gift to Save the Redwoods. We were happy that the land could get broader public use and the virgin trees could be preserved.

Colette and I have been very grateful that we are able to help with the support of these worthy activities.

Conclusion

When we made the decision to come to Palo Alto for me to join HP in 1957, I had no idea that I would get to work for such a great company and have so much satisfaction in the work that was to be done. The atmosphere and personality of the company over a 40 year period were delightful beyond any reasonable expectation. Much of what was good about the company, I believe, flowed from Dave and Bill and I am just grateful that I had the chance to work in their company during what turned out to be a golden era.

I never had any allusions of changing the company, or its culture. Over the years my consistent personal goal was simply to make things easier, faster and better. It was my great fortune to work with talented people who could create the tools to make this happen. The company culture created a marvelous environment for change and progress. We were all influenced by innovative lab developments and the constant flow of new products. HP people expected that all things can be improved. This included not only the endless flow of new and improved products, but also better information flows, faster processes, and less expensive administration. We all believed that we had, or could create the tools, to make each of us and the company more productive. This was a winning culture and a delightful one in which to be employed.

I apologize that this account is sketchy and incomplete, leaving out many outstanding HP contributors that I worked with and omitting their significant results. Nevertheless I hope that from this partial account one can gain a feeling for the exceptional nature of company Hewlett Packard as I knew it.

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