Together Forever

Richard and Moonyeen Anderson

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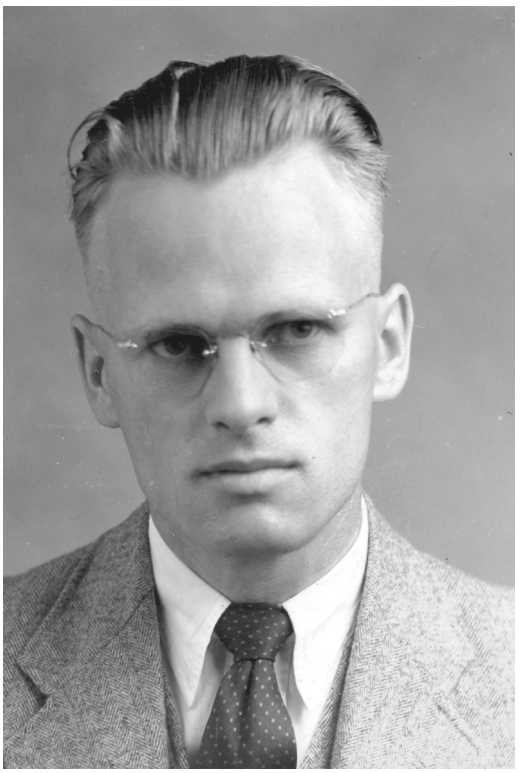
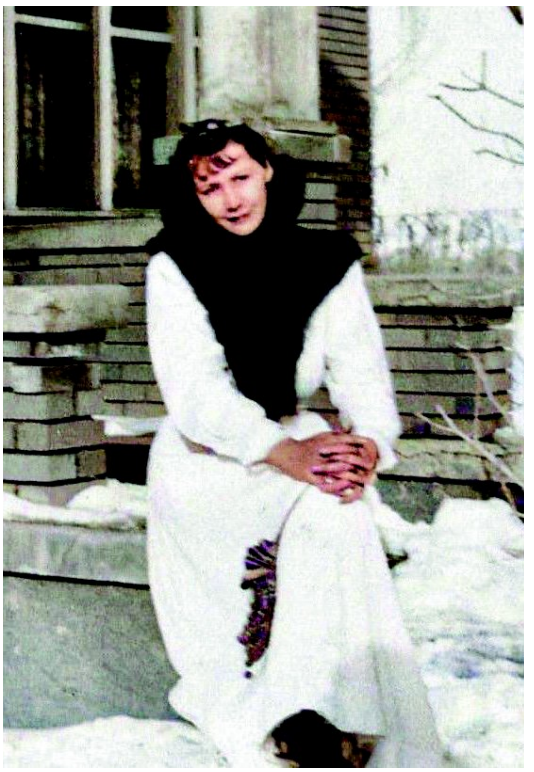


Norman Anderson,
the young man of Scandinavian descent.

Esther Watkins,
the young woman of British descent.



Geneva Hansen,
the young woman of Scandinavian descent.

Ross Rigby,
the young Wyoming man of British descent.

Genesis

On December 21, 1934, a young Utah man of Scandinavian descent married a young Utah woman of British descent in the historic Logan Temple. On October 7, 1935, a young Wyoming man of British descent married a young Idaho woman of Scandinavian descent in the historic Salt Lake Temple.

The first couple, Norman and Esther Anderson, made their home in Brigham City, Utah. The second couple, Ross and Geneva Rigby, chose to homestead on the western slope of the Grand Tetons.

Nine months and two weeks after their wedding, the Rigbys made their way to Idaho Falls where, on July 21, 1936, Geneva delivered a cute little baby girl that they named Moonyeen. The name was taken from a young Gaelic girl portrayed in the movie, *Smiling Through*.

Then one year later on July 23, 1937, Esther delivered an oversized baby boy that they named Richard, after Dr. Richard Armstrong Pearse. Dr. Pearse had the unenviable task of getting that big boy out of there.

The name Richard means 'Powerful Heart'. The name Moonyeen means 'My Girl'.

And now you know how it all began!

Moonyeen, beautiful then, beautiful now!
1937, age 1.

Moonyeen Rigby

Moonyeen Rigby was born July 21, 1936 in Idaho Falls, Idaho. Her parents were Ross Price Rigby and Mette Geneva Hansen Rigby. Moonyeen was the oldest of five children, the others being Billy Ross Rigby, Sandra Rigby, Lawrence Kent Rigby and Toni Rae Rigby. At the time this is written (2020) all five are still living and keep in close contact with each other. The best information we have is that her mother, Geneva, was in Idaho Falls with her sister, Mae, when Moonyeen was born because there was no hospital in Teton Valley where Ross and Geneva lived.

Earliest Memories

On July 23, 1937, when Moonyeen was one year old, Ross and Geneva bought 160 acres with an old wood home and a small barn at the bottom of Fred's Mountain (now known as Grand Targee Ski Resort) on the Wyoming side of Teton Valley. They bought the property from Roland Brown for the princely sum of $800. The Browns had acquired it under the Secure Homestead Act in 1930. There was the small simple two room house, an eight-stall milk barn and an outhouse. There was no electricity and no running water unless they ran to the small stream that ran by the house. Only 40 of the 160 acres had been cleared so there was plenty for the young family to do. Interestingly, Moonyeen's growing-up home was acquired the same day that her future husband was born. The plot thickens!

The first event in Moonyeen's memory was the birth of her brother Billy on May 29, 1938. Billy was born in Idaho Falls because a hospital was still not available in Driggs. She remembers being left with her grandmother while her parents went to the hospital in Idaho Falls. She didn't want to be left there so she kicked her poor grandmother all the way into the house. She also remembers her father acquiring a few cows and also taking the job of hauling his and the neighboring farmer's milk to the creamery in Driggs each morning. In the summer he used a horse-drawn wagon and in the winter a horse-drawn sled. It was a tough way to make a living, but it kept a young, poor family together in very hard

The last pioneer clearing the homestead by mule and ax!
Circa 1938.

Always had a dog.
Bears and wolves were always a danger.

times. Moonyeen remembers that he made fifty dollars a month for hauling and much less for his own milk.

The next memorable event was in 1940 when her sister Sandra was born. It seems Geneva went into labor while Ross was out on the milk route. Things were moving pretty rapidly so Geneva concluded she couldn't wait until Ross got home. So, she set out a clean set of clothes and took Moonyeen, age four, and Billy, age two, and started walking to the nearest neighbor's home, about a mile away. Moonyeen remembers them walking for a ways and then the pains would come and her mother would sit down until the pains passed, then get up and go a little farther before the pains came again. Finally they reached the neighbor's home. The kind neighbor recognized the urgency and loaded the three in her car, dropped Moonyeen and Billy off at Grandma's (no kicks this time), and drove Geneva with the baby, still in place, to the hospital in Driggs. It was a small new hospital built under a Depression-era program. By the time Ross got to the hospital he had a second daughter. Thank goodness for good neighbors.

Life on the Frontier

The pre-grade school years for Moonyeen and her siblings were pretty primitive but they prospered in many ways. All became adept at handling and riding horses. Moonyeen was able to start piano lessons and did exceptionally well at it. She also took dance lessons, and dance fit her slender, lithe body. Come grade school time she attended the Alta School which was about four miles away—by horses in the summer and horse-drawn sled in the winter. The dedicated teachers there focused on the three R's. And don't forget the hickory stick. The school and the church were right next to each other so some of the facilities were used interchangeably.

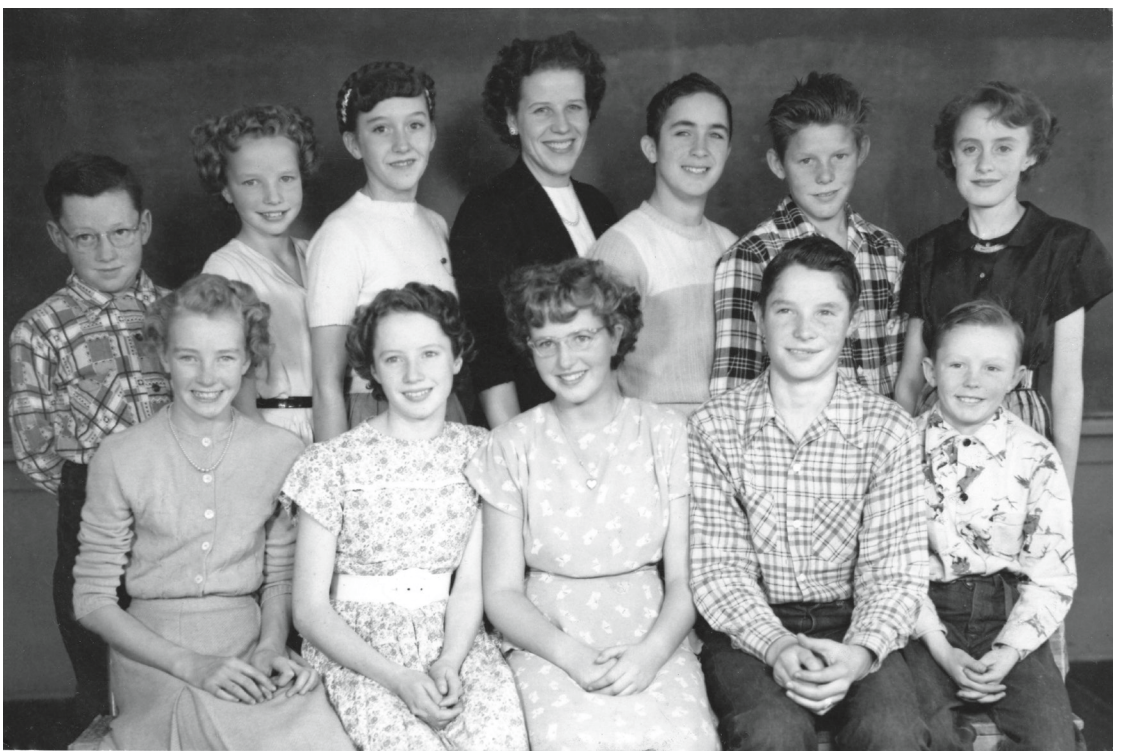
During these years the family also cleared the remaining acreage (by horse, saw and ax). They remodeled the home and added three additional rooms, plus an indoor bathroom. They expanded the barn, piped in good clean water and extended electricity to the immediate area. Ross and a neighbor, Arnold Kaufman, logged out the poles and set them in the ground to bring in the power. Life was much better but work was still the family motto.

Moonyeen did very well in elementary

Moonyeen and her siblings, about 1953.

1950. I was in about 8th grade.

Moonyeen's last year at Alta School which went through 8th grade.



school. Her first and second grade teacher was a wonderful lady named Theola Ricks. World War II ended when she was in the fourth grade. Her uncles that had served returned home and seemed to look to Ross as a proxy father. Their own dad had died young and their mother had remarried and taken on a new family, the children of her previously-widowed second husband. Ross and Geneva's home was the family gathering place and the brothers always seemed to reserve vacation time to hunt and fish in the Tetons. It was almost rare to have a night that some family visitor, maybe with a friend, wasn't spending the night in one of the small added bedrooms.

Meanwhile, Moonyeen continued her academic education while growing athletically, spiritually and artistically.

Moonyeen's first year at Teton High School.

Moonyeen, 1949 - 1950.

By the time she reached high school age, she was very accomplished on the piano, as a dancer and in tumbling. Her brother, Billy, has commented that, "She never seemed to have her feet below her head. She was always turning cartwheels, summersaults, walking on her hands, or doing high kick dance steps." Her siblings all commented how beautifully she played the piano. When she would come home from a date they could tell how it had gone. If it had gone well she played something like Clare de Lune. If it had gone badly it was something like Beethoven's Fifth. She did date a lot, mainly dancing. Her frequent and talented dance partner was a young man named Lemoyne Woodell. She enjoyed classical ballroom dancing as well as upbeat styles like the Jitterbug and the Bop. She and her dance partner taught dancing to the young people of the area. She played the bass drum in the high school band and also took glee and speech. Her least favorite class was probably algebra based on her grade there. She was a pleasure to be around for all who knew her. But don't ever attack her family or you were in for trouble. Her brother, Billy, was quite small but an excellent horseman. He did real well as a jockey on the race tracks of Wyoming. One year he had apparently agreed to race the horses of an owner named Goldie Gosser. Apparently it wasn't going well for Billy so he wanted to quit. However, Goldie insisted that

they had an agreement. Moonyeen wasn't happy with the way Goldie was treating Billy so she let him have it with a tongue lashing he never forgot. Moonyeen's mother was there at the time and was trying hard to calm things down. Moonyeen was still a teenager at the time but she wasn't going to let it go. You can be sure, Goldie treated Billy a lot better after that.

The Rigby Family Home Economics

The Rigby family economic approach was kind of a throwback to pioneer days. Self-sufficiency was the system. The meat on the table was usually the result of successful hunting and included elk, moose, venison and trout. Hunting and fishing were almost a religion for that family. Otherwise meat was from a home-butchered farm animal such as a pig, a lamb or a calf. From the small dairy came fresh raw milk, cream and home-churned butter. At times Ross farmed peas and potatoes, some of which made it to the table. A small garden provided strawberries, raspberries, radishes, beans and carrots. In August each year there was a short family pilgrimage into the forested area to pick huckleberries, always with a dog to warn of a bear. Bears love huckleberries. Of course there were chickens for both eggs and meat.

Teton Valley has very cold, deep snowy winters so home heating was critical. The Rigby home was heated in the long winters by wood for about 90% of the need. A little coal was bought each year to last through the night but mostly it was wood in the kitchen stove for

Rigby Family: Ross, Geneva, Moonyeen, Sandra, Billy, Lawrence and Toni.

cooking and the living room heater for the rest of the house. The wood was from dead trees hauled out of the forest by horse and sled in the early winter.

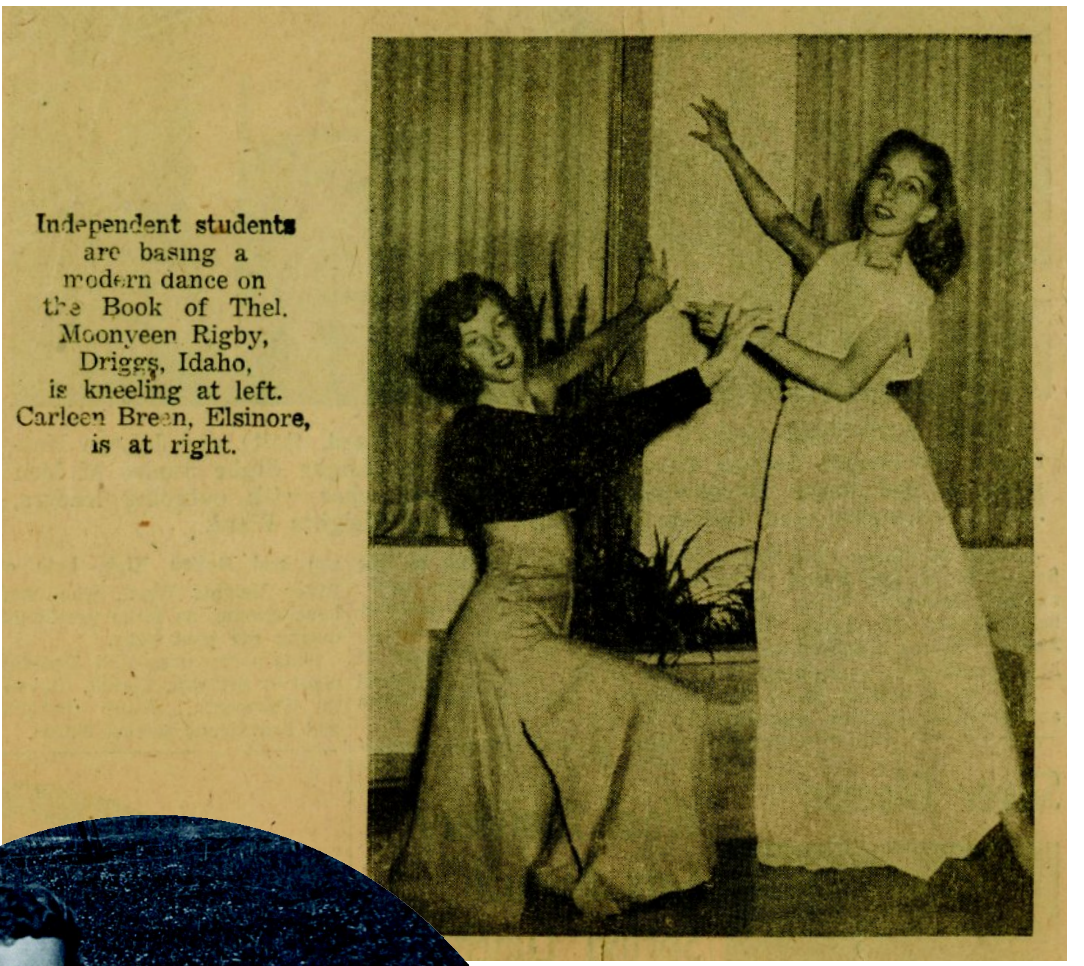
Geneva made all the girls' dresses, from school and everyday clothes to formals and dance costumes. Moonyeen has often said that she never had a bought-en dress. She also never wore one out. When she outgrew it her mom would make a few adjustments and hand it down to the next sister and sometimes to one of her cousins. Moonyeen was the tallest and, by far, the thinnest girl in the family so Mom always had enough length but she needed to add a little extra width at the seams for the system to work.

Moonyeen as a Junior. 1953.

Graduation and on to Ricks College

In the spring of 1954 Moonyeen graduated from Teton High school in Driggs, Idaho. She had done well enough to receive a scholarship which gave her the resources to enroll at Ricks College in Rexburg, Idaho. Ricks was a small LDS-owned college that was originally established by Thomas E. Ricks, but another early founder was William F. Rigby, Moonyeen's great-grandfather. It mainly catered to students from Southeastern Idaho. At the time it was a four year college but the choice of majors was limited. Interestingly, Moonyeen's grandmother, the receiver of the kicks, had also attended Ricks.

Moonyeen enjoyed Ricks very much. She shared an apartment with three other girls and all remained friends for life. She continued her dancing and participated in intramural athletics, dated some and did well in her classes. She did so well in her dance classes that sometimes the teacher just turned the class over to Moonyeen while she attended to other class matters. From years of dancing Moonyeen had beautiful muscular legs and ankles. In an art class she was asked to model, since her ankle muscles were so well defined. Academic classes at Ricks were mostly the basics as there wasn't much choice in majors. When she finished her sophomore year, the decision was made to make Ricks a two year junior college, so now she had to make a decision. It seemed that there were three choices: Idaho State, which didn't impress her, BYU, and Utah State. Somehow, the more she thought about BYU, the more she felt Utah State was the right choice. So in the fall of 1956 she made the trip to Logan and registered at Utah State Agriculture College where she chose Social Work for her major.



Above: Moonyeen at Ricks. Circa 1955.

Left: Bathing Beauty, about 1956. Summers in the Tetons can come and go in the same week.

Utah State Agricultural College and more

Moonyeen felt a bit overwhelmed by Utah State, or "the AC" as it was called. It was much larger than Ricks and Teton High. There were students from every part of the United States as well as many other countries. The diverse student population and a religiously diverse (or no religion at all) faculty took some getting used to. It was a more worldly environment than she had experienced at Ricks or in Teton Valley.

She did appreciate the LDS Institute of Religion and took enough classes to graduate from the Institute. She also played the organ in the student ward Sabbath meetings and attended the social functions as well (including the Tuesday night dances). She kept her dancing going and dated some.

For a while she dated her roommate's brother who didn't live in the area so it didn't go very far. She also dated a student at the University that was different from her in many ways. He wasn't the same religion, he smoked, and had different values than her. In the early spring of 1957 she decided to break it off. He didn't want that and kind of frightened her.

It was then that she decided to go back to where she felt comfortable. So even though it was midterm exam time, she decided to go, alone it turns out, to a regularly scheduled Tuesday night religion class and dance. And things would never be the same.

A New Coat for Moonyeen... AND her Sisters

by Deborah Justesen

When Mom was a little girl, the children did not begin school until they were six years old. Mom knew that when she started school, she would need a new coat to keep warm and to wear each day to school. Like Dad, her family did not have all the luxuries that children take for granted today, and so for her, a new winter coat was a very big luxury.

Mom knew this was something her family could not afford very easily, and so she came up with a plan. In the summers, people would work in the fields picking potatoes. They were paid $0.05 a basket. Mark Wilson, Mom's uncle, was able to provide a job for her picking potatoes with Grandma Rigby. Mom remembers that Grandma Rigby was a hard worker and a fast worker. Mom had to work quickly to keep up with her.

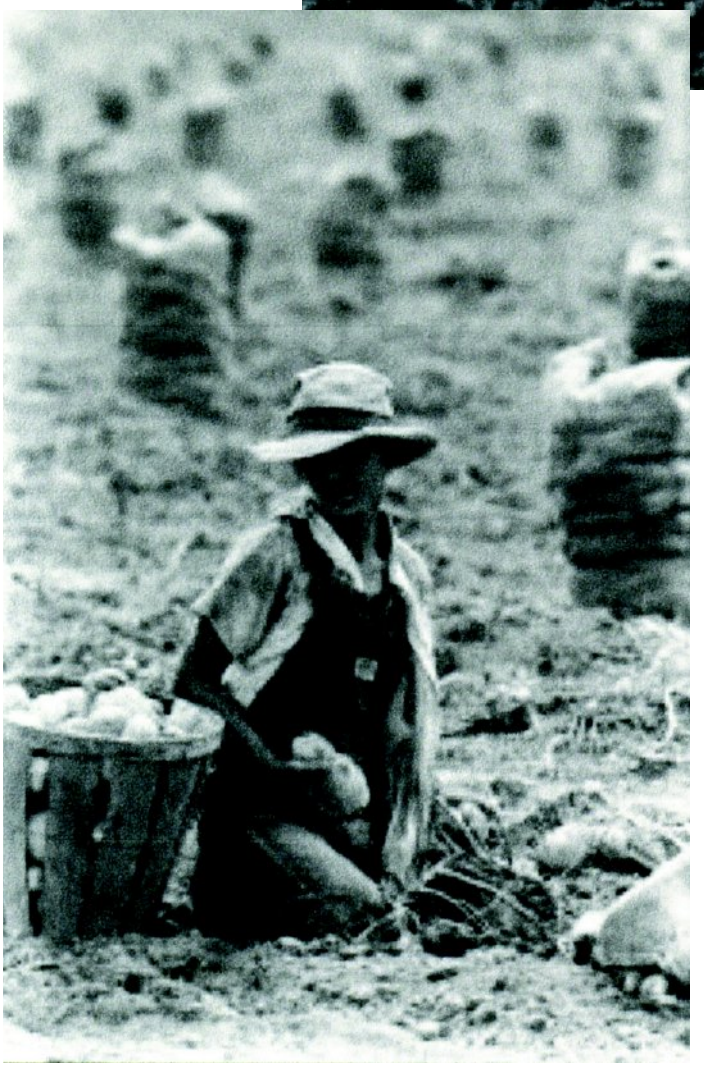
All summer, day after day, as a six-year-old girl, she worked out in the hot sun picking potatoes and placing them in baskets. A coat at that time cost approximately $15, so Mom needed to fill at least 300 baskets over the summer time. Six days a week, she and her mother worked and filled basket after basket.

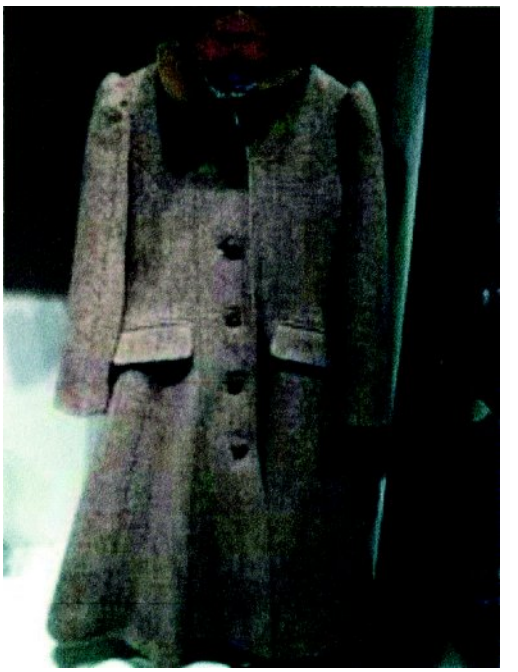
Finally the summer came to an end and she was able to purchase the coat for school. This made Mom very happy as her efforts had provided that coat, but even greater was the excitement she experienced knowing that once she had grown out of the coat, she could pass it on to her sisters. There were two younger sisters who would one day be in need of a warm winter coat, and Mom's efforts would provide this small luxury.

While Mom was growing up, she never had a purchased dress until she was in the 8th grade. For most of her clothing, a cousin named Sabra who lived back in Chicago gave Mom her hand-me-downs. Sabra's mother did not have a sewing machine, so she sewed all the dresses by hand. She was a wonderful seamstress and Mom loved the dresses she received.

Mom remembers that there was so much pride in being able to help out the family by working during her childhood and youth. She developed her independence and self-reliance as she discovered that she could work hard and add value to her family.

Top: No OSHA here! If you are big enough to get paid, you are big enough to carry the spuds!





Left: Sacking potatoes is hard, dirty work.

Right: Coat purchased with potato money. All three sisters would wear it with pride!

Memories of Moonyeen

from her brother, Billy

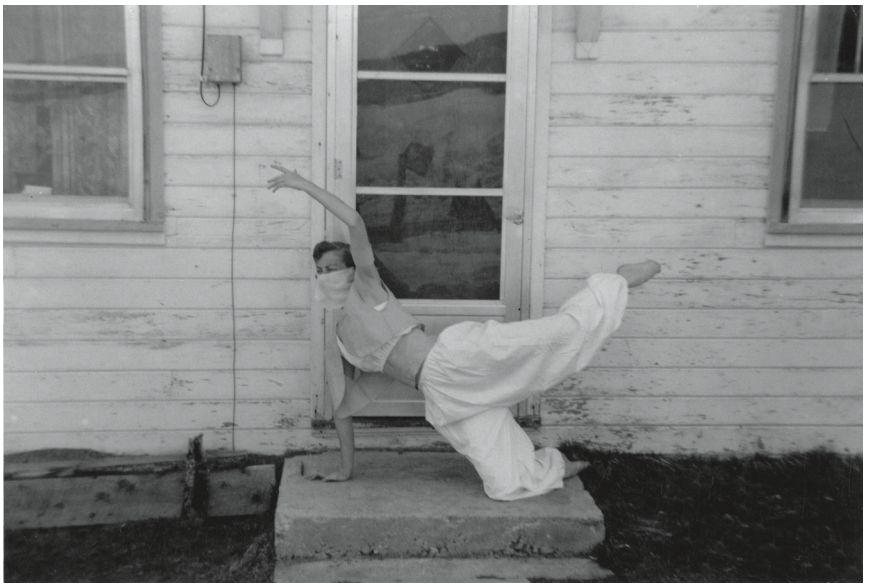
In Teton High School Moonyeen dated a few fellows. I remember Kenneth Hansen, Billy Wade, Bucky Rieley, and Kent Sorensen were a few. Moonyeen was pretty fussy about who she dated. I don't remember when she brought Richard home to meet the family. I do remember Mom told us to behave ourselves.

Moonyeen was tall and slender, too skinny. Her feet were above her head a good share of the time. She loved gymnastics. She could roll in a ball and roll around on the ground. She could walk on her hands and feet with her belly up. Cartwheels were straight. She was a very good dancer and loved to dance.

She learned to play the piano from Phebe Christenson. I didn't make the grade myself (I quit). Each one of us kids had a chance to play a musical instrument. Some did better than others. Moonyeen played the bass drum in high school and sang in the choir also. She also played basketball a little. We lived a ways from town, so that was a little harder for her to get back and forth to practice, and sports were somewhat limited.

Moonyeen felt she was boss over us kids and her actions made us believe she was boss. She would drag me by the hair more than a few times. She could lick us kids physically and verbally. She could be quite verbal. One time when I was sixteen, I signed a contract to ride racehorses and I wanted to go home. The boss had said no. Anyway, Goldie Gosser was telling mom in the car, I couldn't go home. Moonyeen was in the back seat and she got mad. Her eyes popped open and she lit into Goldie—called him names and told him what she thought. He pulled his head out of the car window, put his hands up and backed off. Mom

Dance recital; Moonyeen is far left. She loved to dance.



It's hard to dance in the yard! Circa April 1956.

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was apologizing the whole time. Moonyeen did voice her opinion for me.

As a kid, Monyeen must have felt like she was responsible for us kids as she tried to whip us into obedience. When we got into high school we would come home from school activities, and Moonyeen would play the piano and we would sing. Most of the time Dad would get up and say, "By hell, it's time to go to bed. We have work tomorrow."

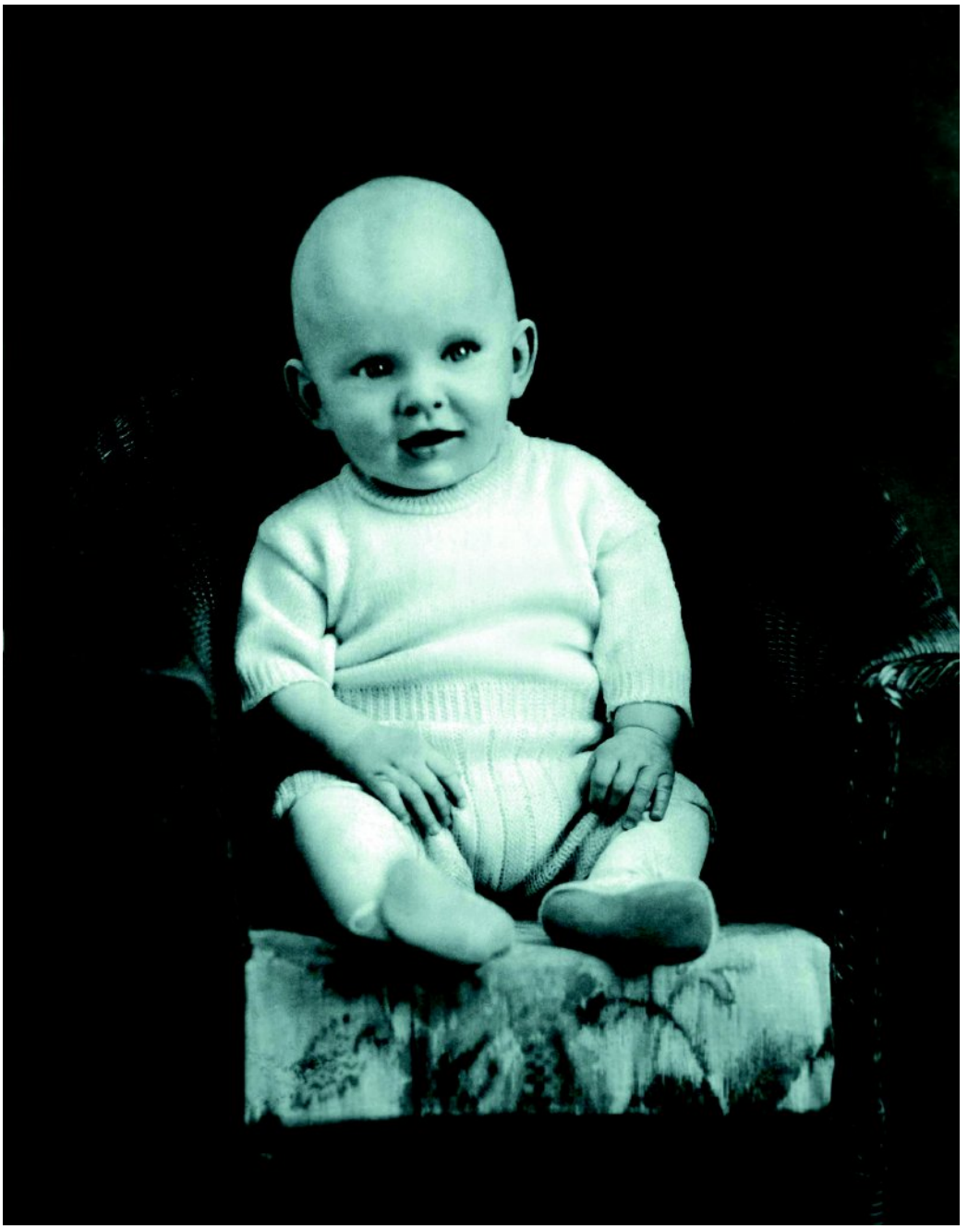
At one of the Green and Gold Balls, Moonyeen needed a formal, so Mom ordered a light green chiffon and a soft light green satin to go under it. It came a day before the dance, and Moonyeen was upset. There was a blizzard going on, so after milking, Dad saddled old Turk and rode 8 miles into town to get the material for Mom to make Moonyeen's dress. It was late when Dad got home, almost frozen. Mother took the material laid it out on the table and began to cut the dress out. She then started to sew. She almost finished the dress that night. She had Moonyeen try it on the next morning, so Mom could make the final adjustments. For some reason, Moonyeen became angry and said she would not wear that ugly dress. Mom finished sewing it and Moonyeen did wear it. It looked very nice on her.

I remember Mom sitting down and crying for a minute after the argument. She was so tired and wore down from the worry, not to have the dress, and then not to be appreciated, that it really hurt. I think Moonyeen far better understands her mom's feelings now. We just do the best we can at the time; it's a growing time for both child and mom.

The folks never had a lot of money but they had lots of love and shared what they had.

Moonyeen has always been kind of a beacon for us. She was our caretaker for Mom. Mom and Dad had to work side by side to clear the trees and get the 160 acres so they could farm it. Then, after the crops were ready, there was hay to cut and stack, grain to thrash and always cows to milk. It was a busy time for both Dad and Mom.

Moonyeen is much like Mom in that she wanted to help others and has done so. She made a wise choice in companions. She has struggled with pain but never given up. She is my sister and I am very proud of her and love her very much.



My baby picture.
No hair then, no hair now!

Richard Watkins Anderson

I was born July 23, 1937 in the Pearse Private Hospital in Brigham City, Utah. My father, Norman H. Anderson, was a return missionary and college student and my mother, Esther Watkins Anderson, found whatever work she could. 1937 was a very difficult year and work was very hard to find. Unemployment was deep into double digits. The Great Depression was seven years long and counting. A terrible drought had turned the Midwest into a 'dust bowl' and farmers were abandoning their farms in hopes of finding work at the end of a long, difficult pilgrimage to California. I have often wondered how my parents had the courage to even get married, let alone to add a baby and another mouth to feed to their family.

WHEW!

I was born on a Friday at 11:48 pm after a long, difficult delivery. I know my mother was very tired, Dr. Pearse was tired, and my father was still frightened by the whole ordeal. I, of course, don't remember any of this but I have been told that I was a very happy baby. I am sure that I was glad to be here and have since marveled at what a wonderful time, place and family situation for my birth.

My first memories as a child were in Park Valley, Utah in the fall of 1939. I know that in the two preceding years my parents worked as janitors of the chapel in the second ward in Brigham City. Dad finished his bachelor's degree at Utah State Agriculture College and took a summer course at the University of Idaho. Teaching jobs were still hard to find and he wanted to be eligible to take a job in Idaho if he had the opportunity. But, in the fall of 1939 the opportunity came to teach in the booming metropolis of Park Valley, Utah. If you don't know where that is, it is close to Rosette and Grouse Creek.

Halloween

My memory is that I was standing in my crib when my parents came into my room with another school staff member and tied some balloons with Halloween markings and colors to my crib rails. I remember being

Richard and Emma Louise Carter in Park Valley, 1940. She is the first non-family-member in my memory.

Third birthday in 1940.

excited, especially that the balloons were accompanied by some Halloween candy.

A Baaad Day

Another lasting memory was my first encounter with sheep when I was about three. Park Valley has long been sheep winter range. A common sight in the fall and spring was large herds of sheep being moved to and from the high country or between grazing areas. The school where Dad taught was about a quarter mile from where we lived. Every afternoon Mom would let me run up the dirt road to meet Dad coming home from school.

On this one day, just as I was running to meet Dad, a group of men and sheep dogs were moving a large herd along the road past the school. Just as I came to the herd, one of the rams deemed me a threat and butted me solidly in the chest. The force flattened me on my back. I looked up just in time to see one of the sheep men swat the ram on the butt with a large rod and then Dad gathered me up, unhurt but crying, and carried me home.

Shockingly Hard Lessons

In the summer of 1940 we moved back to Brigham City as Dad had accepted a teaching job in Elwood, about 15 miles northwest of Brigham. We moved into a rental unit that belonged to an Anderson family (no relation). It was a bit more modern than our Park Valley home. It had a lot more electric items like lamps, a toaster and a radio.

I became particularly interested in electric outlets. You plug the radio in and you heard people talking. Plug a lamp in and you got light. Wow! What magic is in there? Maybe I could pry open one of the little slots and see what's

there. A kitchen knife should work just fine, so I proceeded. It was then that I made a very shocking discovery about electricity.

After I picked myself and the knife up off the floor, I resolved to show electricity more respect in the future. My fascination, though, never went away so maybe that is why I became an electrical engineer.

Boys and Girls are Different. Just Take My Word for It!

When I was about four years old, my Grandma Watkins was having a lot of health problems. She was a widow and struggling with her chores such as washing and ironing. Her two sons, including my mother's older brother, John, lived with her. John needed a lot of help with his meals and upkeep.

Grandma lived about a mile from where we did, so quite often mother and I would walk to Grandma's home to help her with her care and housework. To help cover her financial needs, Grandma had rented her basement to a family with two little girls about my age (about four years old).

One day when we were at Grandma's, I was outside playing with these two girls when our attention was drawn to anatomy. Then somehow we agreed to show each other our differences. We also thought it ok to show each other how differently they functioned. At that very moment, Mother was in Grandma's bedroom with the window open and her mother's intuition prompted her to call out, "Richard, what are you doing?" "Peeing!" I replied.

I had no idea my mother could move so fast. She would have left Jesse Owens in her dust. Before I could get my pants up my bottom received about five hard slaps that even Grandma could hear in her bedroom. My behind was still bright red when I went to bed that night. Even now I hyperventilate if there is a nurse in the room when my doctor checks for a hernia.

The moral of this story: Don't get caught with your pants down if there is an angry woman observing your activities.

Words Have Meaning

I learned a few other lessons the hard way at Grandma Watkins' home. Grandma had a neighbor family about 300 yards away that I will describe as hardscrabble. The family included three boys a few years older than me that seemed much better educated than me. They used a whole bunch of words I had never heard before and the words seem to express actions and things so emphatically. I kept the words in my mind looking for the opportunity to show my mother how smart and sophisticated I was becoming.

One day my opportunity arrived. Mother had picked a big bucket of string beans from Grandma's garden and she asked me to help her snip them. If you don't know what snipping beans is, ask your mother or grandmother. As we snipped away I reached into the bucket and pulled out the longest bean that mother had picked that day. Here was my chance to impress mother with my newly expanded vocabulary. "G..! look at that big bast..d!" I blurted out. And there it was again that emphatic slap, this time as a right cross, that would have put Joe Louis on the canvas, right across my mouth. "Don't you ever say that again!" exclaimed mother!

I have never had trouble keeping the third commandment since that day. The Lord's name couldn't pass my lips, vainly, without me feeling that sting, even to this day.

The moral of this story: Words have meaning. That is why I want originalists on the Supreme Court.

World War II

On December 7, 1941 everything changed. Early that Sunday morning, Japanese bombers attacked the United States Naval Base at Pearl Harbor, Hawaii killing 2403 United States

troops and civilians while sinking 19 Navy ships. Our Pacific Fleet was destroyed. The next day President Roosevelt referred to the day as a day of infamy. Then the United States Congress declared war on Japan. A few days later Germany and Italy declared war on the United States. We reciprocated and the war was in full swing—a war that would result in the death of an estimated three percent of the world population.

The Haircut to Remember

The day after the war started my mother's younger brother (my uncle), Ray H. Watkins, made the decision to join the Navy. First he had to get a Navy regulation haircut. We were with Grandma Watkins at the time and mother asked Ray if he would take me with him as I was also in need of a haircut. Shortly after, we were in Elmer Schow's barber shop waiting our turn. The shop was full of men eager to join our military and their conversation scared me. "The 'Japs' bombed Pearl Harbor!" Me: "What's a 'Jap'? What's a Pearl Harbor? Are they going to bomb our house?" It was very frightening for a four year old.

Utah Responds

Utah was heavily affected by the war. The infamous Japanese Internment Camp, Topaz, was in Utah, along with Dugway Proving Ground, Fort Douglas, Ogden Army Supply Depot and what would become Hill Air Force Base. Northern Utah had very good rail connections east, west, north and south so it made good sense to locate a much-needed army hospital in Utah. Brigham City was the chosen location, so in the southeast corner of the city a very modern 1300-bed hospital with supporting facilities was constructed in what must have been record time. Eventually some 13,000 troops would be treated, many for amputations and related complications.

I remember the construction phase well. Brigham City people bent over backwards to assist the effort. One of my mother's aunts had a large, mostly empty house so she rented rooms where workers could stay. My mother, who was an excellent cook, prepared the meals for these same workers in our home and at our table. I helped set the table and wash the dishes (no such thing as a dishwasher appliance). The army was never billed for my little service but the lessons learned were tremendous.

No Taste for Good Comic Books

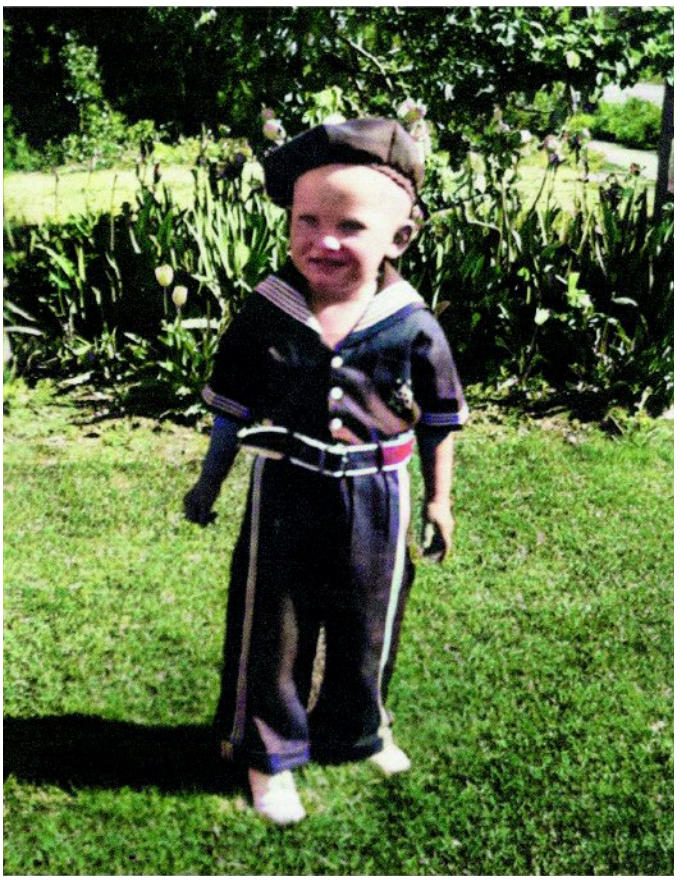
After the hospital was completed, my mother and her sister, Jane, frequently took homemade treats to the hospital patients. After all, these were mostly young men, some as young as 17. Many would spend the rest of their life missing an arm, or a leg, or multiple limbs. They loved the treats and they loved the kind attention.

I enjoyed going with mother and Aunt Janey, because, among other reasons, these young soldiers would give me their used comic books. If I would have saved half of them, l could make our entire family very wealthy. Only one thing bothered me, it was strange to me that great comics like Superman, Batman and Robin, and The Green Hornet were less common than I expected. It seemed that every patient there had every issue of a particular comic that would have been my last choice. Why would they pick that comic over Captain Marvel for instance. I was befuddled. What was that favorite comic? WONDER WOMAN!

The moral: Boys will be boys!

I want a Sister Baby

Shortly before my fourth birthday it seems the stork was planning a second visit to the Anderson home. Mother was expecting and I was most excited. For over a year my refrain had been, "I want a sister baby!" We



A young patriot at about the time WWII was starting in Europe.

Bushnell Hospital which became the Intermountain Indian School after World War II.

all seemed certain it would be a girl and most of the family wanted her name to be Norma after my dad's name. However, I was in love with a lady that worked in a local drug store named Ruth. So I wanted a sister baby and I wanted her name to be Ruth. On June 8, 1941 a beautiful baby girl was born and our parents named her Ruth. Thank you, Mom and Dad! Sadly, Ruth left us way too early at the tender age of sixty.

Above: So happy to have a sister baby! Big family event of 1941.

Below: Sister baby growing up too!

My Sled

You might remember that in 1941 Dad was only in his second year of teaching school. There was no health insurance and Dad only made about $1000 per year teaching. They simply didn't have the money to pay the doctor and hospital bills. But, for the 1941/42 school year he was able to join the Lincoln School faculty teaching 5th and 6th grades. The Lincoln School was in Brigham so they figured he could walk to school and they could sell the car to pay the bills. This they did so that Ruth was fully paid for. The only problem now was how to get mother and the new baby to the doctor when there was snow on the walks and no way to walk or use a baby buggy. Well, for Christmas in 1941, Richard's gift from Santa was a beautiful Flexible Flyer sled. Through that winter when snow was a problem, Dad pulled Mom and Ruth on the sled to the doctors office for visits. I still have that sled and it is sacred to me. I hope whoever inherits it treats it the same way.

My sled and former family vehicle. 2021.

Dad Dodges a Bullet, by Accident

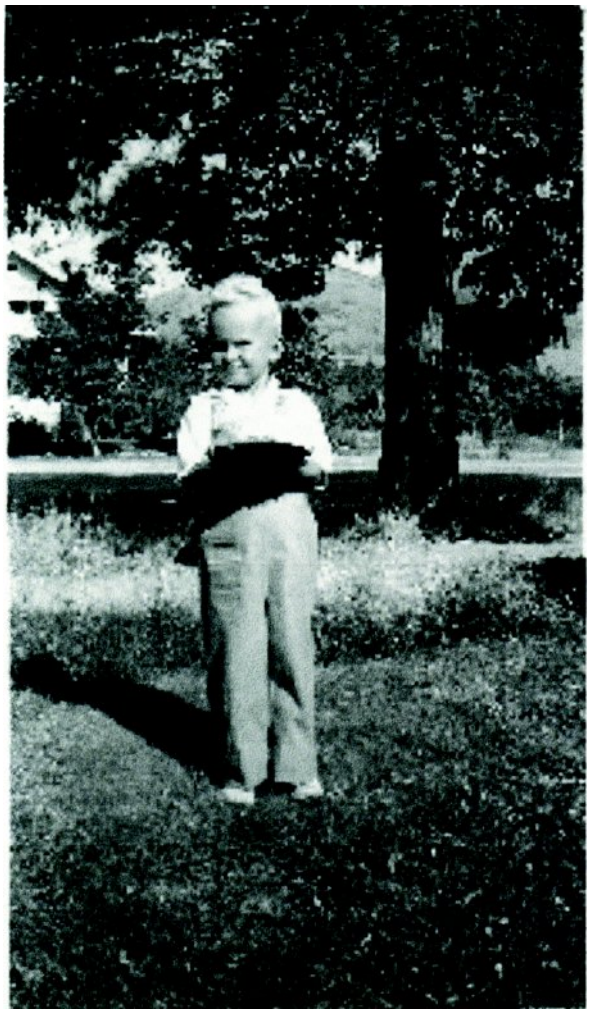
When the war broke out, Dad received his draft notice to report to Fort Douglas for his pre-induction physical. I remember traveling to Salt Lake and waiting while Dad was examined. Before Dad went on his mission he was picking cherries for a farmer and fell out of a tree. He injured his back and Dr. Pearse fitted him with a corset to stabilize it. It did bother him while he was in France and all the rest of his life. Well, it also caused him to flunk his Army physical, since his back had been broken and had mended a bit crooked, so he was rejected for service. Nevertheless, he joined the Civil Air Patrol which had been established in case our city was ever attacked. He was issued a white metal helmet, a billy club, and an identifying chest band. I still remember occasional air raid drills when the fire siren in the old city hall would sound a very shrill warning and we would all seek cover. Fortunately we were never bombed. Dad also worked summers, weekends and some evenings at the Ogden Supply Depot. He would ride the Northern Utah Railroad to get to work. Many of the workers there were German and Italian war prisoners. Dad had good command of German, Italian, Spanish and French. He was frequently put in charge of prisoner details. I learned that the prisoners came to love him because he could talk to them and share insights about the war and their home countries. Dad had a great love of languages and history and it showed.

The Little Red Wagon

by Deborah Justesen

When Dad was a little boy, his family did not have a lot of money. Grandpa Anderson was a school teacher and Grandma stayed home to care for Dad. Both parents were very hard-working people and were willing to sacrifice to give their children the things they needed.

Grandpa Anderson received employment out in Park Valley first and then transferred to Elwood to teach school. At this time, the family had one car. A new position opened up in Brigham City to teach at Lincoln Elementary School that would be where Grandpa taught for the next 40 years. Great-grandma Watkins had died, and in exchange for Grandma Anderson looking over her brother John, Dad and his parents were able to take over the family home and pond. Although it was over a mile from town, it was a wonderful home and both Grandma and Grandpa were glad to be close to family. At this time, Dad was the only child, but Grandma Anderson soon became pregnant.



Most likely my 5th birthday in 1942.

Back in those days, the patient paid medical bills, for there was no insurance to help with large medical bills. Having a baby was very expensive, and after Ruth, Dad's sister, was born, the family decided to sell their only car to pay the bills.

Each day Grandpa would walk to work to teach school, but this left Grandma Anderson without a car to run errands or go shopping for the weekly food. This time, Grandma Anderson came up with a wonderful idea. Dad had a little red wagon that he played with. Now this red wagon became the means for the family shopping. Though only five years old, each time his mother needed some groceries, she would send Dad.

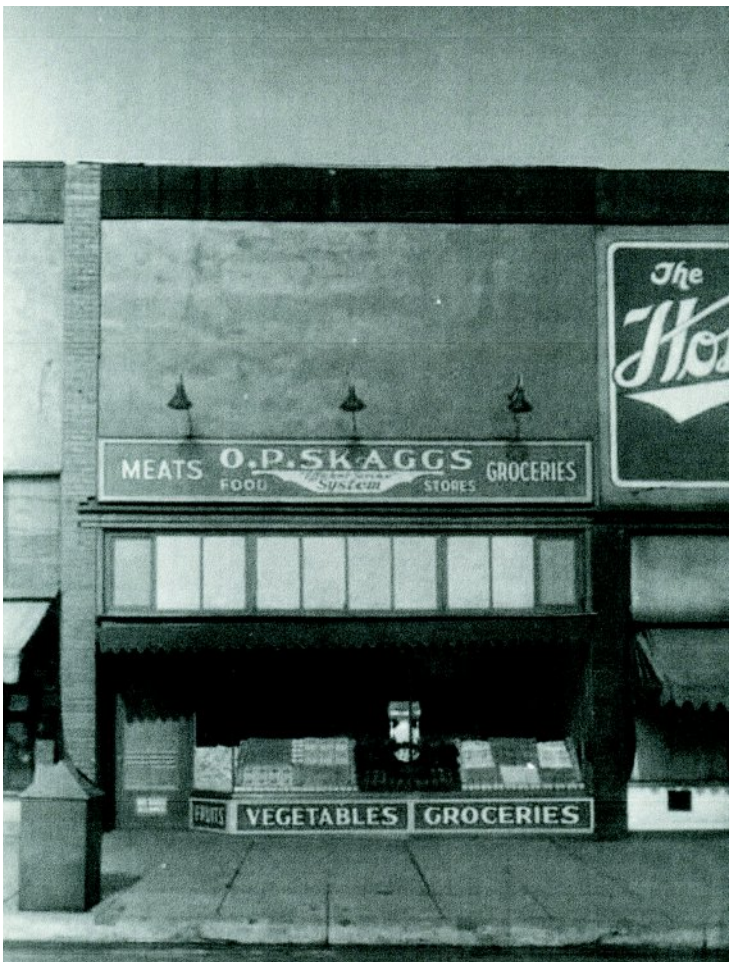
Dad could not yet read, but Grandma would write out a list of the things she needed and give it to Dad along with a little black bag with the money for him to purchase the items. The grocery store was over a mile away, but Dad would faithfully go to the market for Grandma, give the owner of the O.P. Skaggs

grocery store the list and then pay for the groceries. Then Dad would walk, or if there was room in the wagon, ride all the way home, as it was downhill from town.

But this was not all the little red wagon was used for. As Dad helped his mother pick fruit and vegetables in their large garden and orchard, the wagon was used as a small "store front". After the fruit was put in bushel baskets by Grandma Anderson, Dad would head up to town to sell his wares to the packing companies. When the employees saw Dad coming, they would always exclaim, "Here comes Producer Anderson!" Perhaps this was just the beginning of Dad living up to the title of producer. Sometimes Dad would take beans they had picked up to Rennie Smith's store, the founding store that would later spawn the D. Glen Smith's grocery chain.

Dad says that this experience is one he looks back on with pride as he recognizes that today young children would not be called upon to have such large responsibilities. At the same time, it was an era when people could trust others to be honest and to look out for small children.

In 1953 Dad bought his first car, which was the first car the family had owned since 1941. Finally in 1956, Grandma and Grandpa Anderson purchased their own automobile.



O.P. Skaggs Grocery Store

Down by the Pond

On June 25, 1942, Grandma Watkins passed away. She was only seventy years old. Grandpa had died some seven years earlier so her family consisted then of my mother, my mother's two sisters, Jane and Lenora, and two brothers, John and Ray. Ray was in the Navy and shipboard somewhere in the Pacific. I don't know how long it was before he knew his mother had crossed the great divide. Consistent with the times, Grandma left her home and accompanying land to her two sons. Daughters were supposed to get their inheritance through their husbands. John at the time was about 45 but he was never quite right. I think he had limited cognitive capability and also had a lot of anxiety and emotional problems. He had a maintenance job with the city and worked keeping the city parks nice. He was a very sweet man. He wouldn't hurt a mouse. He was very religious and never missed a church meeting. He even attended MIA, which then included an adult class. He didn't participate much in discussions, usually sitting quietly on the back row. He never married, never drove a car and never had a girlfriend or maybe any friend at all. He really was incapable of living alone. After Grandma's funeral, it was decided that we would move into Grandma's house, rent free, in exchange for taking care of the place and Uncle John.

Grandma's home sat on some 15 acres on Forest Street between 6th and 8th West. It is directly across the street from Reese Pioneer Park and included a 6+/- acre pond that had been used by my grandfather and his brother to freeze ice in the winter for sale in the summer. West of the home was the Big J flour mill. Just beyond that was the Utah Farmers Association feed and egg processing plant. Just beyond that was the Brigham City Union Pacific Railroad Station. The far south end of the property was a two-acre lot that had been used for trailer houses when Bushnell General Hospital, mentioned earlier, was being built. It was sometimes used for a hobo camp, sometimes a camp for transient farm workers during fruit harvest time and sometimes as an encampment for Native Americans (mostly

My mother and my two cousins, Eva Jane and Ray Christensen, on the pond ice, about 1932.

Shoshone) when they came into town for a variety of reasons. At times there would be as many as a dozen teepees pitched out there. It was handy to the park where water, toilets and even showers were available. Reese Pioneer Park was used for semi professional baseball games, for boating. As now, there was a swimming pool and a very ample playground. It all made the camp and the home a very interesting place. Today the property of my grandmother's is called Watkins Park. The pond is no longer there but is now a venue for youth soccer, football and even vintage car shows.

My First Best Friend

Sometime after we moved to our new home down by the pond, I met a boy who would be in my class at school. His name was Max Snow. He was of the Lorenzo Snow family, probably a great-grandson. We became very good friends during the entire time we lived there. We both loved adventures and we lived in a perfect area for boyhood adventures. We were Huck Finn and Tom Sawyer for sure. We had the hobo camps and the Indian camp to visit, we had the trains to watch and dream of hopping and being hobos ourselves. We fished the pond in the summer and explored the fields and marshes west of the city. We caught frogs and snakes and took them home in our pockets. We built a raft from old railroad ties and poled it around the pond. We made hideouts in a hollow where my grandpa's old icehouse had stood. We snuck into wrestling matches on summer nights at the ballpark. I remember a seemingly angry tag team match between Gypsy Joe and Floyd 'Meany' Hansen, the bad guys, vs local favorites Kenny Mayne and Joe Reynolds. Finn Gibbs was the referee and the father of Diane Gibbs, one of my school classmates. I recall that Finn sang at my grandfather Anderson's funeral. Max and I would often sleep over at each other's home. Max's family lived in an old two story pioneer era adobe. It was right next to the railroad tracks and those were the days of steam engines--very noisy but also fun to watch and listen to. Their home had electricity and indoor water but no indoor bathroom. The outhouse was very cold in the winter. Both their home and ours were heated by wood and coal stoves so we both had a lot in common.

Learning to Work

While we lived in the house by the pond I learned a lot about work. When I was about five I did most of the grocery shopping for our family. Mother would make a list of what we needed and I would pull my coaster wagon up town, about a mile, to O.P. Skaggs Grocery Store and give the list to one of the staff.

They would pick out the items and put them in bags or a box and put it in my wagon. I would give them the money Mother sent and trust them to return the right change. If there was room in the wagon I could coast most of the way home since it was all down hill. One day I observed that most of the fruits and vegetables they were selling weren't nearly as attractive as what we grew on our little farm. So, the next time I went shopping, with Mother's permission, I took a box of our now famous green beans and asked the manager if they would like to buy them? He responded, "Sure!" He paid me for the beans and put them next to what they already had but at a higher price. I think they were sold before I left the store. On leaving the manager told me if we have any more they would be happy to buy them. I was in business! If I would pick them and take them to town, mother let me keep the money. I also had to help with the irrigating.

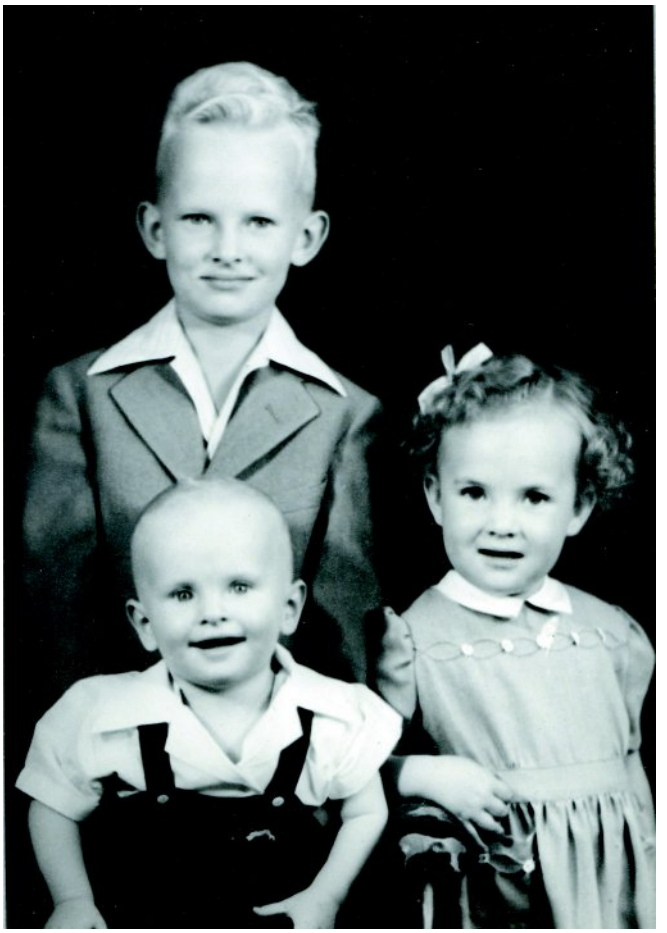
Over time I also sold raspberries, apricots, cherries, peaches, tomatoes, and cucumbers on the same basis. I also sold to Lorenzo Smith's Market, the forerunner of the modern Smith's Market chain. I also found summer jobs picking strawberries, cherries and peaches for neighbor farmers, all before I turned 11 years old. I actually earned enough money during the war years to buy four twenty-five-dollar war bonds. Each cost $18.75 and returned $25 when mature. For my effort, I got to ride in a Jeep with an army officer and autograph a bomb casing as though I had paid for it. I wrote, "Here's for you, Hitler!" I was glad when I learned that he was finally dead.

The Newspaper Boy

On January 1, 1949 when I was 11, I got the job of delivering the Salt Lake Tribune to subscribers living in a fairly large portion of Brigham City. I had to get up at 5:00 am and pick about 100 papers up and deliver them to my assigned subscribers before 7:00 am, then go home and get ready for school which started at 9:00. I also had to go door to door each month and collect for the papers delivered. The subscribers paid me 5 cents per paper or $1.50 per month. I had to pay the Tribune 3.6 cents per paper, so when the month had 31 days I didn't even make 1.4 cents a paper. And, if a customer moved or failed to pay me, I still had to pay for the papers and just eat the loss. I continued to pass papers for about five years and saved enough money to buy my first car, a 1946 Chevrolet, in 1953, and after Moonyeen and I were married, I used the last of my paper route savings to buy our first car, a brand new 1958 Fiat.

I want to add that 1949 was a terrible time to start a morning paper route. It was clearly a 100-year winter, at least. It snowed and it

My family with my childhood home in the background. About 1947.



Richard, Ruth and Kent in the mid 1940s.
Photo on the right is taken at our childhood home.

snowed and it froze and it froze. I observed that at -20 degrees F, my tears would freeze. I got a bad frostbite on my feet. The snow was so deep and frequent that I couldn't even use my sled. I just had to walk and carry the papers in canvas bags on my shoulders. My fingers would get so cold even with the heaviest mittens that I could find. There was so much snow that the deer came down out of the mountains and wintered in the ballpark across the street from our home. The wild ducks that would sometimes winter west of town came into our frozen pond and then begged for food at our back door. It was awful. I want to add here that my dad helped me through this tough winter, especially when my feet were hurting. He was a great man and a super great father. And my mother was the same way. I love them with all my heart.

Elementary School

In the summer of 1943 I attended kindergarten at Central School. Central School was located on the west side of Main Street between 200 and 300 South. Today the Brigham City Temple is on that same site. Central was a classic old-time school building, built like a giant cube, three stories high with fire escapes on both sides, entries on the front and back and with a flag pole in front. It was a little over a mile from our old home at 701 West Forest Street. It was quite a walk for a five

year old but I was used to walking since our family had no automobile. My kindergarten teacher was a great lady named Blanche Ferry. She was also my third grade teacher and I will always remember how sweet she was with all of her students.

My first grade teacher was Blythe Tingey. She really gave me a great start in reading and arithmetic. I also had her as my homeroom teacher in the fifth grade. My second grade teacher was Miss Hopkins. I will remember her first name when I am not trying to remember it. Oh, just remembered, it was Delores. In the third grade, as I mentioned, I had Miss Ferry again. I remember that I had perfect attendance that year. She gave me a book for my effort. She wrote in it that someday she would like a boy just like me. I felt truly honored. I hope she got her wish and hope he was much better than me. She deserved it. I think later she was honored as Utah's outstanding elementary teacher. I remember the book was titled *Mystery at Lake Retreat*. If any of my family find it after I'm gone, please treasure it.

I did very well in elementary school. I was able to score well in arithmetic, reading and spelling. In the fourth grade my teacher was Jane Linford. I thought the world of Mrs. Linford. She helped me a lot in the fundamentals, especially spelling. She had a class spelling bee that I won. It turns out that she and my mom had the same birthday. When I learned this, I took on the task of raising money from our class to buy her a present. A classmate, Bob Jensen, helped me go home-to-home of our other classmates to solicit a quarter each. We raised enough to buy her a nice flower from Henry Drewes' floral shop. It turns out that Mrs Linford would be my last teacher in the old Central School building.

My last year at the old Central School. The Brigham City Temple now stands at this spot. Note the class size. I am #25.

The Terrible War is Finally over

1945 was a big year in America. In April of that year President Roosevelt died. I remember Miss Ferry teaching us how to spell the new president's name: T-R-U-M-A-N. Most Americans really had no idea who he was. A few days later Berlin fell to the Allies, Hitler and his mistress committed suicide and the Nazis surrendered unconditionally. My father and I watched the unraveling of Hitler's regime with great interest and anticipation. That left Japan as the only obstacle to peace.

Baptism by Water and Fire

On August 4, 1945 I was baptized by my father in the font in the Brigham City 5th Ward Chapel. The next day I was confirmed and received the gift of the Holy Ghost in the Second Ward Chapel. This later ordinance is often referred to as Baptism by Fire. Shortly thereafter the United States military dropped an atomic bomb on Hiroshima, Japan providing a literal baptism by fire. The blast and after-effects killed an estimated 160,000 Japanese people. A few days later a second bomb was dropped on Nagasaki killing thousands more. A few days after, Japan surrendered unconditionally on the deck of the battleship Missouri. The deadliest war in world history was finally over.

The Bishops of my childhood in the Brigham 2nd Ward. Back: J.A. Meservy, LeGrand Horsely, Glen Knudsen, Raymond Olsen; Front: Carlos Soderholm, Nephi J. Valentine, Thomas Blackburn

Central School Burning

The summer of 1947 things felt pretty good. Most of our troops, including my Uncle Ray, were home at last. With no more war casualties, Bushnell General Hospital was closed after caring for some 13,000 badly injured troops, some of which married Brigham City women and chose Brigham and nearby areas to make their new home. Also the hospital and resource people there did much pioneering work in the use of antibiotics and light-weight plastic prosthetics. But a big change was coming.

One day in August I was at home enjoying the last few days of summer vacation when I observed a large column of smoke to the south and east that I concluded could not be far away. I immediately started toward the smoke column and after a few blocks I could tell that Central School was burning. The fire lasted several hours and left a three story hollow shell. Now what do we do for a school?

The Army to the Rescue

Bushnell General Hospital was never intended to be an elementary school. But in a pinch, a good dose of ingenuity can go a long way. Here was a burned out school and an empty hospital. There has to be a good solution in there. With approval of the US Army, a few buildings of the hospital were quickly configured

(Fire at Central School, 1947. Courtesy Compton Collection, USU Special Collections.)

"Explanation of the cause of the fire remained pure speculation, as evidence appeared, then was disproved of various causes. Guesses that the fire resulted from defective wiring were discredited in view of the fact that the building was completely rewired nine years ago. It was reported that painters had been working in the building, and that the fire may have started from spontaneous combustion of a paint soaked rag, but the painting contractor said no one had been doing any painting in the building since Thursday, two days before the fire, and that then only a few cupboard doors had been enameled. He said this theory of the cause of the fire was 'impossible.'"

"Considered generally as the most likely cause of the fire was lightening, which might have entered the building by its wiring and started fire smouldering in the basement floor."

"The painting contractor previously had been informed that the building was to be fumigated Saturday. He went to the building at 2:15 o'clock and noticed that the basement was full of smoke. He assumed the fumigation was in process, and did not report the fact. He noted that the upstairs floors were free of smoke."

"Nearby residents reported a terrific crash of thunder and lightening which appeared to have struck something nearby during the very hour, and a family living across the street reported having noted smoke coming out of the school house's chimney from shortly after noon until the time the fire was reported. After the fire it was discovered the doors of the furnace were open, forming a flu from the basement up through the chimney."

"The Central School building was constructed in 1901 and was remodeled at a cost of $10,000 shortly before the war. It was completely repainted inside and out, last summer. It contained 14 classrooms on three floors, in addition to offices and hallways. (Box Elder News-Journal, 13 August 1947)."

Excerpt from "Harvest of Faith: Brigham City Utah Temple" p. 17
Published by the Temple Department February 2013

with portable partitions and chalk boards, tables and chairs into different-looking but usable classrooms. There was also a transportation problem. Bushnell was too far from most homes to allow walking to school. Also, being a military installation, young civilians wandering around was not a good idea. Central School also had very few bused students and so had very few buses. Now every student needed to be bused. The School Board officials hunted all over the state for old unused school buses to haul us all to school. It made for a pathetic armada of near-antique buses. My fifth grade was spent in the former Bushnell General Hospital. It was a very good year and I remember it very fondly.

A Life Changing Experience

Since I brought the Army Hospital up again, I have one more story to relate. It seems sometimes the young veterans there enjoyed doing a little fishing. Since we lived across the street from a nice park and had a pond, it was common for our pond to be a choice for a place to fish. One day a young man was by the side of the pond trying his luck. I sat down on the pond bank behind him to watch. It was a hot summer afternoon. He questioned me as to whether I thought my parents would mind if he took a little swim. Feeling pretty big, I assured him that they would not mind, not at all. It was the shock of my life: first he took his shirt off; then he took his pants off; then he removed an artificial leg and hopped on his one leg into the water for a refreshing swim. I have never looked on our fine service members and veterans with anything but deep respect and admiration since that day.

With siblings when I was about eight.

High School Years

The fall of 1948 brought some big changes, and more would follow over the following years. It was decided to change the school situation between the two elementary schools in Brigham. The fifth and sixth grades were combined and called the Central School and the four lower grades were combined to be the Lincoln School. The lower grades met in the old Lincoln School building and the reorganized Central School was shoe-horned into the bottom floor of the Box Elder High School Building on 400 East. As my dad had taught 5th and 6th grades at the Lincoln School, he now moved to the reconfigured Central School to teach there. And as fate would have it, he was my homeroom teacher for the 6th grade.

My First Date

The biggest change for me was a whole bunch of new classmates. There were new boys to fit into the pecking order and new girls that seemed more interesting than the ones we had gone to school with for four years. There was one that particularly caught my eye. She was both polite and attractive and seemed so much more knowledgeable than me. Her name was Donna Jean Prisbrey. She lived right by the high school and her dad taught there. She seemed to be interested in me and I was very interested in her. On a couple of occasions I rode my bike from 700 West where I lived to 400 East where she lived. We also started to share little candies and notes during class time. I also learned that we were born on the same day in 1937. Karma for sure! Well, I finally got up the nerve to ask her if she would go to the Sixth Grade Reception dance with me. I asked her by writing my invitation on a candy wafer called a Necco. When she figured out what I was asking, her face lit up with a pleasant smile and she promptly wrote yes on the wafer and passed it back to me. Needless to say I was very happy.

As I recall, the Sixth Grade Reception was sponsored by the high school as a kind of welcome to high school. It was held in the spring and I had asked her in the fall. Our friendship was kind of up and down through the year but was up in the spring so we went

to the dance together. I remember it rained that night so I took a taxi from our home to hers. I had bought her a small corsage for the occasion and we were both dressed very nicely. I had a brand new suit which I had bought with paper route money. I would also need it to wear when I was ordained a deacon that summer. The dance was fine and we exchanged dances with a few of our friends. After the dance and I saw her home I walked home in the rain. This was my last date until I turned 16. I would go to dances through those years but I must have liked going without a date, then I could dance with whoever I chose.

Just a last bit on Donna Jean, I really think her mother liked me better than she did. We did date again some in our senior year. In fact, she was my date for the Senior Prom. She got married about a year after high school. I didn't know her husband but I was asked to help with guest greeting at their reception. Her mother kind of embarrassed both us when she introduced me to some of the guests with the comment that she had tried to play Cupid but it didn't work. I will add that even with our dating history, we never shared a kiss. Maybe we were such good friends that it would be like kissing your cousin.

History, Geography and Baseball

I thoroughly enjoyed having my dad for a sixth grade teacher. In the sixth grade we studied world history and the geography of Europe and Asia. Dad made it interesting and I really learned to love history. I feel I have retained much from our study of Egypt, Greece, Persia, Rome and the Middle Ages. Dad also taught baseball. He arranged to have the World Series piped into the classrooms. It was between the Cleveland Indians and the Boston Braves that year. Both teams had great pitchers. Cleveland had Bob Feller and Bob Lemon; Boston had Warren Spahn and Johnny Sain. Dad would discuss it for us in the context of past great players like Babe Ruth and Walter Johnson as well as dark days like the Black Sox scandal and Shoeless Joe Jackson. We had baseball teams from the four home room classes and played each other for the school championship. I wasn't very good at it but stuck with it for several years and got to the point where I enjoyed it and was reasonably competent.

Junior High

I did pretty well in the 7th, 8th and 9th grades. Each year I took math, English, history and science. I liked all four subjects and got A's

The pond is finally ice free.
Time for baseball. Hoorah!

and B's for the most part. I also took physical education as required and chose wood shop, art, speech and seminary as electives. My worst subject was art, maybe because I didn't care for the teacher. I did run for Junior High Student Body President but didn't win. I had the lead male role in the Christmas play. I received an individual award for athletics in the seventh grade, mainly because I was part of the best team in intramural physical education. I had to behave in Seminary because my teacher was also my bishop.

Moving Closer to Town

In the spring of 1950 my parents bought a small red brick home at 120 South 400 West in Brigham City. It was just half a block south of Grandpa and Grandma Anderson's home. I loved my grandparents and I particularly enjoyed my relationship with Grandpa. Grandpa was a country peddler. He had outfitted an older car (a 1936 Chevrolet as I remember) to hold a stock of the most popular items. The products he sold were from the W. T. Rawleigh Company. His customers were all farm families that bought farm family oriented products such as fly spray, salve for people and livestock, vanilla extract, cough medicine, pepper and spices, fruit punch concentrate, etc. He would drive from farm to farm and sold primarily to farm wives who usually handled the activities that called for such commodities. Sometimes during the summer Grandpa would take me out in the country where he made his calls. He was a good salesman and was well liked by his customers. Grandpa was very articulate and was asked to speak at many of his customers' funerals. Traveling with him taught me a lot. He would never call when it was lunch time. When I traveled with him we would usually stop at a country store and pick up some milk and lunch materials. We would then find a park or a place by an irrigation canal and enjoy a nice lunch. He would sometimes read me a story from Reader's Digest and then take a short nap before we hit the road again. Sometimes we went so far from Brigham that we would stay in the area for a night or two. We would stay with a farm family that had

Grandpa made his sales rounds summer or winter. Picture taken about 1952.

empty beds from children that had left home. Grandpa would trade commodities for our bed and meals. After dinner we would usually play Chinese checkers with the family for several hours. Grandpa was very good at it. On the way home we would usually stop at Crystal Hot Springs for a nice swim. That is where I learned to swim.

New Friends

Moving to a new neighborhood meant new neighborhood friends. Three stand out in particular: Lynn Reeder, Hal Reeder and Jerry Valentine. All were very good athletes and running with them made me better. Lynn and Hal were brothers just one year apart. Lynn was a very good runner and held the high school region record for the 440 yard race. Hal was an all purpose tailback on the football team and a pitcher on the high school baseball team. Both were also on the basketball team. Hal went to the University of Utah on an athletic scholarship. Jerry was an excellent basketball and volleyball player. Jerry and I roomed together for a couple years at Utah State. We all spent a lot of time together during our last six junior and senior high school years. We fished together, hunted together and slept out on our lawn in the summer together. The last two years of high school we also chased girls together.

Surgery

During the seventh grade we were all required to have a physical examination. Two or three of the local doctors came to the school one day and all the students, boys in one area, girls in another, were paraded through for their examination. When it was my turn, Dr. Felt came to the part where he pokes his finger in an uncomfortable place and then instructed me to cough. After an anguished cough he says, "Again!" I cough again and then he tells me to have my mother give him a call.

When I got home that day I told mom to call Dr. Felt, which she did. Here is the conversation as I recall.

Mom: "Richard said I needed to call you."

Dr. Felt: "Yes, Richard has a hernia."

Mom: "What do we need to do?"

Dr. Felt: "He should have surgery."

Mom: "Is that major surgery?"

Dr. Felt: "Yes!"

Mom: "How much would that cost?" (We had no health insurance then.)

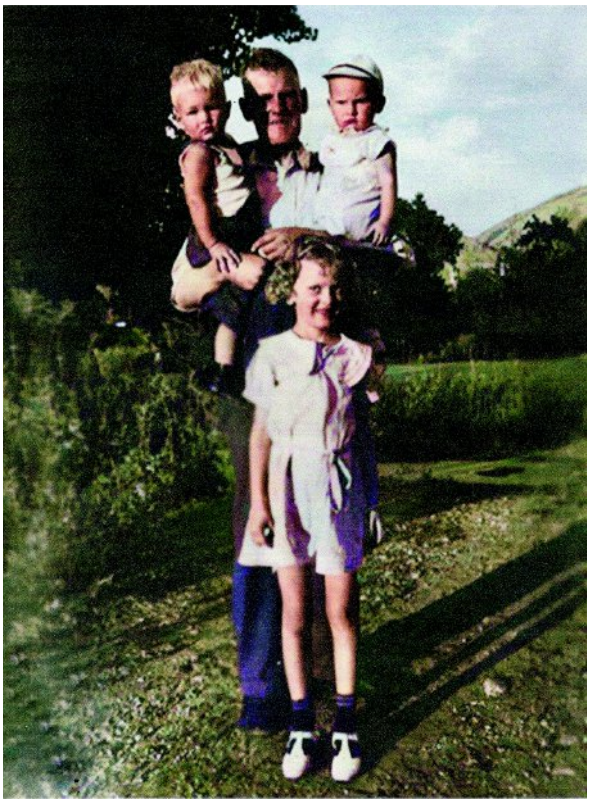
Dr. Felt: "I will do the whole thing for $150 including two follow up visits. He will be in the hospital about three days at $20 per day plus $25 for the operating room. So figure about $235 for everything."

How far we've come!

So a day or two after school was out in the spring of 1950 I had surgery for that hernia. I still have about a four inch scar on the left side of my lower abdomen. The anesthesia used was ether, which was administered through a mask over my nose and mouth. It took about ten days to recover so I could walk fully erect again. I played baseball all summer but my parents talked me out of going out for football in the ninth grade. They were worried that I would 'rupture' myself again. I probably wouldn't have been very good at it. I was tall and thin and only weighed 165 lbs when I graduated from high school. But I could catch a ball pretty well, so maybe if I had added twenty pounds of muscle I might have been ok as a tight end.

Smoking Caffeine

Through my youth years I stayed very close to my cousin, Gary Quinney. His mother was my dad's sister. They lived in Montpelier, Idaho which is about 100 miles from Brigham City. We tried to spend a week or two together each summer. Either I would travel to Montpelier or he would come to Brigham City, and then anything was worth trying. One year when he was staying with me in Brigham we decided we needed to learn to smoke, so we



My cousin Gary and I with Grandpa Anderson and his youngest daughter, Aunt Jeannine. We were his oldest grandsons. 1939.

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carved ourselves pipes out of dried corn cobs. For the stem we used a hollowed out reed. Now what do we do for tobacco? My parents didn't smoke and the stores would never sell us Bull Durham or Prince Albert tobacco. Well, tobacco and raw coffee look a lot alike, and grocers would sell coffee to minors. Besides, coffee smells good and would probably smoke pleasantly as well.

One day when both Gary and his parents were in town it was decided we would have an outing and dinner in a campground up Box Elder Canyon. Gary and I told them we would walk up ahead of time and fish the stream that ran down the canyon. So with fishing gear in hand we left for the canyon, stopping first at Ken Jensen's Market to buy a can of Folgers Coffee. Well, we were so anxious to test our smoking hypothesis that we couldn't wait to even get to the canyon. As soon as we reached the edge of town we got out our pipes, opened the can of coffee, loaded our pipes and lit up.

It was summer and there was a lot of dry grass where we were lighting up. One of us dropped a burning match (probably me) and a small clump of grass caught fire. We immediately tried to stomp it out but to no avail. In just seconds the fire circle was about ten foot in diameter and we were losing the battle. A couple of passing cars saw the smoke and we quickly got some help. Then we heard the fire alarm in the city go off and just minutes later the fire truck and crew arrived. Fortunately, with the folks that stopped to help we had the fire out and were greatly relieved.

The chief of the fire crew asked if we were trying to build a campfire. We responded, "Yes, that is what we were trying to do alright." We got a good lecture on dry grass not being suitable for a campfire. We assured them that it would never happen again. As soon as we reached the river the coffee can was emptied. I wonder if the fish downstream got hooked on caffeine. We finished our hike to the campground and awaited our fate when our parents arrived. As it turned out, they had heard the alarm but didn't think it was us. We had a hard time convincing them that it was us, so there were very few repercussions. It had a big impact on both Gary and me. Neither smoking nor coffee belonged in our future.

The Firecracker Run for the Border

The summer when Gary and I were both fourteen, I stayed a few days in Montpelier with him. At that time, Idaho kids could get a daytime drivers license at fourteen. Gary had his license and had access to an old Hudson (circa 1934) to drive around in. We decided one day to drive to a spot on the road called Border, Wyoming. There was nothing there except a small store that sold stuff that

wasn't available in Idaho. For us, the special contraband was very potent firecrackers.

There was one problem—the radiator in the Hudson leaked. No problem, the road to the border ran along the Bear River, so we carried a two quart bottle and would stop every few miles, run down to the river, fill the bottle, add the water to the radiator and continue the run. It must have been quite a sight—two little boys that could barely see over the dashboard herding this big old Hudson down the road, with frequent stops to get water from the river.

HIGH SCHOOL AND THE THEATER

Technically, senior high school started with the tenth grade. For me that was the school year of 1952 and 1953.

That fall I got a job at the Roxy Theater, even though I was still fifteen. I started out as an usher and ticket taker. The Roxy was a classical, single auditorium, sit-down theater. It would seat about 300 people and had a viewing screen about 25 ft wide by 15 ft high. While I worked there, movie technology advanced to widescreen and some three dimensional movies so the screen was replaced by a curved one that was about 30 ft by 20 ft.

I mention that because I had undertaken a very full day. I would get up at 5:00 to pass my paper route by 7:00, hurry home to eat and be to school by 9:00. At 3:30 school was out and many days I had to collect for papers and then be to work at the Roxy from 6:00 until 9:00 pm. It was a very long day for a 15 year old.

Twice a week I would change the marquee letters and the window posters on the front of the theater. That took about an hour and was mostly done on a ladder. It was a miserable job on cold winter nights as it had to be done after 9:00 pm.

When I turned 16 I trained to be a projectionist. I projected movies on weekends from then until a few months after Moonyeen and I were married and had moved to Logan, almost six year altogether. I projected some great movies over that time—The Caine Mutiny, The Ten Commandments, From Here to Eternity, The Greatest Show on Earth, Rear Window, the Abbott and Costello Series, and the Martin and Lewis Series, to name a few.

HIGH SCHOOL CLASSES AND GRADES

In my sophomore year I took Plain Geometry, English, Biology, Seminary,

Roxy Theater in Brigham City where I was a projectionist from 1953 to 1958.

Physical Education and Typing. It was a pretty easy year and I think I remember getting A's and B's. My favorite class that year was English.

In my junior year I took Algebra and Trigonometry, English, American History, Physical Education, Chemistry, and Seminary. My favorite was the math class; my least favorite was American History as I didn't get along very well with the teacher. My Seminary Teacher was a young Boyd K. Packer who later became an Apostle and President of the Quorum of The Twelve Apostles. During my junior year I had my jobs, a car, and girl friends, so I didn't do as well in school, mostly B's and some C's.

I did better my senior year. I took College Algebra and Analytical Geometry, Physics, English, Mechanical Drawing and Electronics/Radio. I only took five classes and reserved one hour each day for study time in the library. That gave me a chance for better grades and put me under a little less pressure. My grades were better, mostly A's and B's. I enjoyed all the classes and made the clear decision to major in Electrical Engineering in college.

Let me comment here on some additional work I found in my senior year. That year after winter was over, I turned my paper route over to my brother, Kent.

My math teacher was one of my all-time favorites. His name was William H. Griffiths, or "Griff" as he was known to his math boys. There were about twenty of us that took every math class that Griff taught. It was an all male class, as fields like engineering were considered purely masculine at that time. The jokes told and language used was all boy. Most of us did go on to become engineers and scientists with many earning advanced degrees and enjoying rewarding and successful careers.

In the spring of my senior year, Griff offered me a job assisting him as an assistant surveyor. The other assistant was Lester A. (LA) Richardson, my high school physics teacher. Griff also held the elected office of county engineer and did all the surveying work for roads, canals and building sites. When we would go out on surveys, Griff would run the transit and the level while Lester and I would man the chain, hold the calibrated rod and drive the stakes. We would discuss the survey results, estimate the fill and cut requirements and estimate project times and costs. They would have me check the arithmetic and climb the difficult terrain. I learned a lot and loved every minute of it.

In 1955 I received my high school diploma. I was offered no scholarships and received no rewards or special recognition. I was just an average kid that wanted to go on to college with modest hope for a decent future, but also one that knew how to work hard when it was needed.

High School Dating and Romances

In the spring of 1953 when I was still 15, I bought my first car. I bought it from Hansen Motors in Montpelier, Idaho. My uncle, George Quinney (Gary's father), worked for them and he arranged the sale. It was a 1946 Chevrolet Fleetmaster. It was a good sized car and it could easily fit four dating teenage couples—two couples in the front seat and two in the back. We all loved the coziness. The car had a 'three on the tree' manual transmission, an 85-horsepower straight six engine that could just barely get the car up to 72 miles per hour. It was blue and white to which I added red fender skirts. I named it the Roaming Rocket and I loved it. Especially since it opened up a whole new world for me—dating!

She Took Her Glasses Off

My friend, Jerry Valentine, had a cousin that lived in the little farm town of Bothwell, Utah. She had several friends (girls, of course) that also lived in Bothwell. She had arranged for three of my friends to meet three of her friends for a sort of friendly pairing off. She chose to pair with another of Jerry's friends. This was the summer of 1953 and I had just gotten my driver's license and I had a car. My friends were anxious to have me join in on their arrangement since I had a means of getting us all to Bothwell which was some twenty miles from Brigham. But to interest me they had to find another girl. Well, they did! She was a year older than the other girls and the same age as me. A date was arranged and four of us took four girls to a movie.

The girl they picked for me was an attractive blond. She wore large glasses with plastic rims. She seemed a little older than her age and had obviously dated before. She had applied a very alluring perfume before our date and leaned close to me during the movie. We held hands during the movie and it seemed we both liked that.

After the movie we rode around for a while and then decided to go visit an old abandoned farm house that was alleged to be haunted. While we sat in the car talking, all eight of us, it got kind of quiet and then my date took her glasses off. It quickly occurred to me that a somewhat experienced girl would

only take her glasses off at a time like that if she expected to be kissed. Well, who was I to frustrate her expectations? I was right in my conclusion and she seemed pleased with my response. We tried it a few more times and then all decided it was time to take the girls to their homes. I was hooked. I liked dating. I liked girls. I even thought I was in love. We dated a few more times and while I think she did like me, she was also dating others and took her glasses off then as well. I decided to move on.

A Steady Girlfriend

I next started dating a girl named Mary. She was from Tremonton where her father owned the local telephone company. She was primarily of Italian ancestry. She was an A student, very athletic, a little stocky in build with a cute smile and dark impish eyes. She was fun to be with and I dated her regularly for about a year. We exchanged nice Christmas and birthday gifts. Since we lived some twenty miles apart and since I worked we could only manage about one date per week.

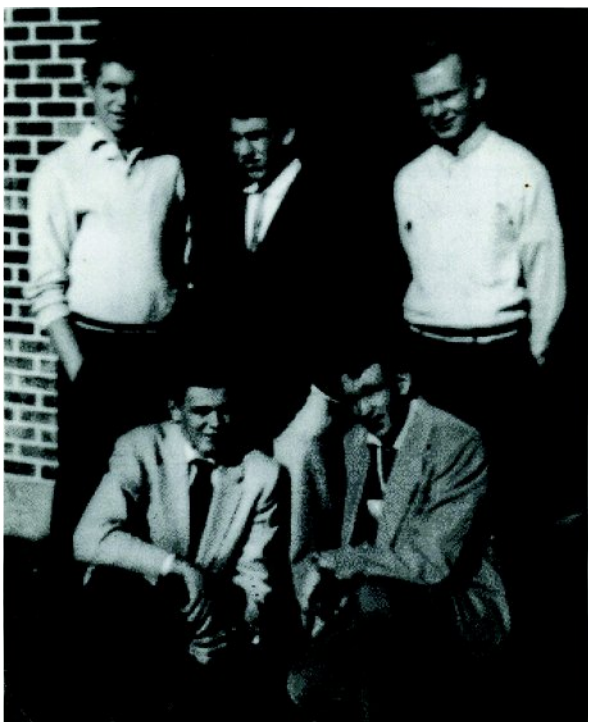
Dating was a very big thing when and where I went to high school. If you didn't have a dependable dating partner, you were considered a loser. The norm was a date per week and it was easy to get down on yourself if it didn't happen. Mary was a reliable date and we enjoyed our time together. We usually dated with one or more other couples. We would go to high school ball games and dances, to movies, swimming and skating at Crystal Springs and sometimes to church. Everything was pretty safe—even the movies were free of sex scenes and bad language. Mary was not a member of my church but I understand that she did join later in life. I never, at this stage, thought in terms of marriage and we never discussed it. The fall of my senior year we started to drift apart. I dated other girls and she started dating a guy that I wouldn't want my sister to choose. We broke it off and went our own ways. She did marry that guy but I am told it didn't go well.

Playing the Field

For the rest of my senior year, through the summer, and my first year of college, I dated many different girls. Names I remember include Shirlene, Ila, Beverly, Francine, Donna, Dorthy, Catherine, Elva, Elberta, Barbara, Donna Jean, Connie, and a few others whose names I can't remember. I enjoyed that period because it helped me with my confidence around women and gave me a better idea of what I would like in a wife when I felt the time had come to look seriously. I am very happy I chose to date regularly over several years and at various levels of commitment. I think it made me ready to recognize it when the right one came into my life. And the right one did come and at the right time!

Richard and his first car, the "Roaming Rocket", in 1954. The actual color of the fender skirts was bright red. This made the "Roaming Rocket" red, white and blue.

The 'Cool Cats' of the Second Ward. Back: Jerry Valentine, Hal Reeder, Richard Anderson; Front: Jerry Meservy, Lynn Reeder. Circa 1954!



College Days
Becoming an Aggie

In the fall of 1955, I enrolled at Utah State Agriculture College and declared Electrical Engineering as my major. I quickly learned that I had chosen the most demanding major that Utah State offered. I was more than a little concerned that my high school extra curricular working and dating might put me at a disadvantage in such a rigorous major. Electrical Engineering then required 216 credit hours over 12 quarters or 18 credit hours each quarter to graduate. And, all but about 30 of 216 credit hours covered very difficult technical subjects. To make matters worse, I still had to work weekends and for the first month I also worked the night shift at the Perry Cannery. I commuted from Brigham to Logan each day with Randall Jensen, Wallace Bunnell, Paul Siggard and Masayoshi Sumida. We each drove one day a week.

About December 1st it started to be very wintery and it was hard to get over the mountains to Logan, so most of us joined with some other male students from Brigham and boarded with a family in Logan, the Hubbards. My most difficult class that first quarter was chemistry. The quarter ended at Christmas time and I actually did ok, escaping with a B+ average. We stayed with the Hubbards through winter quarter and then commuted again in the spring. I dated infrequently that year as study demand was much higher than high school and weekend work pulled me away from most college activities. I did manage to hold my grades above a B so I was pretty much on track heading into my second year.

My second year at Utah State, I, along with three of my friends, Jerry Valentine, Paul Siggard, and John Willie, decided to rent an apartment in Logan rather than commute from Brigham each day. We rented two upstairs rooms and a bathroom in an older home on Logan's west side. One of the rooms held two double beds where we slept, two to a bed. The other room was modified to be a kitchen. I know that would be unthought of today but we were all secure in our manhood so there was never a problem. Just stay on your own side of the bed and no farting. The cost was $40 per month or $10 each. We bought

a few groceries, brought some bottled fruit and other items from home and lived pretty cheaply. I would add that we all, pretty much, financed our own education.

While I'm on the subject of financing, let me write a bit about summer jobs through high school and college. I have already written about my year-round jobs with the paper route and the theater. My approach in the summers was: if there was an available job, I took it. In high school it was mostly farm work. I picked cherries, peaches, apricots, tomatoes and cantaloupes. I thinned peaches, hauled hay, thinned sugar beets, topped sugar beets and irrigated fields and orchards. I would keep my name with the Utah State Employment Office in Brigham. That got me a lot of short term jobs in construction such as mixing mortar and helping set tile.

In my later high school summers I worked at the Perry Cannery. They canned peas, carrots, tomatoes, peaches and pie cherries. The boss there was a big tall man named Valroy (Valey) Christensen. He was always coming by the work area to make sure we were working hard and fast. I think he liked me and in time he let me take over some of the supervision tasks. I learned how to say, "Get your hind end in gear!" with plenty of emphasis. I probably wasn't the most popular guy in the warehouse. The jobs helped a lot and I learned a lot from the experiences.

My second year courses were the advanced math series, physics, electricity and magnetism and basic electronics. I enjoyed all my classes and my grades improved markedly over my freshman year. I also took Military Science and Tactics, also known as Army ROTC. Utah State was a land grant college so all male students were required, by law, to be registered for the draft and to take two years of ROTC unless they were veterans or in some branch of the military reserve. We were issued a uniform and an M1 rifle and provided a locker for our weapon. We had two classes each week and then either two hours of marching drill or weapon training if the weather was bad. I actually enjoyed it and did quite well. We worked through student ranks starting as a private and adding rank if we did well. The top rank a sophomore could obtain was Platoon Sergeant which I made during that year. I was gaining a lot of confidence that I would be able to finish the engineering program and have good career options. Maybe it was time to start looking more seriously for a helpmate.

In the spring of that year my roommates John and Jerry went back to commuting so Paul and I moved into a different apartment with Dean Olsen and Stan Shelby. They were a little older than us and had both served in the military. They had been trained to keep their quarters meticulously clean and orderly so it was new rules for Paul and me. We still went home for weekends but we had to leave things spic and span for when we got back Sunday night. On Friday afternoon the floors were mopped, the shower scrubbed, the toilet cleaned, cabinets wiped down, bedding washed, and refrigerator cleaned out before we could leave. But we got used to it and actually appreciated the discipline.

One of the nice things at Utah State was the LDS Institute of Religion. I enjoyed classes there which I usually took during lunch hour as the teachers were kind enough to let us eat our lunch during class. Even more I enjoyed Tuesday night MIA which featured dancing after the classes. I had been dating a girl named Marge but it had pretty much wound down so I was pretty much out of date options.

During the midterm week of spring quarter, Dean, Paul and I had decided to stay home that night and study for our mid-term exams. Stan was going to MIA and the dance. Well, about the time for the dancing to

start, we got a call from Stan: "Hey! You guys don't know what you're missing. The place is crawling with girls. You need to get up here!"

A fast shower and shave, splash on the Old Spice and we were off to the Institute. When we got there, the place was virtually empty—one person playing records and two couples dancing. That was all, no Stan, of course. "Boy, are we going to kill that guy when we get home." That was when I decided, "Hey! I didn't come all the way here to not even dance one dance!"

Resolved, I looked at the two dancing couples and recognized that the one girl had been in a class with me so I decided to cut in there. When the guy saw me coming he figured my intent and swirled her gracefully away. So, what the heck? I just turned quickly to the other couple and tapped that guy on the shoulder. That was very normal then and he obligingly turned the young lady over to me. We introduced ourselves and finished the dance. It turned out to be the last dance of the night so I asked her if she needed a ride home. She accepted my offer and we four got in one car and then dropped her off at her home about four blocks from the Institute.

Every year in those days, Utah State had a big invitation event to attract high school seniors. It was called Agathon. Each department had displays, the ROTC had people recruiting, there was a regional high school track meet, free Aggie ice cream, and it was capped off with a very nice dance on Friday night. The dance usually featured a top dance band like Les Brown or a vocal group like The Four Freshmen. It was always a wonderful evening. Well, Agathon was coming up and I didn't have a date. Hey, I thought, the girl that I danced with the other night was quite good looking and seemed very nice. I wonder if she would go to the Agathon dance with me.

MARCHING IN PLACE, A STEP IN TIME OR WAS IT STALKING?

My problem was I couldn't even remember her name. Finally I recalled that her last name was Rigby and she had a very strange first name. Maybe that was enough information to locate her. So, I went to the large student records files in Old Main. Those records were open then. I went to the Rs, then found the Rigbys and then went record card by record card until I found a strange name: M O O N Y E E N. How in the world do you pronounce that? No matter; the file also included her class list and classroom number. I saw that on that day, her last class was in the classroom at the south end of Old Main. So I hatched a plot. I would just happen to be walking by the classroom when she came out and started down the hall. At the appropriate time I went to the south door of Old Main and waited for the bell to ring. Then I slowly walked in place until she finally emerged from the class room. Then I picked up the pace and walked up beside her.

"Oh, hello! Fancy meeting you here!"

"Oh, hello!" she replied.

"Do you have another class today?" I already knew the answer.

"No, I am on my way home."

"May I walk you there?"

"Sure!"

My little scheme had worked. On the way home I asked her if she would go to the Agathon Dance with me. She said she would and our lives were on a new path that we both believe was more than an accidental consequence of a dirty little prank phone call.

The Agathon dance was wonderful. I quickly learned that she was a marvelous dancer and very fun to be with. When I dropped her off at her apartment in the basement of a home on 600 North, we closed a wonderful evening off with the best part of the night. We shared one short sweet kiss.

Courtship, Marriage, and Graduations

After our first big date we continued to see each other on a regular basis. She continued her classes in Sociology and Social Work and I did the same in Engineering. Whenever I could, I would give her a ride home from school. However, summer was coming and she would probably be returning home to Wyoming. I was afraid that our relationship was too brief to last three months of separation. My fears were soon abated when I learned that she had decided to stay in Logan for the summer and attend summer school. She did go home for a couple of weeks but we kept in touch with a couple of letters.

That summer while she took classes at Utah State, I joined a construction crew that was laying an oiled road from a location near Promontory, Utah to a place called Little Valley on the peninsula in the Great Salt Lake. There had been a railroad track called the Lucin Cutoff across the lake. The fill under the rails had failed in a big storm in the early 1950s. Little Valley was created for temporary home sites for construction workers engaged in rebuilding a new and stronger rail line across the lake. Initially only a dirt road led to the peninsula construction site and it could be impassable in wet or winter weather. It was hard dirty work for me but the pay was good. With my night job at the theater, I could save money that I secretly hoped would buy wedding rings if things developed as I hoped they would.

Even with the hard work schedule, I made every effort to get to Logan for a date each weekend. Depending on the day we would either go to church, as Moonyeen was the ward organist, or we would see a movie if it wasn't Sunday. Driving back to Brigham after our date was always a problem since I would be very sleepy from my intense work schedule, but I survived and it was worth it. We had one very nice date that summer. Over one of the July holidays we went to a dance and show at Lagoon, an entertainment park north of Salt Lake City. There we enjoyed the incomparable music and singing of the great Louis Armstrong. He and his band had recently been in a movie, titled *High Society*, which also featured Grace Kelly. The

Moonyeen in a Jitterbug dance contest in 1957—but not with me.

Moonyeen about 1957.

musicians with Louis were the same ones in the movie. You can probably still see it on a classical movie channel.

Look What Followed Me Home

As the summer of 1957 came to a close, Moonyeen wanted to go home for a visit before she started her senior year. She also saw this as the time to take her new friend home to meet her family. My family had already met her and they loved her. So, the week before school started I drove her to Alta, Wyoming for her to visit and me to meet her family. I am sure that they wondered about me. However, I was a bit taken back by her brothers Billy and Lawrence's tussles. My most vivid recollection was the two of them wrestling in the bathroom and Billy pushing Lawrence's head into the toilet bowl.

School had already started in Teton Valley so I didn't see much more of her siblings. I think Billy was getting ready for his second year at Ricks College. Sandra was the most

quiet of the family, but she was excited to be starting her senior year at Teton High. Toni was her fun-loving self, active in everything and blessed with a strong, deep voice that didn't seem to fit a little girl, but it definitely fit her personality. I recall that Lawrence was trying out for football but it seems that wrestling was his real forte. I could see that they were a very good family, not endowed with much wealth, but clearly, Ross and Geneva would do anything for their children. I was also impressed that Geneva's mother, Mette Hansen, lived in a small house the family had built a few feet from the Rigby home. She had suffered a stroke years before and needed help with almost everything she did. Ross and Geneva provided her total care for over sixteen years. They were a great example of a cohesive, nurturing, God-fearing family.

Our next visit to Wyoming was for Thanksgiving. That was when I didn't fit in so well. Ski season was in full swing and I hadn't taken up skiing yet. I was also poorly dressed for Teton Valley winters. My car didn't have tires to match the roads there so I was pretty well tied to whatever the family was doing. It was getting to crunch time in the first quarter of my third year in the Engineering program. Since I still worked weekends, I couldn't afford to let any time be spent in idle activities. So my studies went with me. When there wasn't much going on, I studied. Moonyeen and her siblings went skiing at a place called Big Piney. I went with them. There wasn't much for me to do there so I sat in the small lodge or else their car and studied. I knew by then that I would want to go to graduate school after I graduated with my BSEE, so I wanted to have grades to get me there. After that visit I know the family wondered about me. Was I a person or just an oversized slide rule? I think Moonyeen kind of wondered herself.

That fall was also complicated by a severe influenza epidemic, the Asian Flu!

Moonyeen and I both contracted it and were pretty sick. Working in the Animal Science Department, she was able to get a penicillin shot, even if it was with a big cow needle. But for me, cough, sneeze, ache, puke and diarrhea! In December things were fine for both of us so I took my summer road construction earnings and bought her a diamond engagement and wedding ring set. I presented them the night of the College Christmas Dance along with a bended-knee proposal of marriage. She accepted and we

Moonyeen and I when we were dating.

were formally engaged.

On the way home to Brigham after the dance I was at ease but very sleepy. While driving through Sardine Canyon I observed the headlights of a car coming toward me. I closed my eyes for a second and actually dozed a bit. When I opened my eyes I was shocked that the lights were no longer there. Had I passed the oncoming car while asleep? After several more feet I realized that I hadn't. The approaching car had gone off the road and was at the bottom of a gully. Apparently the driver of that car had been even more sleepy. I stopped, hiked down through the snow and cleared the car door so they could get out. It was a young couple with three small children. The father got out and the two of us carried the children up the embankment and put them in my car. The parents climbed in and I drove them to the state road sheds at the top of the pass. It was warm there and the night crew called some of their family to come pick them up. It was almost sunrise by the time I got to my parents' home in Brigham. I didn't get sleepy again for several hours. Moonyeen went home for Christmas and probably got some static for accepting my proposal, but I think they resolved themselves that their sister would be Mrs. Anderson. She returned to Logan just in time to go to a New Year's dance. I was glad that she hadn't changed her mind.

Moonyeen's graduation from Utah State. June 7, 1958

The rest of the school year went by in a hurry. Moonyeen had her job in the Animal Science Department, mainly cleaning and sanitizing test tubes and vaccination equipment. Whenever I could, I would pick her up after work and give her a ride home. We both did well in our classes. After my sophomore year I had expected to go into advanced ROTC and accept an officer commission in the Army. Because of the full load requirement of Electrical Engineering, I would have to take another year if I went that route. Things were pretty quiet that summer so I decided the risk of being drafted was low so I put off ROTC and loaded up fully on my third year engineering program. Then I could take my senior program plus advanced ROTC over the last two years and also take some graduate courses toward a master's degree. It was a good decision to focus on my engineering program, as I would later learn.

On June 7, 1958, Moonyeen graduated from Utah State with a Bachelor's Degree in Social Work. Her mom came to her graduation ceremony and then Moonyeen rode with her mother back to Alta for last minute preparations for a wedding—hers!

On June 9, I drove to Alta and stayed the night in the boys' bedroom. Early the next morning, June 10, 1958, we drove from Alta

to Idaho Falls where both of us, together with members of her family and my family, went through a full temple ceremony where we received our endowments. After that we were sealed together for time and all eternity in the Idaho Falls Temple. President Alberto Choules, who had been Moonyeen's Stake President, administered the sealing ordinance. After that we went to Moonyeen's Uncle Charles and Aunt Mary Jane Rigby's for a very nice wedding lunch, then back to Alta for a reception in the church cultural hall. We had many guests, including my college roommates who made the long journey to support us. After the reception we drove to Rexberg where we spent our wedding night. No more details will be provided but it was the culmination of a long and wonderful day.

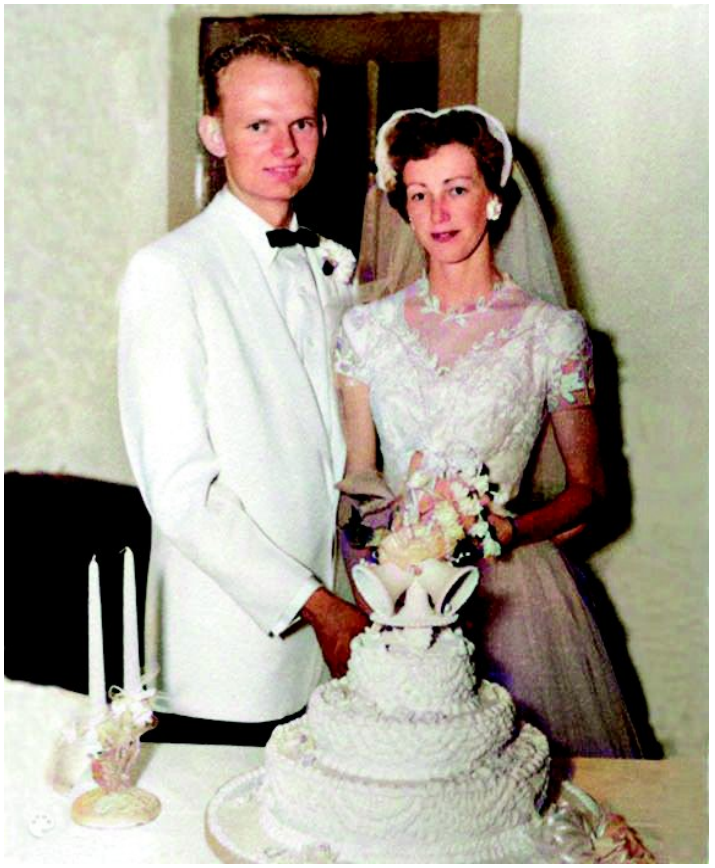
Married Life

The next day we started out on our honeymoon. Our plan was to drive north to Glacier National Park which straddles the Canadian and Montana border. The first night we stayed in Yellowstone National Park. We saw a lot of bears that seemed to be quite hungry after the long winter hibernation. The next day we continued north taking the Cooke City Highway to Cooke City, Montana. It was a beautiful drive and we enjoyed a night's stay there. I might add that these places are at high altitude and it can still be very cold in mid-June. All the better for cuddling, my dear! After Cooke City we drove to Billings and stayed there for a couple of nights. While there we visited Moonyeen's Uncle Noel and Aunt Mary who lived there with their two daughters, Mary Margaret and Elsa. We also started to reflect on our financial situation. 1958 was a recession year and neither of us had jobs for the summer. We figured it would be just as nice to honeymoon in the little apartment we had rented in Brigham City. So we decided we could see Glacier Park another time and get back to Brigham. We did drive down through Yellowstone and Jackson Hole and then over Teton Pass to Alta. We loaded the car with as many wedding gifts as we could and headed to Brigham to look for work.

We were able to find jobs for each of us that weren't too great for honeymooning. Mooneen got a job as a telephone operator working the 3:00 to 11:00 pm shift. I got the job running the pea viner in Harper Ward north of Brigham City. Farmers cut their peas in the evening after sundown. At 12:00 am the viner would start accepting the peas and proceed to separate the peas from the vines and the shells. My job was to open the viner, start it running, and manage accepting, weighing and issuing receipt tags to the farmers. The viner stayed open until about 8:00 am when the truckers came and hauled the peas to the cannery. After that, the viner had to be thoroughly cleaned and closed down until the next night. I usually got home just in time to take Moonyeen to work. Then I would sleep until time to pick her up from work at 11:00 pm and then off to start the viner again. Maybe we should have stayed in Montana.

But better jobs were on their way. After the pea harvest was over, I got a job with a State Road engineering crew. The job was in Cache Valley and consisted mostly of surveying and marking for construction of an asphalt-paved road up Blacksmith Fork Canyon. The new road would run from Hyrum to Hardware Ranch. It was our job to mark turning points, center lines and set cut and fill stakes. We also marked brush and trees for removal or trimming and tested concrete in bridges as they were constructed. It was outdoor work in a beautiful canyon at a very slow pace. We would arrive at the office in Logan at about 8:00 and organize our materials for the day. At about 9:00 we would start for the job site but only after a stop at a donut shop for coffee or chocolate with donuts.

At about 10:00 we would get to the job site where discussion would be held with the



Our Wedding Day
June 10, 1958

Wedding reception with parents.

foreman and crew, usually covering subjects I won't comment on here, then maybe an hour and a half of real work before lunch. Lunch took about half an hour and then the card deck came out for about an hour of playing a game called 'Solo'. Then back to work for about two hours, and it was then time to head back to the office to turn in our report and put the equipment away. No wonder it's hard to get people to quit government jobs. And the pay is pretty good to boot. When it came time for the public schools to start, Moonyeen was offered a teaching job at Bunderson Elementary School in Brigham where she taught second grade. I started my senior year in Electrical Engineering at Utah State.

About Christmas time we decided to move to Logan. We rented a small four-room house on the 'Island'. The rent was $40 per month and we had to pay for electricity and oil for the one little heater that supplied heat for the whole house. Shortly after the move to Logan, Moonyeen realized she was pregnant. It was good to be in Logan where I was given a job at the University correcting homework and grading tests of sophomore and junior Engineering students. It did mean that Moonyeen had to join a carpool to get to the school in Brigham. I also worked the Christmas holidays on a University-contracted upper air research project.

In January I started interviewing for jobs after graduation. One of the companies that I interviewed was Hewlett Packard, a small Palo Alto company that produced very high quality electronic test equipment. The man that interviewed me was named Bruce Wholey. We seemed to get along well and I received an offer to fly to California for a much more intensive interview. In February I made the flight, my first time on an airplane. It was on a propeller-driven DC3 operated by United Airlines. Shortly after my trip there I received an offer to work at HP for $425 per month plus a production bonus that might take my salary

Graduating USU, 1959.
Debbie is present but not visible.

to $565 per month. I promptly accepted the offer with plans to join the company in June. It is interesting that some years later I accepted the job that Bruce Wholey had held for many years.

In June of 1959 I graduated from Utah State in Electrical Engineering. I had gotten almost all A's the last two years. So I felt ready to see if I could succeed as an engineer at a very highly respected electronics company. Meanwhile, Moonyeen had finished her year teaching school and we were ready to open a new chapter in our lives. We felt blessed that we had each other and could open the new chapter together. By now we knew that there would be at least three in this new adventure.

Starting Career and Family in California

The Monday after Richard graduated from Utah State, we loaded as much as we could into our little 1958 Fiat and headed west on US Highway 40. There was no Interstate 80 in 1959. Richard's brother Kent accompanied us to help with any move-in tasks. The trip took two days with a stay overnight in Winnemucca, Nevada. The next day we finished the drive to Palo Alto. The last part of the trip we took El Camino Real through some of the cities south of San Francisco. Moonyeen was close to depression when she saw how close the houses were. She felt better when we arrived in Palo Alto where lot sizes seemed much more reasonable. We stayed in a motel in Palo Alto that night.

The next day we went looking for an apartment to rent. We hoped to find a nice furnished apartment since we had no furniture. Palo Alto was impossible. There were very few rentals and the rent rates were much higher than we felt we could handle so we moved south to Mountain View. Mountain View had far more rentals but very few were furnished. The ones that were furnished catered to a poorer market and were grungy to say the least. Finally we found a new complex being built on Ednamary Way. The units were unfurnished but brand new. The complex also had two swimming pools, one just outside the building that we chose to live in. The rent was $115 per month, almost three times what we paid in Logan. Oh well, get used to high California prices.

But what do we do for furniture? The first night we slept on the floor with only a bit of bedding we brought with us in the Fiat. Moonyeen was seven months pregnant which made for an uncomfortable night. The next day we decided to go shopping to see what we could do for furniture. We ended up in the Montgomery Ward Department Store in Palo Alto. You can ask your grandmother what that was. After identifying a few pieces that we wanted to buy, I showed the finance manager a copy of my offer letter from Hewlett Packard. He knew HP very well and, on the strength of that letter, he agreed to extend us credit. We bought two kitchen chairs, a double bed, a chest of drawers, two bedside tables, a sofa

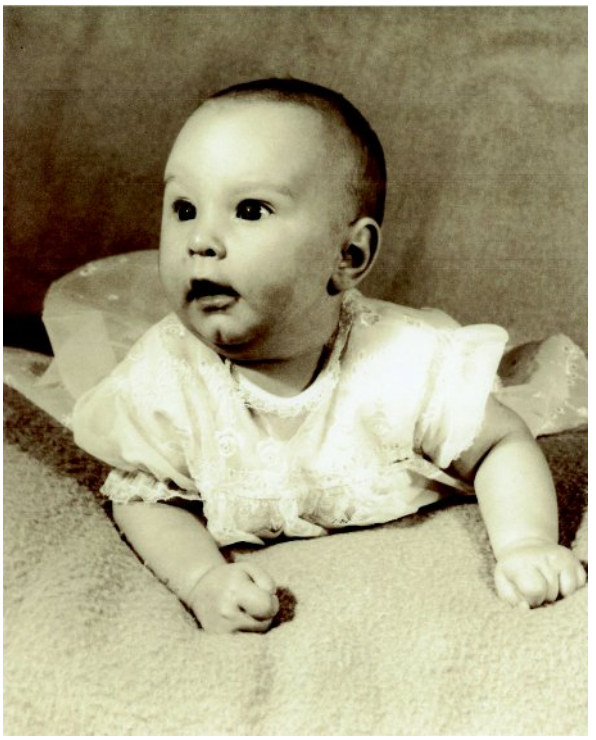
that could be opened to a bed, an end table and a table lamp. That was enough to get us going and was the last furniture we ever bought on time. As it turned out the apartment had a small, built-in kitchen table and one of our new neighbors gave us a rocking chair that they didn't need anymore. All the comforts of home. The first thing we looked up was the address of the closest LDS church. We went the first Sunday we were there and have rarely missed a Sunday since. Not until this year (2020) that is, with the Covid-19.

On June 10, 1959 I joined the Hewlett Packard Company as an Engineer Trainee. Hewlett Packard was in Palo Alto on Page Mill Road. Palo Alto is at the north end of Santa Clara County, now often referred to as Silicon Valley. There was no such identification at that time. There was a growing electronics industry in the area. The major players were Lockheed, Sylvania, Philco, Varian Associates, Ampex, Eitel McCullough, Litton Industries and, of course, Hewlett Packard. The dominant technology of all these companies was vacuum tubes. But, there was a really small company in Mountain View called Schockly Semiconductors. Change was coming.

My first training assignment at HP was testing HP 150A Oscilloscopes. From there I worked briefly in almost every part of the company. Dave Packard and Bill Hewlett wanted their engineers to really understand how the company worked. The training program lasted some six months and was a great learning experience for me. It didn't take me long to realize that I had joined an exceptional company formed by two outstanding leaders.

While I was still on the training program on August 17, 1959 I received a page on the company PA system. When I called the operator she told me to call home. Moonyeen was having labor pains and suggested that I hurry home. This I did and by the time I got there her water had broken, so we headed as fast as we could to the old Palo Alto Hospital. Her doctor was a Dr. Ted Hopkins. She had already called him to report her situation. It turned out, though, that he couldn't be there but his associate, Dr John D. Milburn lll, would be there to assist her. We arrived at the hospital and pulled into emergency at about 6:00 pm. The orderlies met us and helped her into a wheelchair and wheeled her into the delivery room. In what seemed like minutes Dr Milburn came into the waiting room carrying a beautiful baby girl that would be our Deborah. I was given a few minutes to see Moonyeen and was home fixing myself some dinner by 8:00 pm. Not too shabby for a first baby. It turns out that Dr. Milburn delivered all five of our children, as well as Debbie's first child, Tyler.

I continued with the training program until the Christmas holidays when I became



Debbie

Top: Debbie, Moonyeen, Grandma Rigby, Great-grandma Hansen. 1960.

Center: Debbie, Moonyeen, Grandpa Rigby, Great-grandma Rigby-Wilson. 1960.

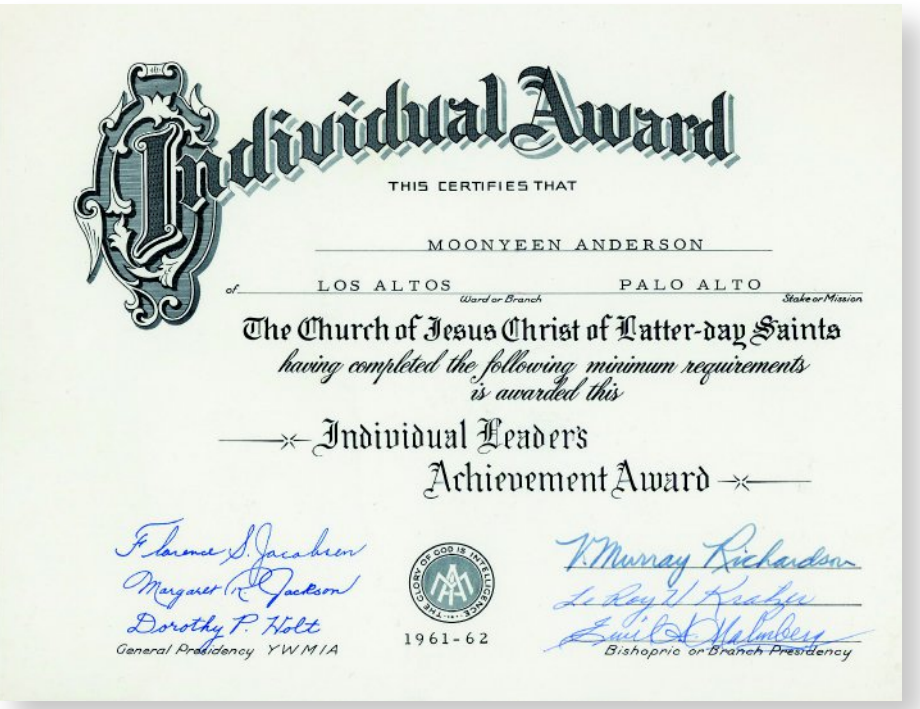
Bottom: Stanford Graduation, 1963.

eligible for one week of paid vacation. We decided to drive down to Los Angeles to visit relatives there and to go to Disneyland. Moonyeen had three uncles there and I had an uncle and aunt. It was a nice trip and Debbie seemed to enjoy Disneyland even though she was only four months old.

When we got back home I interviewed the various engineering department heads to see where I might fit best as a new engineer. At Utah State I had taken classes on electromagnetic theory, microwave devices, antennas, guided waves and transmission lines. I had also worked the Christmas before on measuring the characteristics of ionized patches in the upper air layers of the atmosphere. I was excited to learn that the HP Microwave Lab was undertaking a project to design a Microwave Spectrum Analyzer. I was even more excited when the project manager, Art Fong, asked me to join the team. I promptly joined and took all of the plans home every night to study and get up to speed on the project. I was assigned the microwave portion, probably based on my college emphasis. As the newest engineer on the project, I just focused on getting my part done and didn't try to add much to the other parts of the system. I continued in that mode for my first year on the project.

In the fall of 1960, we took our annual vacation with a car trip to Utah and Wyoming. We attended the temples in Idaho Falls and Salt Lake City, went fishing in the Tetons, enjoyed Peach Days in Brigham City and had nice visits with our families. When we got back to Mountain View, I started the next phase of my educational pursuits. I was approved by Hewlett Packard Management and Stanford University to enroll in the Engineering Department to seek a Master's Degree in Electrical Engineering. Since I would continue my job at HP it would take me three years to earn my MSEE from Stanford in 1963. HP would give me time off for classes but I had to keep my project work on schedule, which I did. I took a broad mix of classes and generally did quite well. In fact, I had a higher grade point average at Stanford than I did at Utah State. During all this time Moonyeen and I stayed very active in our church. I was ward financial clerk and she was the young women's president.

In February of 1961, we purchased our first home. It was a nice, three bedroom home on Arbor Avenue in the Country Club Area of Los Altos, California. We paid $23,500 for it and the previous owner carried a second



Individual Award

THIS CERTIFIES THAT

MOONYEEN ANDERSON

of LOS ALTOS (Ward or Branch) PALO ALTO (Stake or Mission)

The Church of Jesus Christ of Latter-day Saints

having completed the following minimum requirements

is awarded this

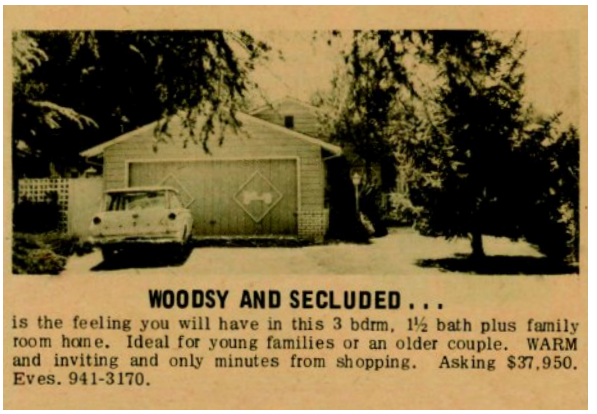
Individual Leader's Achievement Award

Florence S. Jacobsen
Margaret R. Jackson
Dorothy P. Holt
General Presidency YWMIA

THE GLORY OF GOD IS INTELLIGENCE

1961-62

V. Murray Richardson
LeRoy W. Kratzer
Emil A. Holmberg
Bishopric or Branch Presidency



WOODSY AND SECLUDED . . .

is the feeling you will have in this 3 bdrm, 1½ bath plus family room home. Ideal for young families or an older couple. WARM and inviting and only minutes from shopping. Asking $37,950. Eves. 941-3170.

Our first home in Los Altos. This is the newspaper ad we ran when we sold it.

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mortgage since we could only come up with $1,000 for a down payment. Later he agreed to discount the second by $600 if we could pay it off early. We refinanced the home with a larger loan at a slightly lower interest rate. We paid off the second mortgage so we now felt much more secure financially.

In July of that year, Moonyeen delivered our son, Richard Michael, on her 25th birthday, July 21, 1961. He was a handsome baby. Unfortunately he had to put up with a brace on his legs for the first couple of years. Mike was born in the brand new, beautiful Stanford Hospital. We were now a family of four, living in our own home in an exceptionally nice neighborhood with a good job and me pursuing a master's degree at one of the nations top universities. The Lord was truly blessing us.

On August 19, 1963, we had another major family event. Our daughter Rachelle was born. As had also been the case when Moonyeen was pregnant with Mike, she was the ward dance director. In both of those years, our stake participated in regional dance festivals. In 1963 it was held in Santa Rosa. It was a lot of work for Moonyeen. She taught the kids the dance steps, in spite of being conspicuously pregnant. At that time, I rode a bike to and from work at HP, about seven miles each way. The ride would have been much longer but for a commuter train line that ran from Los Gatos to San Francisco. It went through Los Altos along what is now Foothill Expressway. There was a dirt service road alongside the tracks on which I rode my bike. A few days before Rachelle was born, Moonyeen had the feeling that she was going into labor. I jumped on my bike and pedaled home as fast as I could. This happened several days, but, every time the symptoms had passed by the time I got home. So, no hospital trip that day. As I recall, I was home when the time came so we had plenty of time to get to El Camino Hospital. Dr. Milburn assisted in the delivery of our third child, a cute little girl with some very blond hair. We were now a family of five. Shortly after that, Moonyeen's mother and younger sister, Toni, flew to California to see the new arrival. While they were there, Moonyeen's Grandma Hansen passed away. Moonyeen's mother, by then in bad health herself, was so sad that she wasn't with her mother at the end.

In 1965 the Stork visited the Anderson household for the fourth time. On September 16, 1965 our third daughter was born. This would be our Suzette. She was a very pleasant and attractive baby. Moonyeen's mother had gone girl, boy, girl, boy, girl. Up to then, Moonyeen had gone girl, boy, girl. Maybe she was on the same track as her mother, but it wasn't to be. When Suzette was born her Grandmother Rigby was in the hospital in Salt Lake City. While Moonyeen was still in the hospital she called her mother to give her the news. Her mother's response was, "I knew you couldn't do it!"

That would be Moonyeen's last conversation with her mother. Mette Geneva Hansen Rigby passed away on September 24, 1965. Moonyeen was unable to go to her funeral, so I attended to represent our little family of six. Moonyeen's father asked me to dedicate her grave which I did. Her body has

Shellie

Mike

Sue

Tina

been at rest for over 55 years in the Tetonia, Idaho Cemetery.

I should add that my church calling during this time was teaching early morning seminary for the two wards that met in our church building. I enjoyed it very much and clearly learned more than the students. I taught for four years covering the Old Testament, New Testament, Church History and Book of Mormon. Class went from 6:30 to 7:30 am, five days a week. Then I went to work at HP, starting my work day at 8:00 am and usually running to 6:00 pm. Then after dinner I helped put the kids to bed and then prepared the next day's seminary lesson. It was a very rigorous schedule.

The Stork didn't visit again for almost nine long years, but then on May 9, 1974 he finally found our chimney. On that day our fifth child and our fourth daughter was born at Stanford Hospital. Yes, Dr. Milburn delivered the goods, for the fifth time. This was the first time that I was permitted in the delivery room. It was a very pleasant and sacred event. She was good sized and pretty as could be. We gave her the name of Kjirstina which we took from her Norwegian Great Great Grandmother, Kjerstianna Jonsdotter Ora.

Hewlett Packard

The Spectrum Analyzer Project

In the late fall of 1959, after a week's vacation, I joined a Hewlett Packard project team that was working on the company's first venture into spectrum analysis. At Utah State, I had taken classes on electromagnetic theory, microwave devices, antennas, guided waves and transmission lines. I had also worked the Christmas holidays before on a project to measure the spectral characteristics of ionized patches in the upper air layers of the atmosphere.

I was excited to learn that the HP Microwave Lab was undertaking a project to design a Microwave Spectrum Analyzer. I was even more excited when the project manager, Art Fong, asked me to join the team. I promptly signed up and took all of the plans home to study and get up to speed on the project. I was assigned the microwave portion, probably based on my college emphasis. As the newest engineer on the project, I just focused on getting my part done and didn't try to add much to the other parts of the system. I continued in that mode for my first year on the project.

In the fall of 1960 I was approved by Hewlett Packard Management and Stanford University to enroll in the College of Engineering to pursue a Master's Degree in Electrical Engineering. I took two classes each quarter and finished the program in 1963. I was given time off to take classes but was expected to keep my part of the project on schedule, which I did. I took a broad range of classes primarily in communications and information theory. I enjoyed it very much and did quite well.

In 1961 and extending into 1962, I started taking a much more expansive view of my engineering responsibilities. Fortunately, my supervisor, Art Fong, was very encouraging of the engineers working for him to extend their thinking. Art was one of only two Chinese American Engineers at Hewlett Packard. He had graduated in Engineering from the University of California at Berkeley and then joined the Research Lab at MIT where much of the early work developing radar was done

The Spectum Analyzer Team
Standing left to right: Ed Phillips, Jerry Boortz, Ed Hurd, Bill Hanish, Rich Bauhause, Richard Anderson, Dave Veteran, John Cardin, Roger Rauskolb, MacMcGrath, Ron Given
Seated left to right: George Jung, Harley Halverson, Art Fong, Howard Poulter

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during World War ll. Art was the natural choice to manage the spectrum analyzer project and most of the early design ideas were his and were very good.

After I had worked on the basic components for a little over a year, I saw a way to greatly increase the range of frequencies that the analyzer could present in a single display and to also greatly improve the speed with which a very large range of frequencies could be searched and analyzed. When I first presented my ideas to Art he said, "It sounds too good to be true." He then had me present it to the rest of the team and later to his manager. All were excited and said, "Let's go for it!" The project team worked hard to effect the necessary changes. The schedules were adjusted and the Hewlett Packard Spectrum Analyzer was on its way.

At that time Art added the system integration, performance testing and presentation analysis to my responsibilities. After a few months of hard work, the HP 851A/8551A Spectrum Analyzer was operational and ready for a limited showing in the spring of 1963. The special invited guests generally agreed that if we could meet the target specifications in production and make the whole instrument reliable that it would sell very well.

In the fall of 1963 we started showing it to a few potential customers. One of the first was the Army Fort Huachuca in Southern Arizona. Fort Huachuca was responsible for a great deal of Army research in communications, networking, radar and electronic countermeasures. Art Fong, a gentleman named Lyle Jevons and I made the trip. I presented the HP Spectrum Analyzer to a group of their technical people and demonstrated how it might help them better understand their research and design issues. After the presentation they asked how soon they could get one. Shortly thereafter we completed a pilot production run and began taking orders. I trained Lyle Jevons on the fine

HP Spectrum Analyzer - Block Diagram 4-18-61

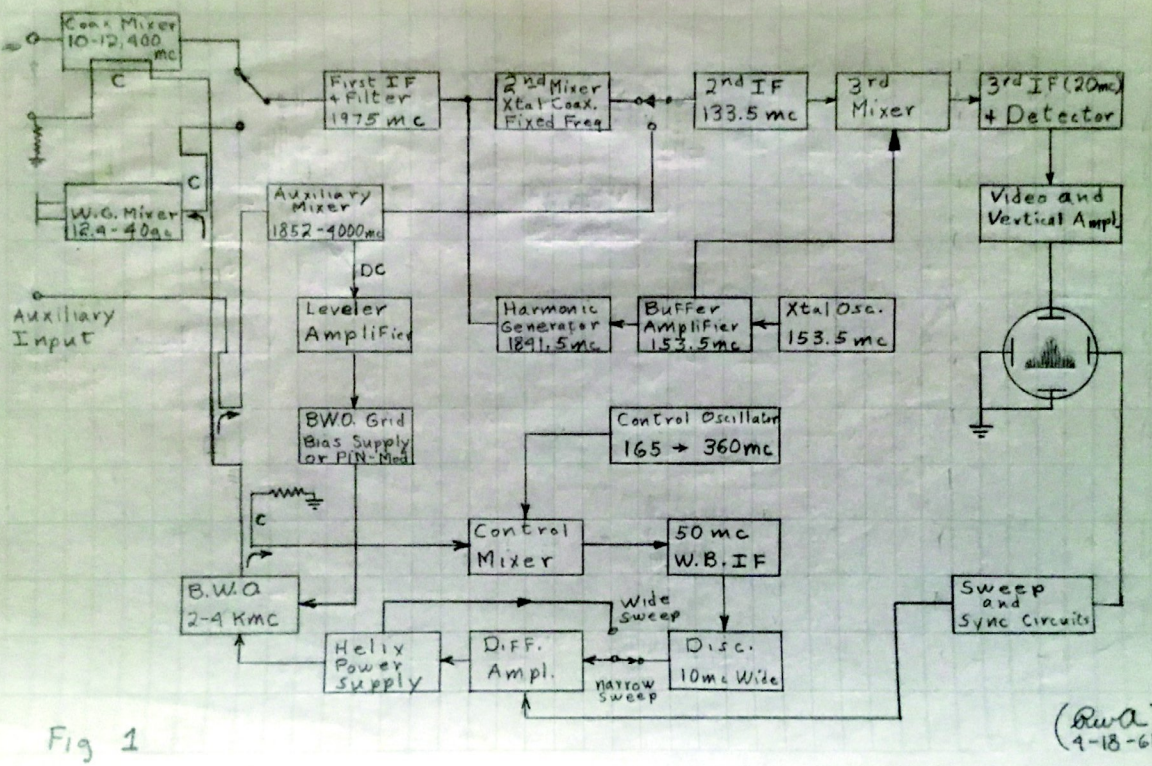

Fig 1

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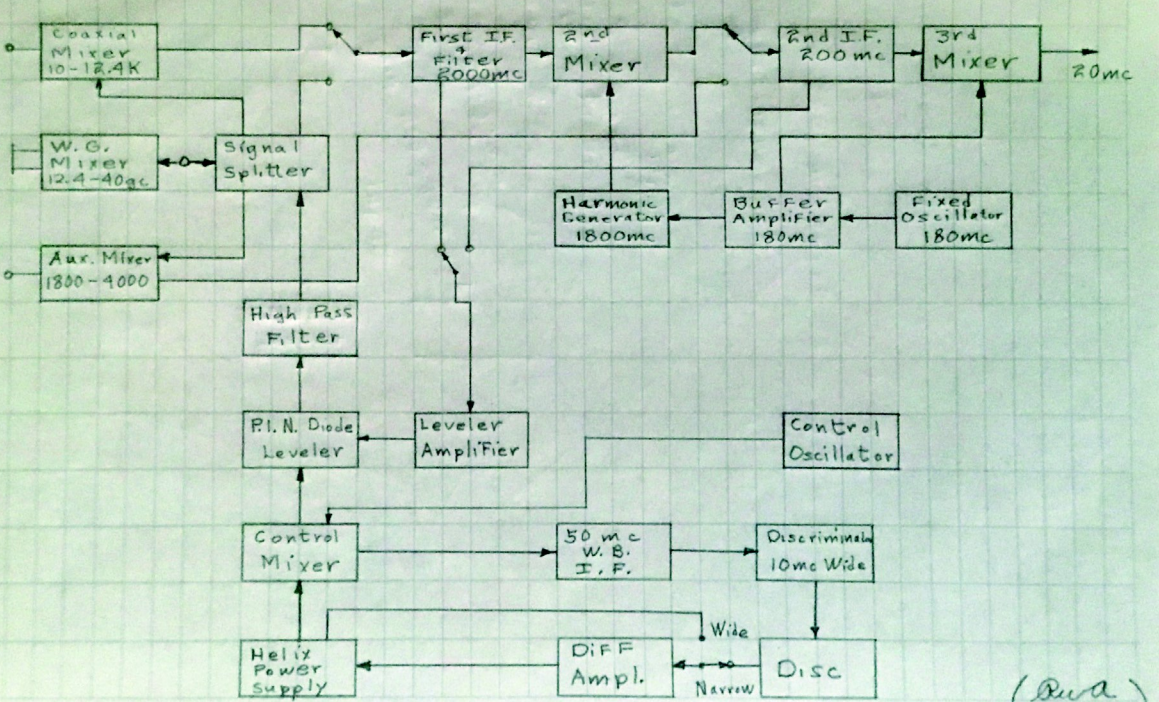
Spectrum Analyzer R.F. Section 4-9-62



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The HP 851A/8551A Spectrum Analyzer

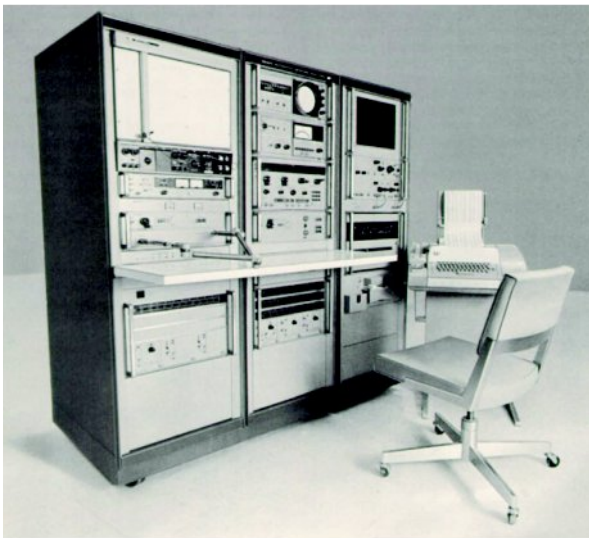
points of spectral analysis and he took one on a world introductory tour. Lyle traveled with it across the US and then to Europe over some six months. We could always tell where Lyle was by where orders were coming in from. The HP 851/8551A made a spectrum analyzer a 'must have' in every microwave and wireless engineering laboratory. HP quickly took about 90% of the market. It turned out to be HP's biggest revenue generator up to that point in time. I was also granted three key patents that helped HP retain a secure competitive position. A few of these original products are still in use after over 50 years since introduction. You might even be able to buy one on Ebay.

LOOKING FOR A NEW CHALLENGE

With my first engineering project behind me and completion of my master's degree I was at a decision point. My advisor at Stanford told me I would be welcome to enter the Stanford PhD program. Since my work on the Spectrum Analyzer was over, the Lab Manager, Howard Poulter, assigned me to some research projects. One was joint with a part of HP called HP Associates (HPA) that was chartered to develop specialized semiconductor devices. In 1962 a British Physicist named Ian Gunn working at IBM's Watson Lab discovered that applying a sufficiently high voltage to a semiconductor diode could cause the diode to emit radiation in the microwave frequency range. Diodes constructed for this purpose were called Gunn Diodes and the oscillatory radiation was called the Gunn effect.

After Gunn reported his work, engineers at HPA were able to duplicate the Gunn effect and construct some experimental diodes. The problem was keeping the diodes from destructive burning under such high impinged voltage. I obtained some sample diodes and mounted them on coin silver posts in a coaxial structure. I was able to sustain oscillations continuously and may have been the first person to do so. The HPA lab director that I worked with was Mohamed M. Atalla, known as Martin or John Atalla. He had worked at Bell Labs where he co-invented MOSFETS. It was a fun assignment for me but we didn't think Gunn Diodes were ready for prime time

The Automatic Network Analyzer



The HP 8542A Automatic Network Analyzer
Hewlett Packard Journal, February 1970, page 3
Courtesy of the Hewlett Packard Company

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so I left the project to pursue other ideas.

It turns out that there were also some interesting new challenges to tackle in microwave and wireless engineering. I had some ideas that I developed in my spectrum analyzer work that could be coupled with developments at HPA and usefully applied in other areas. I collaborated with Paul Ely, who managed one section of our laboratory, on a technology investigation. Together we defined a preliminary block diagram for a wide band microwave network analyzer. Shortly after, Paul was appointed Microwave Division Engineering Manager replacing Howard Poulter. After a little courtship period, I decided not to return to Stanford and was asked, by Paul, to assemble the needed talent for a lab section to develop a microwave network analyzer. I was just 27 at the time and I think that made me the youngest engineering section manager in HP. That would have been in 1964, as I recall.

Engineering Management and Network Analyzers

Managing the Network Analyzer Section was really exciting for me. I had assembled a very talented, hard working team. I was also very much at home with the technologies and the intended applications that we were designing. I was given a free hand by division management to set the business strategy, define the products and guide the projects to completion. We were breaking new ground and were convinced that our solutions for network analysis and design would revolutionize the microwave and wireless industries. Hopefully just as much so as the HP Spectrum Analyzer had done. The big day came in late 1966 when the HP 8410A system was introduced in the marketplace. Over the Christmas holidays in 1966, I wrote a major technical

paper on designing high frequency circuits using Scattering Parameters (S Parameters) which the Network Analyzer measured. The Network Analyzer and the S Parameter paper were both very popular and it was clear HP had another big winner in the Microwave and Wireless Space. The Microwave Division experienced another burst of strong growth. Because of the strength of the Spectrum and Network Analyzer program it was by far the largest division in the company. John Young was promoted from Microwave Division Manager to head a group of divisions under the title of Electronic Products Group. He was also elected to Vice President of Hewlett Packard Inc. In 1977 he would be elected President and CEO.

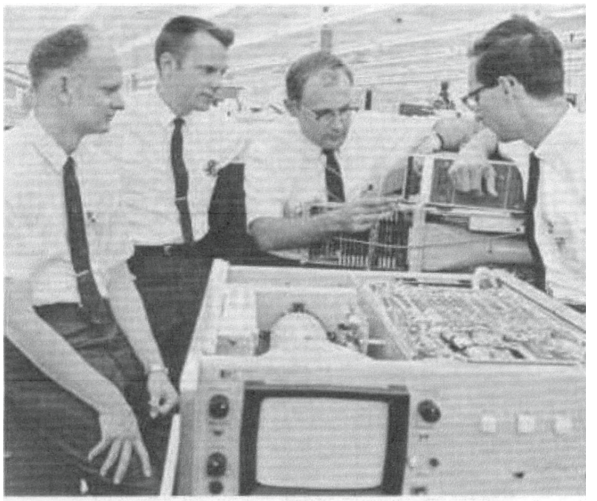
The Network Analyzer, like the Spectrum Analyzer, turned out to be an unqualified success. A highlight for me was traveling to Europe in the summer of 1967 to introduce the Network Analyzer there and train the sales people on the product. Moonyeen traveled with me. I did training in Edinburgh, Brussels, Frankfurt and Geneva. We also visited Southern Germany, Paris, Copenhagen, Ireland and Bergen, Norway.

In Bergen we visited my grandmother's youngest sister Solveig. She showed us where my grandmother had been born and took us to church in the Bergen Ward. While we were in Brussels an enormous fire broke out in a large department store called L'innovation. It was across the street from the Metropole Hotel where we were staying. I was conducting a training session when someone looked out the window and exclaimed, "Oh my God!" The department store was about five floors of mezzanines and every floor was fully engulfed. I was gripped with fear because Moonyeen had planned to go shopping there that day. I hurried and called our room. I was relieved to hear her voice. Fortunately, we had been out late the night before and she had gone back to the room after breakfast for a nap which lasted until my call. When we were in Copenhagen, war broke out in the Middle East between Israel and some of the Arab States.

While we were in Europe, we left our four children with my parents. Debbie and Mike attended a couple of weeks at the Central School where I had received my first four years of elementary education.

As we were wrapping up work on the 8410A project I was surprised one day to get a call from David Packard, the Chairman and Co-founder of HP. At the time, HP was just completing the design of a digital computer, modeled the HP 2116A, in another division. He said, "Dick, I am going to send you a pilot production unit. I would like you to see what you can do with it."

I had only taken one three-hour college course on computers so it was all pretty new to me. But it started me thinking about how a computer like the 2116A might be coupled



Above all, Wescon is an arena of new electronic products. Just about every HP division will be represented at the Cow Palace with new instrumentation. Years of developmental work and months of special effort to meet the show deadline are involved. Such is definitely the case of Santa Clara Division's new 5480A signal averager which promises exciting new concepts, as in spectroscopy and bio-medical applications. The new instrument greatly enhances the resonance resolution of various other HP instruments. Reviewing format of 5480A exhibit are, from left, division engineering manager Dick Anderson, Skip Ross, Jim Daub, and Chuck Taubman.

Richard with three of the Division Engineering Team.

to an instrument like an 8410A to accomplish some really outstanding things. So I added one of my group of engineers, an engineer named Roger Raskolb, to my new little project and we let our imaginations run wild. We shared our ideas with others in the microwave lab including the lab manager, Paul Ely, who encouraged us to start a full project and he allocated us resources to make things happen. After a few days we had assembled enough pieces to start designing the software. Roger was pretty good at programming and I worked hard defining the procedures for calibration, measurement and analysis. Within a couple of months we had a very impressive set of results. With the computer tie in we could improve the accuracy of our measurements by as much as 100 times. We did this by measuring the repetitive system errors using very precise calibration standards, storing these in the computer's memory and then correcting for them in the data of the measurements of interest. The improvements and added capabilities were nothing short of spectacular. Needless to say, Dave Packard was very pleased and he quickly started bringing his industry friends over to see what we were doing. We defined a set of systems that we numbered and HP 854X Automatic Network Analyzers and HP had another set of capabilities in the rapidly expanding Microwave and Wireless Space.

Richard with Ed Hayes and Dave Packard at a Division Review, crica 1980.

microwave journal

HORIZON HOUSE 610 WASHINGTON STREET, DEDHAM, MASSACHUSETTS 02026

June 6, 1967

Mr. John Young
General Manager
Hewlett Packard
1501 Page Mill Road
Palo Alto, California 94303

Dear John:

The editors and staff of the Microwave Journal wish to congratulate Hewlett Packard on meriting the award for "Outstanding Microwave Product Development" of the 1967 IEEE Show.

The display of your "Network Analyzer using the Computer for time sharing techniques" has been selected as the "product of the show" at this year's exhibit. We are having a bronze plaque engraved for you, which you will receive within the next few weeks.

All of us at Horizon House extend our sincere and warm congratulations to you and your associates.

Sincerely,

Bill

William Bazzy

wb/sb
cc: Dean Abramson
GH&K

Offices: 500 5th Ave., Rm. 1602, New York, N. Y., 10036 □ 1-3 Charlotte St., London W.1., England

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

DEPARTMENT OF ELECTRICAL ENGINEERING

January 7, 1969

Mr. William R. Hewlett
President
Hewlett-Packard Company
1501 Page Mill Road
Palo Alto, California 94304

Dear Bill:

This letter is to express the appreciation of the Department of Electrical Engineering at Stanford for the gift of four instruments which we received during the Fall Quarter from Hewlett-Packard. These included a network analyzer - 8410A, a harmonic frequency converter - 8411A, a phase-gain indicator - 8413A, and a polar display - 8414A. The financial value of the gift is significant - $6,135, but in addition the interactions with Dick Anderson of H-P have been interesting and valuable.

Last Spring one of the One-Year On-Campus students from the Bell Telephone Laboratories, Paul Smith, was interested in making measurements of transistors with a view to identifying some model parameters. As I had had an earlier contact with Dick Anderson on this same general subject, I called him and, as a result, Paul Smith had a number of visits at Hewlett-Packard where he measured the parameters of several devices. It was a very useful interchange.

My colleagues and I appreciate the gift of the instruments and also the usefulness of the technical contact which we continue to have.

Best regards.

Sincerely yours,

John

John G. Linvill
Department Chairman

JGL:jw
cc: Mr. R. Anderson
Prof. J. B. Angell
Dean J. M. Pettit
General Secretary

COPY

Nov. 24, 1970 S. F. ADAM ET AL 3,543,197

RESISTIVE CARD HIGH FREQUENCY ATTENUATORS HAVING CAPACITIVE COMPENSATION

Filed Oct. 24, 1966

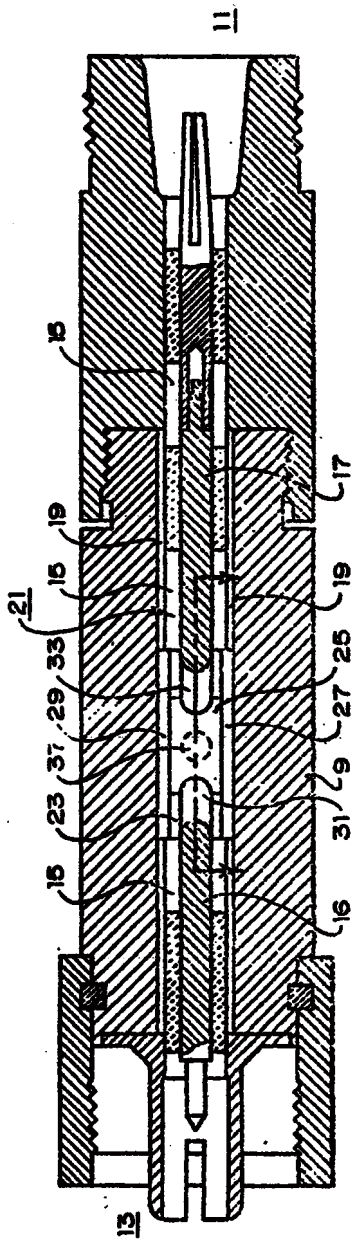


Figure 1

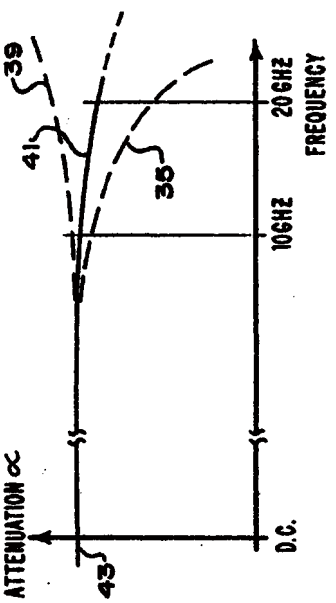


Figure 3

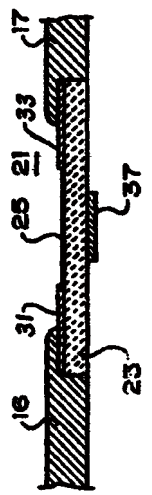


Figure 2

INVENTORS
STEPHEN F. ADAM
RICHARD W. ANDERSON

BY Q. C. Smith

ATTORNEY

May 17, 1966 R. W. ANDERSON 3,252,106

COAXIAL LINE PHASE DETECTOR FOR AUTOMATIC FREQUENCY CONTROL SYSTEM

Filed May 5, 1964

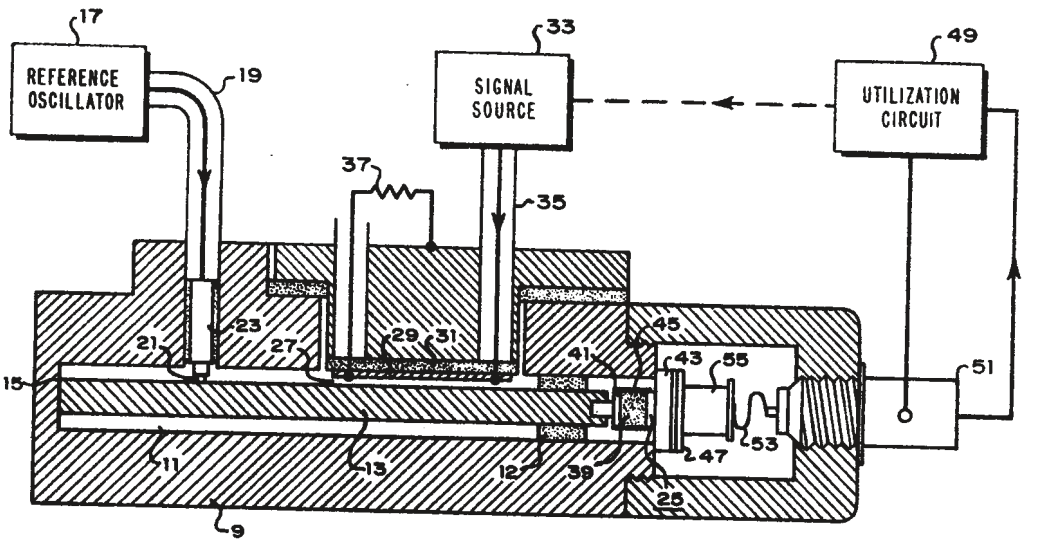


Figure 1

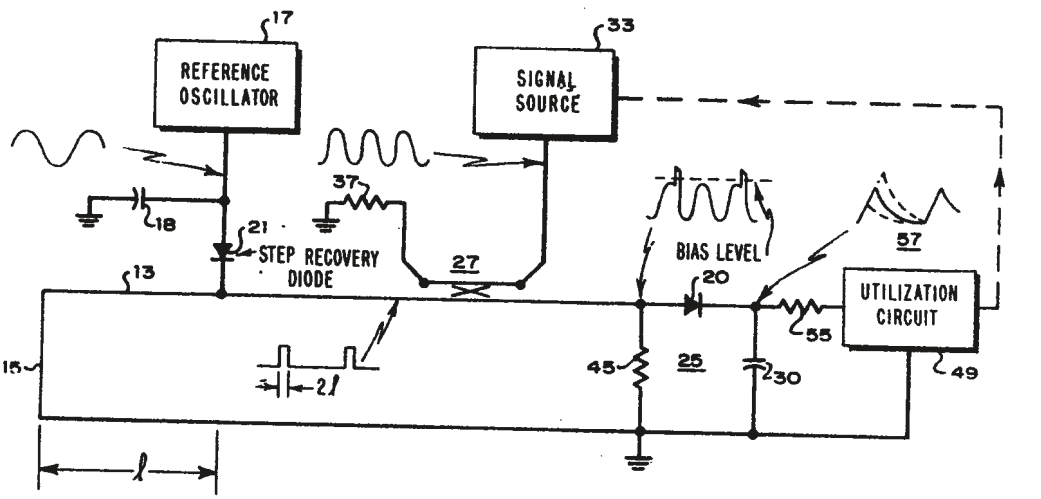


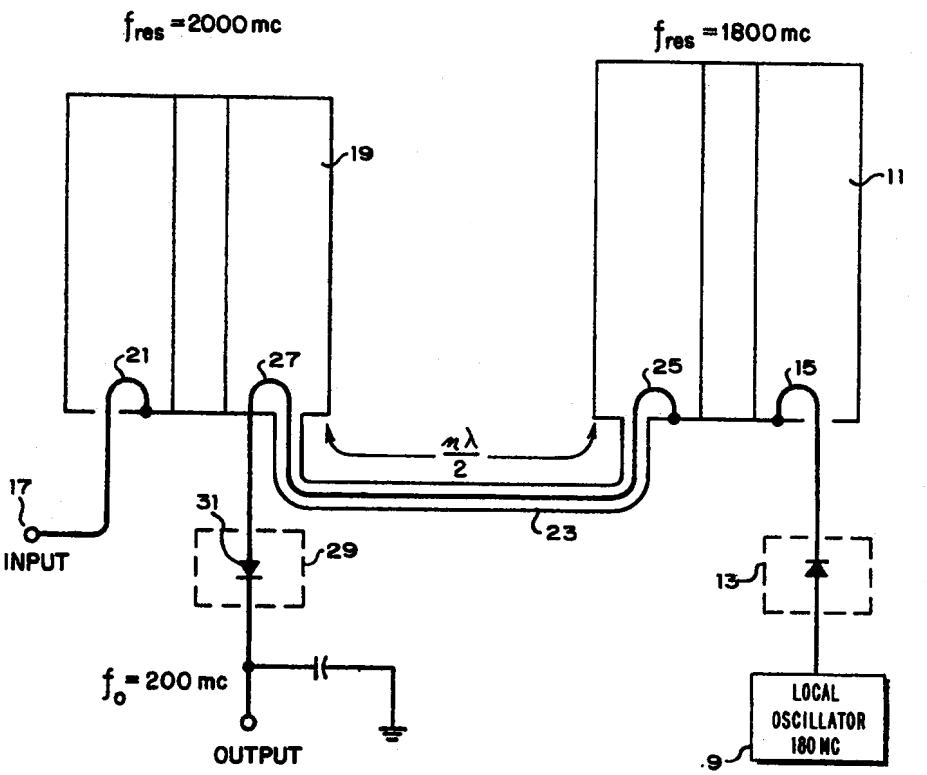
Figure 2

INVENTOR
RICHARD W. ANDERSON
BY A. C. Smith
ATTORNEY

March 21, 1967 R. W. ANDERSON 3,310,747

FREQUENCY CONVERTERS USING A TRANSMISSION LINE IMPEDANCE TRANSFORMER

Filed April 12, 1963



INVENTOR

RICHARD W. ANDERSON

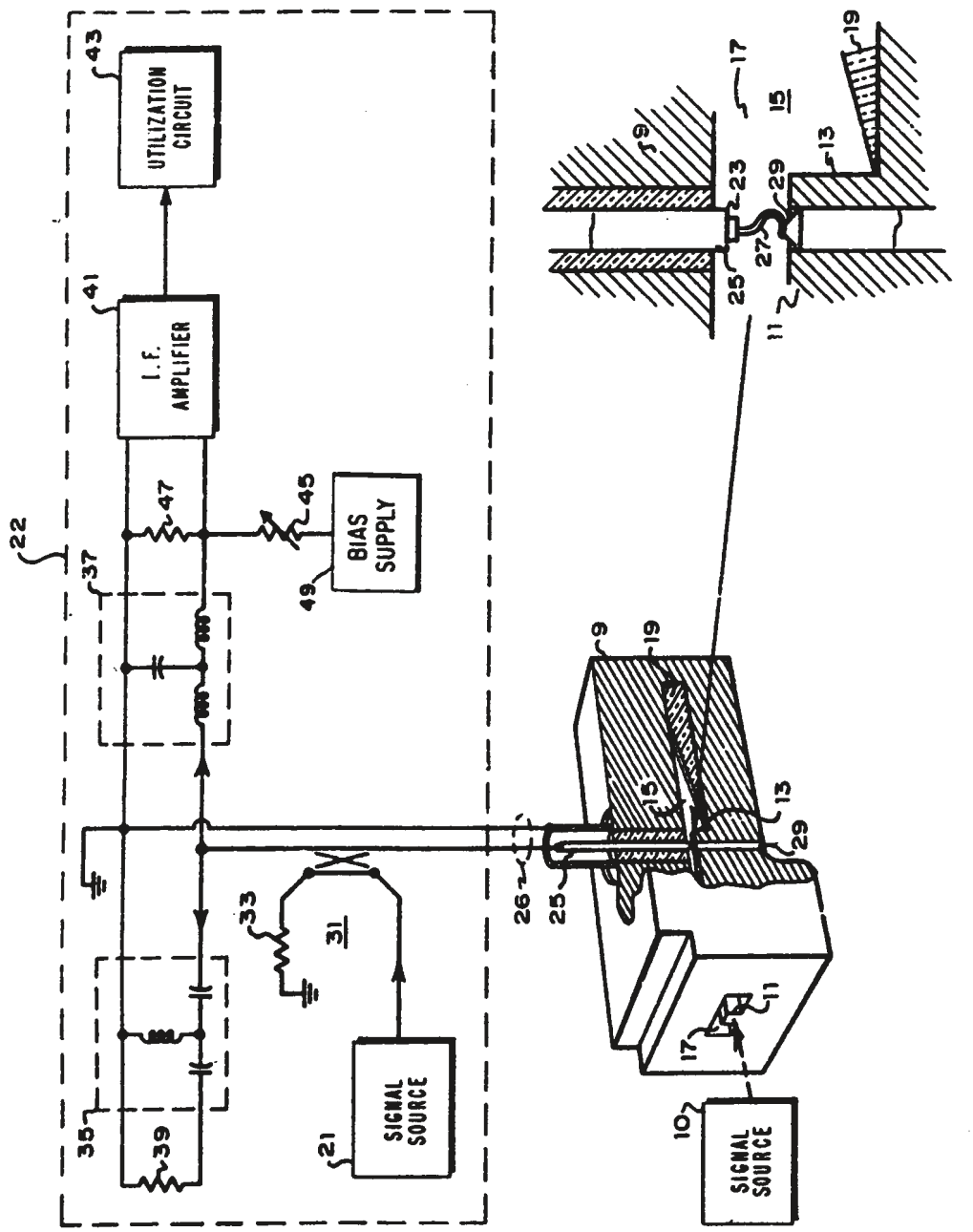
BY J. R. Clopman

ATTORNEY

Sept. 5, 1967 R. W. ANDERSON 3,340,475

SIGNAL MIXER HAVING A COMMON INPUT AND OUTPUT PORT

Filed May 5, 1964



INVENTOR
RICHARD W. ANDERSON

BY Q. C. Smith
ATTORNEY

June 25, 1968 A. G. RYALS ET AL 3,390,356

TEM MODE COUPLER HAVING AN EXPONENTIALLY VARYING COEFFICIENT OF COUPLING

Filed July 30, 1965

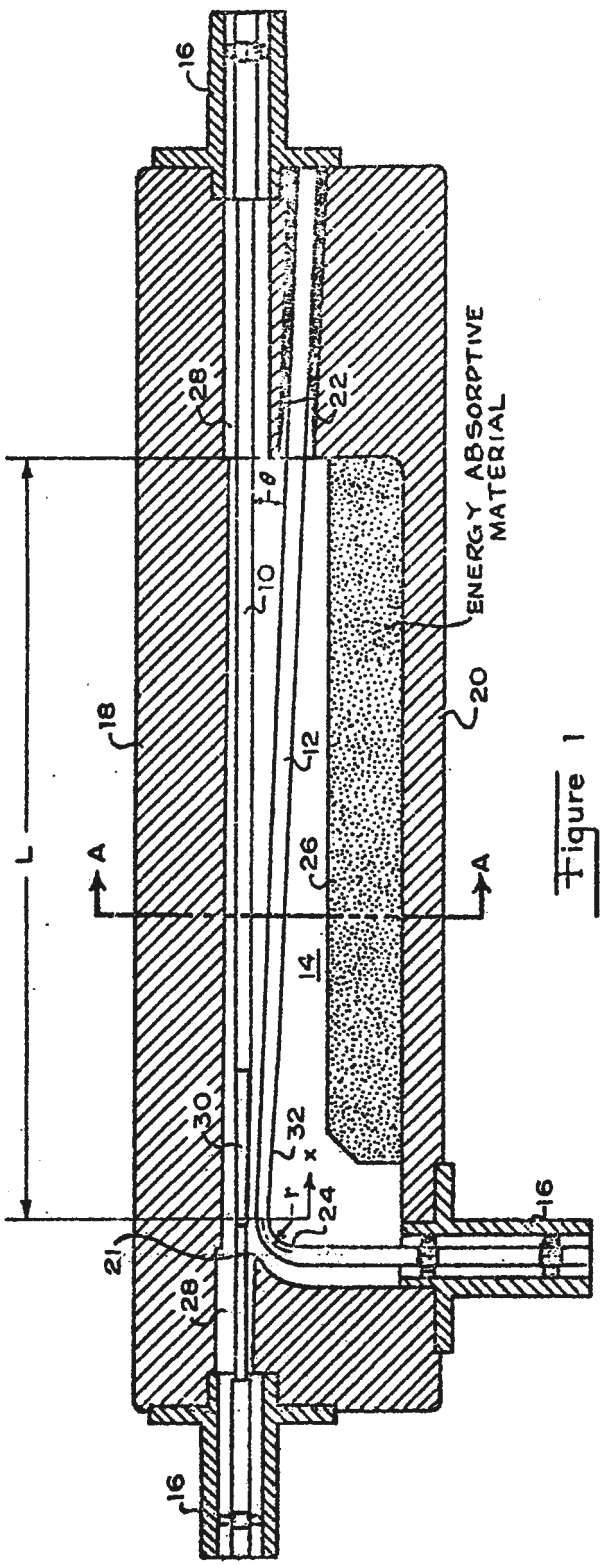


Figure 1

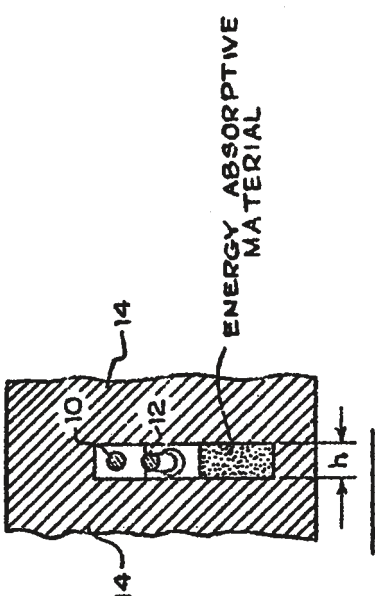


Figure 2

INVENTORS

AUBER G. RYALS

RICHARD W. ANDERSON

BY

March 10, 1970 S. F. ADAM ET AL 3,500,263

PARALLEL-PLATE PERPENDICULAR STRIP CENTER CONDUCTOR TEM-MODE TRANSMISSION LINE APPARATUS

Filed Aug. 16, 1967 2 Sheets-Sheet 1

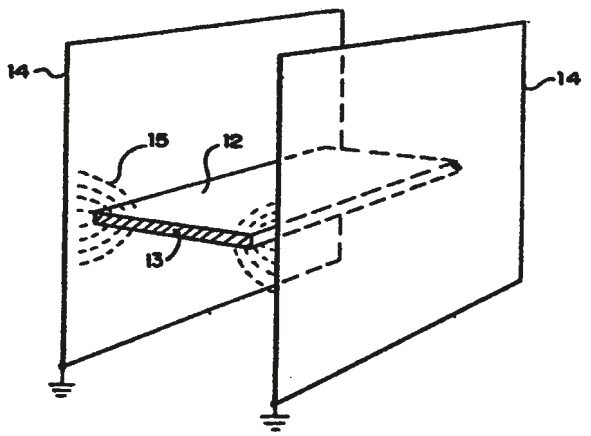


Figure 1

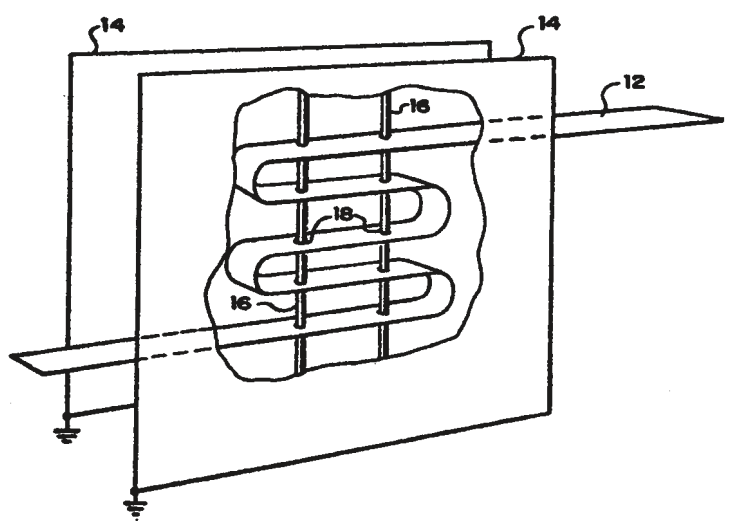


Figure 2

INVENTORS
STEPHEN F. ADAM
RICHARD W. ANDERSON
DAVID R. VETERAN

BY R. C. Smith

ATTORNEY

March 10, 1970 S. F. ADAM ET AL 3,500,263

PARALLEL-PLATE PERPENDICULAR STRIP CENTER CONDUCTOR TEM-MODE TRANSMISSION LINE APPARATUS

Filed Aug. 16, 1967 2 Sheets-Sheet 2

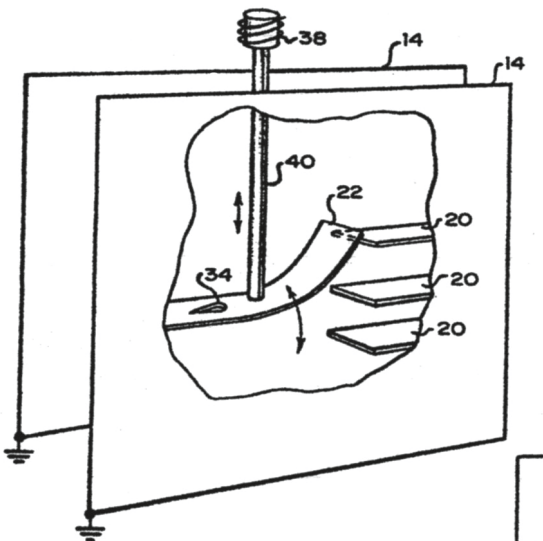


Figure 3

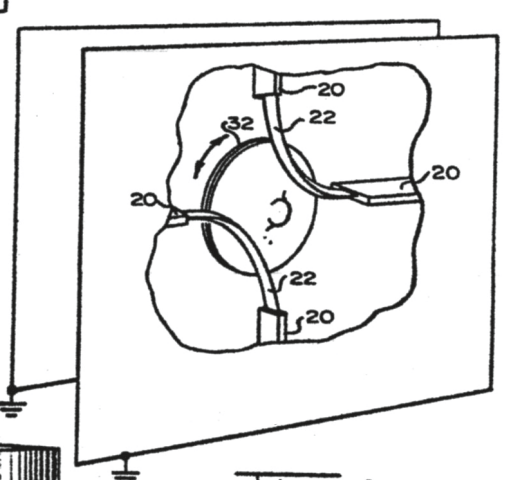


Figure 4

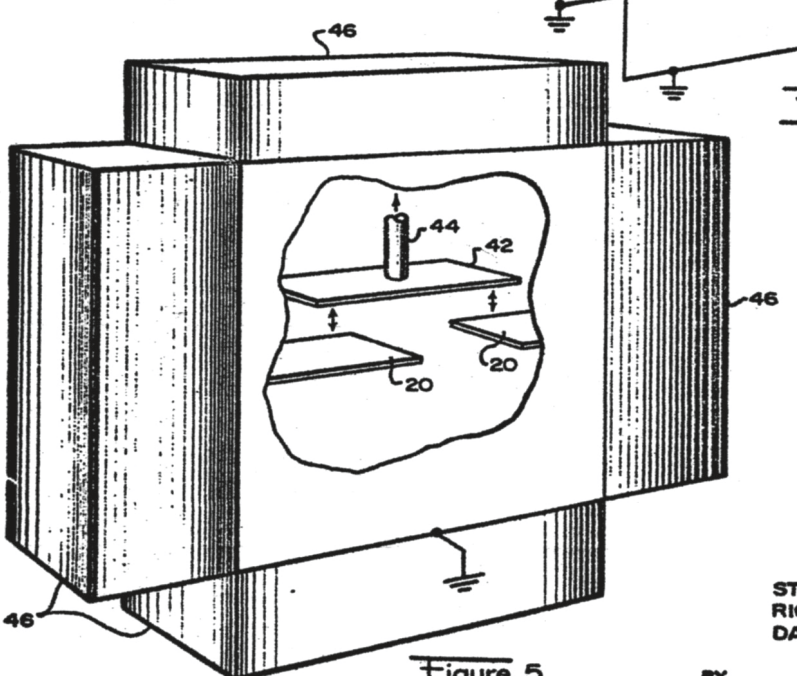


Figure 5

INVENTORS
STEPHEN F. ADAM
RICHARD W. ANDERSON
DAVID R. VETERAN

BY A. C. Smith
ATTORNEY

Counters to Computers

In 1968 I started to hear that I was being considered for the next level of responsibility, somewhere within the company. Some prospects were in the Bay Area where we lived, and others would require a move. Then one day I got a call from one Alan S. Bagley. He was in charge of a division called F&T for Frequency and Time. Al had led HP into its earliest work with digital technology, developing a line of frequency counters and precision clocks. Al was then both Division Manager and Engineering Manager. As might be expected that wasn't going too well. The division was a hodgepodge of projects, morale was low, and a lot of good talent was leaving. During the call, Al asked me if I would meet with him in his car to discuss his organization. I agreed to do so and we started a series of clandestine car rides for his purpose of interviewing me for the job of F&T Engineering Manager. He was nervous to give up the duties himself and he didn't want any of his division people to know he was talking to a 'Microwave Guy' as there was some division rivalry there.

I think he liked my leadership and technical skills but I also think he had some fear that at 31, I was too young to manage the F&T lab. Almost everyone there was older than me. I also think he was a little worried that I might try to get his job. After all, the former manager of the Microwave Division, John Young, was now his supervisor. I had no such interest. In 1969 we finally came to an agreement and I was appointed Engineering Manager of the Frequency and Time Division of Hewlett Packard. I believe that made me the youngest Engineering Manager in the Company.

Since almost all of the people in the lab were new to me, I made a Herculean effort to know all of their names. They were impressed by that and I think most of the engineers really appreciated having someone in that job. I worked hard on two fronts: 1) Get a good idea of which individuals I could count on to produce, and 2) Evaluate how each project could fit into a workable strategy. Over the next few months I trimmed the Engineering headcount by about one third by removing the out of date, the lower skilled and the low enthusiasm engineers and managers. I

also initiated an aggressive college recruiting program to add young, up-to-date engineers who hadn't learned that 'it can't be done'. I also pruned the project list to a workable number that fit some semblance of a business strategy and then staffed them to get the job done.

It is fortunate that I did this trimming when I did. In 1969 Richard Nixon became the US President. The Vietnam war finally came to a close and tensions eased a bit. With the close of the Vietnam period came big reductions in defense spending. Defense spending was a very big driver in the instrument business and we really felt it at HP. To make it even more difficult, Dave Packard joined the Nixon Administration as Undersecretary of Defense in charge of procurement. Dave was a wealthy man that had no interest in running for office and, believe me, he knew how to cut spending. By early 1970 the country was in a recession that hit technology particularly hard. By then, we had moved the F&T Division from Palo Alto to a new facility on Stevens Creek Blvd. in Santa Clara. That was very positive for division morale. The bulk of the division business was frequency counters and the business was becoming very competitive. We focused our efforts on two new families of very competitive, solid state frequency counters, digital signal processing with special computing algorithms (Fast Fourier Analyzer and Signal Averager) and digital circuit test. We got several solid new products to market which helped us weather the recession and set good growth opportunities for the future. Many of our designs incorporated custom integrated circuits. The Santa Clara Division included a complete integrated circuit facility with both bipolar and MOSFET capability. While I never designed an IC myself, many were designed by engineers who worked for me and I learned from them.

In 1970 we ran into a big family issue that was starting to overwhelm us. It is very hard to fit a family of two parents, three daughters and a son into a three bedroom, one bathroom home. We had been looking for a larger home in the immediate area but nothing had clicked. But early that spring the opportunity arrived. There was a very nice, large, Spanish style home on our same street about 300 yards from our home. We knew the family that lived there and we had told them how much we admired their home. It was an older home with two large bedrooms, two smaller bedrooms, three bathrooms, a large living room, a family room, a room we called the garden room, a partial basement, a small den and a dining room. It sat on a very nice half acre lot with an old two car garage behind. The owner called us one evening to tell us that he had accepted a job offer from the French Company, Schlumberger, and they would be moving to Paris. Would we like to buy their home? We shook hands after a house tour at a negotiated price of $65,000.

Our second Los Altos home, as it looked about 20 years after we moved. Image from Google Maps.

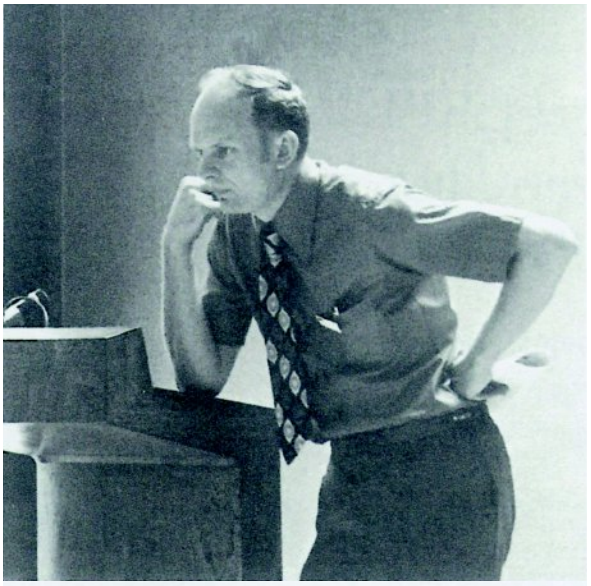
It was a little scary with the recession but we moved in as soon as we could and put our present home up for sale. The recession of 1970 hit really hard so that we had to take every other Friday off without pay. The squeeze was on and it hurt. The hit movie that year was Butch Cassidy and the Sundance Kid. The movie theme song 'Raindrops Keep Falling on My Head' seemed very fitting. The home could sell today (2020) for as much as $5,000,000.00.

I enjoyed my time as Engineering Manager of the renamed Santa Clara Division but my time there was coming to an end. A new division had been organized as part of the Electronic Products Group reporting to John Young. It was called the Automatic Measurements Division or AMD. It was composed of parts of a couple of organizations interested in the 'Systems Business'. Several HP Managers had been tried in the leadership spot but none worked out very well. So comes a call from John Young: "Dick, how would you like to take the job of General Manager of the Automatic Measurements Division? I think you can do the job."

This was a harder decision than my last move. I wanted to talk it over with Moonyeen before I gave my answer. The managers that preceded me had crashed and burned. The risk was higher and there wasn't a high technology component that I could build on. But with Moonyeen's blessing, I accepted the position of Division General Manager of the Automatic Measurements Division. At 34, I think I was now the youngest Division Manager at Hewlett-Packard.

Bagley and Ely Compared

As I look back, I might have been the only person to work directly for both Paul Ely and Al Bagley. In retrospect, they were likely the two most obstreperous individuals in the company. Maybe the only other person to face dealing with those two was John Young. I will let John speak for himself, but as for me, I loved them both.



Accelerating growth of the instrument systems business was described by AMD's Dick Anderson. Points he raised included those of how to take greater advantage of computers and programmability.

Presentation to HP engineering managers. 1973.

Instrument-based computer systems or computer-based instrument systems?

The Automatic Measurements Division already had established businesses. The first and oldest was Data Acquisition and Control. This was now mainly computer based systems with instrument front ends. The division had developed a computer operating system called RTE (Real Time Executive) to bring these two technologies together. The customers for real time systems like this were largely in manufacturing and mineral extraction. Such applications as oil well monitoring, engine testing and material stress testing were typical. The other business was Automatic Test based on computers and instruments combined to test complex electronic systems typical in military systems. Examples would include sophisticated aircraft, guided missiles and

target-seeking torpedos. Another operating system called TODS (Test Oriented Disc System) had been developed for this side of the division. It was a tough management challenge to hold these pieces together and succeed in very different markets while supporting two separate sets of operating software. To make the job even tougher, the organization was spread over several small buildings in two different locations in Palo Alto. AMD employed about 1200 people.

After a few months a building became available in Sunnyvale, California about 15 miles south of Palo Alto. The building was large enough to bring the entire division together under one roof. It belonged to Fairchild Semiconductor, but they had closed their operations there so the building was empty. After a short visit Bill Hewlett agreed to have HP buy the building. We prepared the building for our use and moved the entire division there a few weeks later. In 1971 Dave Packard returned to HP and resumed his role as Chairman of the Board. He visited our division and took a big interest in what we were doing.

First Liftable Megabyte Computer from HP. 1974.

Over the next couple of years I had a lot of contact with Dave as he seemed to enjoy helping us sell our systems. He would call me and say, "I am going to visit my friend, the Chairman of XXX Company. Can you come with me and explain what you are doing in your shop?" I would go and it allowed me the opportunity to meet a lot of interesting people. He would run the meeting but would call on me to present our product and service offering. Among many others I presented to the top management teams at Firestone Tire, McDonnell Douglas and Boeing. We happened to be at McDonnell Douglas to see the first assembled F15 Eagle Air Superiority Fighter. While we were there Dave received a call from Secretary of Defense, Melvin Laird. Secretary Laird told Mr Packard that the US had just signed the Strategic Arms Limitation Treaty (SALT) with the Soviet Union. I learned the news before the press did. Packard also hosted the Chief of Naval Operations, Elmo (Bud) Zumwalt, at the company. Dave asked me to give him a tour of our operations before they went hunting on Dave's ranch on Mt. Hamilton. In February 1974 I spent a week in Russia where I was invited to deliver a lecture at the Lebedev Institute of High Energy Physics. The Lebedev Institute was where the Soviets developed nuclear weapons and nuclear power. Touchy visit!

About the time that I took the AMD job my former boss and good friend, Paul Ely, was appointed manager of the Data Systems Division which incorporated HP's computer programs. In 1974, Paul was put over all of HP's computer organization and promoted to Vice President. Paul then offered me the position of Division Manager of the Data

Systems Division in Cupertino. DSD was HP's biggest Division by then so it was a promotion and offered the opportunity to learn and participate in the computer business. I recall that the headcount was about 2500. So, 1 moved my office to Cupertino and waded full tilt into the world of computers. I held the position from 1974 to 1980. It was a genuinely fun time. I had a very good staff and had lots of interaction with our sales people and with customers. During my time there the division moved from almost break-even to a very profitable situation. During the time I was at DSD the computer business grew rapidly which created the need to create even more divisions.

Bad Accident

In 1979 I traveled through Europe with other computer business managers for the purpose of training and supporting the European sales team. I took my son, Mike, with me. It was right after he graduated from high school so it was kind of a celebration for him. We spent a few days in London and then went to Val d'Isere, France for some skiing with the European sales managers. After our stay there Mike flew home. Somehow he caught mononucleosis while he was there. He later developed a case shingles from it. Maybe too much fun in France.

After Mike went home, I flew to Oslo, Norway and then traveled by car to a ski resort area called Geilo. Again this was an opportunity to spend time with our best sales people from Northern Europe. While I was skiing an out-of-control skier from Sweden crashed into me, knocking me unconscious and causing bleeding from my head, nose and mouth. The ski patrol came and took me off the mountain by sled. An ambulance took me to the hospital in Honefoss where I spent a week in socialized medicine. When I arrived at the hospital there was no room for me so I had to be treated in a hallway. It turns out that I had a skull fracture that was causing swelling that gave me bad double vision. I also had two broken-off front teeth. Fortunately there was a good doctor there that had done some neurological training in the United States. He also spoke good English. He was able to help me get ready to return home as soon as my double vision went away.

An interesting thing happened once there was a room available for me. I was placed in a two-patient room with a Norwegian man a few years older than me. His wife would visit him every day and bring him some homemade treats. When she found that I was there, she kindly brought me treats as well. They spoke no English and I spoke no Norwegian so communication was only by smiles and nods. The mystery to me was, why was he there? I could see no evidence of any illness and he received no attention from any doctors or nurses.

On one of the days that I was there, a manager from our Oslo sales office came to visit me. He, of course, spoke Norwegian as well as English so I asked him if he could politely ask my roommate what he was hospitalized for. My friend found out that the man belonged to a very strong Union that entitled him to a medical rehabilitation on some regular basis and it was his turn. Just a nice, fully-paid rest and relaxation time in the local infirmary. But, there was no room for a guy with a skull fracture. We sure don't want to end up with a mess like that.

In 1980 I made a lateral move to a young, interesting division called General Systems Division. This division had the charter of building a business in general purpose business computers. This division produced the HP 3000 Computer System Family. It was a popular alternative to the IBM family of 'Mainframe Computers'. It was actually fun to compete with IBM. We felt like David dropping the giant Goliath. For me this was

Dick Anderson heads new Computer Systems Division

Dick Anderson, formerly general manager of Data Systems Division, has been named general manager of the Computer Systems Division, one of three new divisions created in August in the formation of the Business Computer Group under General Manager Ed McCracken.

The Computer Systems Division now headed by Anderson has responsibility for the HP 3000 computer systems hardware and operating systems. He takes over from McCracken, who has been serving as interim general manager for the division in addition to his group role.

This is Anderson's third post as a division general manager since joining HP in 1959. He became general manager of the former Automatic Measurement Division in 1971, then was named to head the Data Systems Division in 1974. Previously he held key engineering positions as engineering manager of the Santa Clara Division and section manager in the Microwave Division. He holds a BSEE degree from Utah State University and an MSEE degree from Stanford University.

Functional managers under Anderson are Bob Frankenberg, hardware R&D manager; Howard Smith, software R&D manager; Jack Barbin, manufacturing manager; Bob Bond, marketing manager; Ken Coleman, personnel manager; John Corcoran, product assurance manager; and Alan Groves, controller.

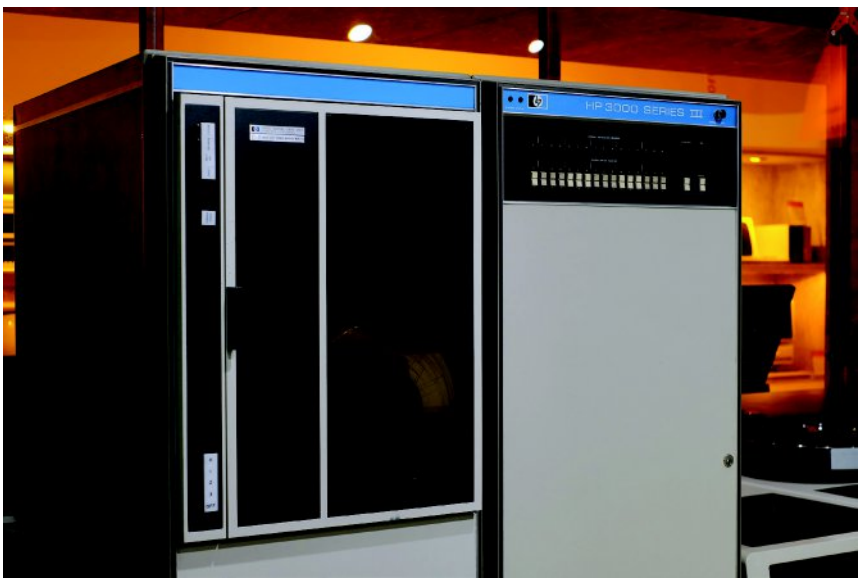
All are from the original General Systems Division except for Frankenberg, who was formerly lab manager for DSD's High Performance Lab. Coleman, Corcoran, and Grove managed the corresponding functional departments at GSD, while Smith, Barbin, and Bond were on the management team for that division's HP 3000 program.

Dick Anderson

In a joint announcement made September 17, Group Managers McCracken and Chance detailed other changes within the Computer Groups organization: Gaylan Larson, formerly operations manager for the HP 1000 computer product line within DSD, was named to replace Anderson as general manager of that division; Roger Ueltzen, formerly marketing manager for DSD, was named to the newly created position of marketing manager for the Technical Computer Group; and the Roseville Operations, formerly part of DSD, has been established as an independent division, to be called the Roseville Division. It will continue to be managed by Alan L. Seely and is part of the Technical Computer Group, headed by Doug Chance.

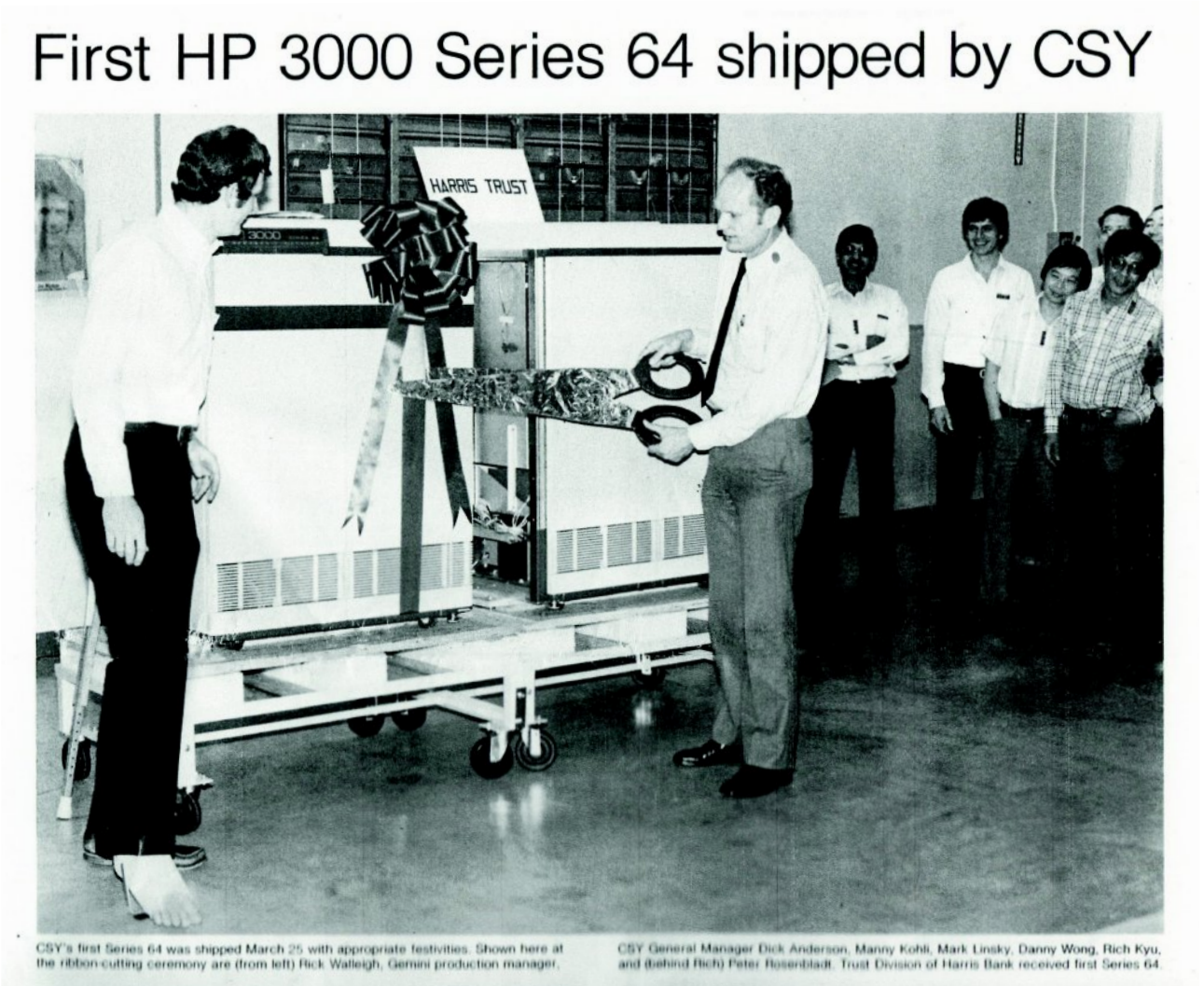
The McCracken-Chance announcement said the changes "are intended to solidify the management structure of the month-old Business Computer Group and to recognize continuing growth and achievement within the Technical Computer Group. These moves are evolutionary in nature – part of the continuing development of HP's computational products activities."

In addition to the Technical and Business Computer Groups, HP's Computer Groups organization includes the Computer Peripherals Group, the Data Terminals Division, and the Computer Marketing Group.



HP's First General Purpose Business Computer, the HP 3000.

Most Powerful HP 3000 System, circa 1983.



First HP 3000 Series 64 shipped by CSY

HARRIS TRUST

CSY's first Series 64 was shipped March 25 with appropriate festivities. Shown here at the ribbon-cutting ceremony are (from left) Rick Walleigh, Gemini production manager, CSY General Manager Dick Anderson, Manny Kohli, Mark Linsky, Danny Wong, Rich Kyu, and (behind Rich) Peter Rosenbladt. Trust Division of Harris Bank received first Series 64.

pretty much a management job. That being the case I focused most of my attention on two important management responsibilities: 1) quality of our products and services, and 2) people development, especially people that were historically under-represented in the best occupations. The division had a headcount of about 1500. My other major contribution was probably keeping a dedicated team happy and making a very good profit.

Quality Initiative

In the late seventies the advances in semiconductor technology coupled with demand for better and more information combined to boost demand for faster, cheaper and more powerful computers. Gordon Moore, a co-founder of Intel, formulated what became known as Moore's Law which observed that the semiconductor chips used in computers were advancing in price performance by 30% per year. That means each year 30% improvement in performance was available at the same cost or, conversely, the same performance could be achieved at 30% lower cost. The computer market exploded as computer makers poured out faster, cheaper and more useful computers at a breakneck pace. Computing functionality was also spreading like wildfire. These advances in technology were showing up in smarter cars, appliances, instruments, medical equipment, television sets, telephones, toys, automatic bank tellers and even shoes. The market was chaotic. Computation-based companies were springing up like tulips in spring and then dying out just as fast. But, in the chaos of the market dynamics, one important aspect was suffering—quality!

In 1980 when I was still general manager of DSD, we were in a very difficult battle to produce computers of acceptable quality. The semiconductor microchips were a particular problem. Manufacturers like Intel, Motorola and Mostek were moving manufacturing of chips to many different Asian countries in search of capacity and lower cost. I remember one of our suppliers' chips were having trouble with intermittent failures. In our effort to help solve the problem we opened several failed chip encapsulations. When we did we found that some of the chip capsules had tiny bits of contact wire rattling around inside. From time to time when the computer was moved, the wire piece would short out an internal contact and cause a miss-function. Since we couldn't open every chip to examine for this problem, we were forced to put each computer on a shake table to cause the failure in our place before we sent the problem to a customer. That is no way to run a computer factory. I might add that this is only one example. Quality needed to be addressed or this budding industry would be choked to death in the cradle.

We pushed very hard on quality for the remainder of my time at DSD. Our efforts were starting to attract some attention in the semiconductor trade press. In March, I was invited to speak on the subject of chip quality at a seminar held on March 25, 1980 in Washington, DC. Note from the program that the luncheon speaker was Illinois Senator Adlai E. Stevenson. He was the son of the Adlai E. Stevenson who ran for President of the United States in 1952 and 1956. It turned out that my talk was the only one that anyone would remember after the seminar ended.

The Bombshell

One of the seminar attendees was Ben Rosen, an electronics industry analyst that published a commentary newsletter called The Rosen Electronics Letter. Ben summarized my presentation, and provided comment that would put me at the center of the semiconductor and computer quality discussions. Follows photo static copies of news articles and the March 31, 1980 issue.

Tom Williams — Sunday Mercury News

Dick Anderson believes that American firms must build more quality into their semiconductor chips

Quality

H-P exec says 'usually reliable' semiconductors won't do

By Bruce Entin

Business Writer

During a busy day on the New York Stock Exchange last October, all trading was halted for about an hour.

Two months earlier on the West Coast, an Air California Boeing 737 nearly collided with three Air Force jets.

The two events were unrelated, but they were similar in at least one way: Both were caused by a breakdown in a computer.

Industry observers say computers — and the semiconductors that go into them — usually are highly reliable.

But critics such as Dick Anderson, an executive at Hewlett-Packard Co. of Palo Alto, says that usually reliable is not good enough for machines that have come to be used for diagnosing medical problems, running factories and controlling bank transactions.

Anderson feels so strongly about the subject that the soft spoken engineer publicly criticized American semiconductor makers last year for making sophisticated chips that did not pass inspection as often as the Japanese version. The chips which Anderson referred to are 16K RAMs (random access memory), which can store 16,000 bits of computer information on a piece of silicon smaller than a fingernail.

In Silicon Valley, it is an unwritten rule that you don't praise the Japanese too highly and you usually don't knock your peers publicly — even if they are competitors.

So why did an engineer go out on a limb? The answer is simple: He couldn't hold in his feelings any longer.

"I feel personally responsible for the performace of our products in hospitals and other places where loss of life and limb are important, or where the financial stakes are high," said Anderson, head of H-P's computer systems division.

The semiconductor industry, which makes high quality products 95 to 99 percent of the time, probably has a better record than most other industries, Anderson said. But numbers can be deceiving, he added.

The semiconductor industry is "playing a statistical game," Anderson complained in an interview. "Ninety-eight percent of the chips may be good, but the thing that worries me is the other 2 percent. To accept 2 percent of defects — to institutionlize it — is an error our society has made."

Anderson contends that U.S. firms do not build quality into the design of the semiconductors, mostly because it costs too much. However, U.S. firms waste more money by trying to rework chips that fail inspections after they come off the production line, he added.

There can also be a problem with a company's quality control.

Just last October, the semiconductor division of Fairchild Camera & Instrument Corp. of Mountain View said transistors it sold to the Pentagon for use in sophisticated military equipment may not meet the high requirements that the Pentagon demands.

This is because over a three-year period, Fairchild properly tested only a sampling of the devices rather than on all of them. Because these stress tests were not performed on all the parts, some may fail sooner than anticipated.

The semiconductor industry is not turning a deaf ear to the issue of quality. Partly as a result of Anderson's remarks, and partly because

Continued on Page 3C

A sustained drive for better quality!

Right: San Jose Mercury Tuesday, January 13, 1981

Below: San Jose Mercury October 22, 1980

Previous: San Jose Mercury January 11, 1981

Putting our chips on better quality

EVERYONE who makes a living in Santa Clara County can be grateful to Dick Anderson, the Hewlett-Packard engineer who made a public issue of semiconductor quality control.

Anderson made a couple of speeches pointing out that American-made silicon chips fail inspection more often than Japanese-made chips. He was talking specifically about 16K RAMs, random access memory chips that store 16,000 bits of computer information on a silicon chip smaller than a fingernail.

We wouldn't recognize a 16K RAM if it plopped off a Bayshore Freeway overpass, bounced on the windshield of our car and stared us smack in the face.

But we recognize that Anderson has a point. There is real concern about whether Japanese competition is threatening Silicon Valley in terms of quality control.

The quality control issue surfaced in different form recently when Fairchild of Mountain View confirmed that transistors it sold to the Pentagon for use in sophisticated military equipment might fail in greater numbers than was anticipated.

Business writer Bruce Entin wrote about all this in last Sunday's Mercury News, and he also reported that several Silicon Valley semiconductor companies are scrambling to make quality control a higher priority. Some say they started even before Anderson spoke out. And some are experimenting with their own versions of Japan's famous "quality circles," groups of employees who get personally involved, with management support, in finding new ways to do their jobs better.

According to Entin's report, there has been measurable progress in improving quality control of American semiconductors. And there also is evidence that the Japanese, meanwhile, are not only meeting some quality control standards, but exceeding them.

Obviously, the answer is not to try to hush this up, or to damn the Japanese, or to play like patriotism dictates an "America first" bravado while American products slowly and quietly slip into second place.

We've all seen what Japanese competition did to Detroit, and no one with an economic or personal interest in Silicon Valley wants to see it happen here. H-P's Anderson deserves credit for his warning that it could.

U.S. semiconductor firms boost quality, H-P exec says

By Bruce Entin
Staff Writer

A Hewlett-Packard Co. executive said Tuesday that the quality of certain memory chips made in the U.S. has improved by 50 percent since last year compared with their Japanese counterparts.

However, Richard W. Anderson, head of the computer systems division, warned that the Japanese are making strides in other areas that point to a "frightening scenario" for the U.S. semiconductor industry.

Last March, Anderson created a controversy in the semiconductor industry when he said that Japanese 16K random access memory (RAM) chips were superior in quality and competitive in price to their American counterparts. The 16K stores 16,000 bits of computer information.

H-P of Palo Alto had used Japan's memory chips in 1977 when U.S. suppliers were unable to meet the company's demand. Tests conducted by H-P engineers showed that Japanese memory chips had fewer inspection failures and breakdowns in equipment used by H-P customers, said Anderson.

When the supply of these chips became scarce again in 1979, H-P turned to the Japanese once more. And this time, the Japanese chips again proved superior in quality, said Anderson.

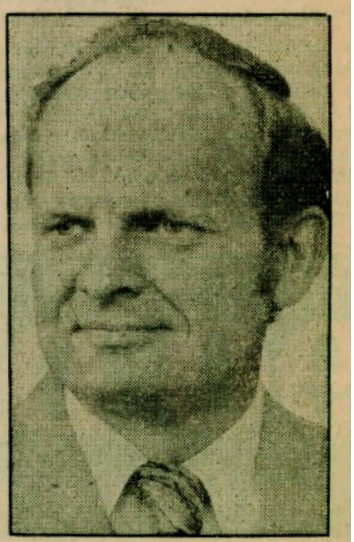
The Japanese now supply more than 50 percent of the memory chips used in H-P products, said Anderson.

Partly as a response to his speech earlier this year, semiconductor companies have improved the quality of their memory chips, he said.

In tests last year, "U.S. chips failed five to six times more often than Japanese memories," said Anderson. "But now, U.S. chips fail only two to three times as often."

Anderson criticized American management "mentality" that does not pay enough attention to quality.

"In the U.S., management assumes that problems will happen with the chips and they set up a testing system to deal with it," said Anderson. "But in Japan, quality is built into the chips so they don't need to rely on inspections."



Richard W. Anderson
. . . *New warning*

The Rosen Electronics Letter

80-5

March 31, 1980

● EIAJ Washington Meeting March 25 This session, sponsored by the Electronic Industries Association of Japan, was the bombshell. To date, most of the transpacific arguments have been put forth by adversaries espousing their respective positions: the Japanese manufacturers on one hand and the SIA members on the other. But the factor that was different in this Washington meeting, entitled "Quality Control -- Japan's Key to High Productivity," was the testimony of a disinterested party, a major U.S. semiconductor user with apparently no ax to grind. And to make his testimony even more valuable, he gave data -- hard data -- the first time we've seen numbers from other than an interested party.

The Anderson Bombshell

The morning in Washington began in rather ordinary fashion (read boring). Having awakened at 5:00 a.m. to catch a 7:00 a.m. shuttle to Washington, my reaction in listening to the initial speeches, one of which was in Japanese and the others of which were boilerplate from speakers representing Japanese semiconductor manufacturers, was muted at best. But then, after the coffee break, Richard W. Anderson, General Manager of the Data Systems Division of Hewlett-Packard, gave his interesting, provocative, and sure-to-spur-controversy speech.

Hewlett-Packard in general and Anderson in particular feel strongly about the quality issue -- hence Anderson's appearance before this group in which his motivation apparently was to raise quality control consciousness among his American vendors. As his example of relative quality, he used the 16K RAM -- the largest-dollar-volume semiconductor device in the world today. Starting in 1974 Hewlett-Packard bought all its 4K RAMs from U.S. vendors and apparently was planning to continue this policy with the successor 16K RAM. HP's first computer using 16K RAMs, announced in 1977, ran into a problem when HP's sole U.S. RAM vendor couldn't meet the demand because of yield problems. So, "after anguish," Hewlett-Packard talked to a Japanese vendor. HP was cautious because of its post-World War II impression of low Japanese quality, but the HP engineers put the Japanese 16K RAMs through a rigorous program. They qualified this Japanese vendor, and then began to buy more and more parts as the U.S. 16K RAM supply tightened.

According to Anderson, HP then started to notice something funny -- the Japanese parts were superior. They had fewer incoming inspection failures, fewer in the production cycle

and fewer in customer hands. These qualities, in turn, led to lower systems costs and happier customers.

When the full-fledged 16K RAM crunch came in 1979, U.S. manufacturers began allocating parts among customers. HP again found itself in short supply and so it qualified two more Japanese suppliers to the Data Systems Division. And again, HP experienced the same phenomenon -- excellent quality at competitive prices.

Then, to buttress his qualitative remarks on quality with some quantitative information, Anderson provided the data shown in Table 1.

Table 1

HEWLETT-PACKARD TEST RESULTS OF 300,000 16K RAMs

Country	Vendor Identification	Incoming Inspection Failure Rate	Field Failure Rate (%/1000 hrs)	Quality Composite Index*
Japan	J1	0.00%	0.010%	89.9
	J2	0.00	0.019	87.2
	J3	0.00	0.012	87.2
U.S.	A1	0.19%	0.090%	86.1
	A2	0.11	0.059	63.3
	A3	0.19	0.267	48.1

**Figure of merit based on the two failure rates plus eight other parameters (cost, delivery, etc.) all equally weighted at 10 points.*

When the slide was projected on the screen, you could hear the audience's jaw drop as one. The data in the table -- for incoming inspection failure rates, field failure rates and a quality composite index -- represent tests on 300,000 16K RAMs, roughly evenly divided among three Japanese vendors and three American (none of whose identities was disclosed). He said that the data in the table is consistent with HP's experience since 1977.

What this experience suggests is that HP had zero incoming inspection failures in its sample from any of its three Japanese vendors as compared with American device incoming inspection failure rates ranging from 0.11% to 0.19% (roughly 50 to 100 bad devices per 50,000-lot samples).

More significant, in Anderson's opinion, and more damaging, were the data shown for field failure rates. The Japanese devices ranged from 0.010% failures per thousand hours for the best vendor to 0.019% for the worst. By contrast, the best

U.S. vendor had a field failure rate of 0.059% per thousand hours and the worst was 0.267% -- an astonishingly bad number. As he pointed out, the field failure ratio of the best Japanese vendor to the worst American was 27-to-1.

The final set of data showed a quality composite index, one which was made up of the sum of ten parameters weighted equally at 10 points each -- incoming inspection failure rate, field failure rate, cost, service, delivery and five other factors. Here, only one U.S. part was competitive with those of the three Japanese vendors on an overall basis and two were at significant disadvantages.

Anderson was careful to say that while the Japanese excelled at quality and were competitive in price, at no point was there unusually low pricing by the Japanese vendors. Indeed, he said that the Japanese vendors never have been the low bidder, though their prices were always "competitive."

Oh, the identity of the vendors. As we indicated, HP won't say (for obvious reasons). But, we believe the three Japanese vendors, in alphabetical order, and not necessarily in the order in Table 1, were Fujitsu, Hitachi and NEC. The three American vendors, in alphabetical order, and not necessarily in the order in Table 1, were probably Intel, Mostek and Texas Instruments.

MANAGING A DIVERSE WORKFORCE

The computer division general management assignments gave me the opportunity to work with many more women and minorities. Engineering had traditionally been a very white male oriented occupation. While I was in the instrument divisions there were a few Asian males joining the company but a dearth of Women, Blacks and Hispanics. Computers offered opportunity for change. The large part played by software along with financial, educational and business type applications made computer businesses much more attractive for job opportunities for women and minorities. In my time as General Manager of GSD I put together a staff consisting of three women, one black male and two white males.

In 1982 I was given the opportunity to take the summer off and go through the Stanford Executive Program (SEP). It was sort of a mini MBA for very experienced executives. The program was intended to train future CEOs. Sometime in late 1983 or early 1984 I was asked to be the Group General Manager of the Microwave and Communications Group. That was likely my best fit in the company and I accepted without hesitation.

SHARON HALL

Pat Castro (left), Irene Bever, Polly Johnson, Nancy Anderson and Mary Chin are among HP's growing number of women executives.

A woman's place: managing at HP

When Dick Anderson was general manager of the Computer Systems Division, women held half the spots on his six-person management team.

For Dick, now general manager of the Microwave and Communications Group, this seemed quite matter of course.

"I've thought a lot about the fact that when I was in high school, nine of the 10 outstanding graduates in my class were women and one was male (and it wasn't me). You have to ask yourself why not appoint a woman—just as you would a man—on the basis of ability, presence, leadership skills, intellectual capacity and personality: all the things

that make a successful manager. I never had a qualm about the women I named to functional management positions, and the record shows I was right. As more and more women pursue technical careers, we'll see their rapid growth in companies. I hope HP will be a leader in welcoming them."

In the decades since equal opportunity legislation was passed in 1964, the numbers (see chart on page 5) show that the company has made a determined effort to recruit more women professionals. As more women enter the management pipeline, a small but growing number now hold executive-level positions at HP.

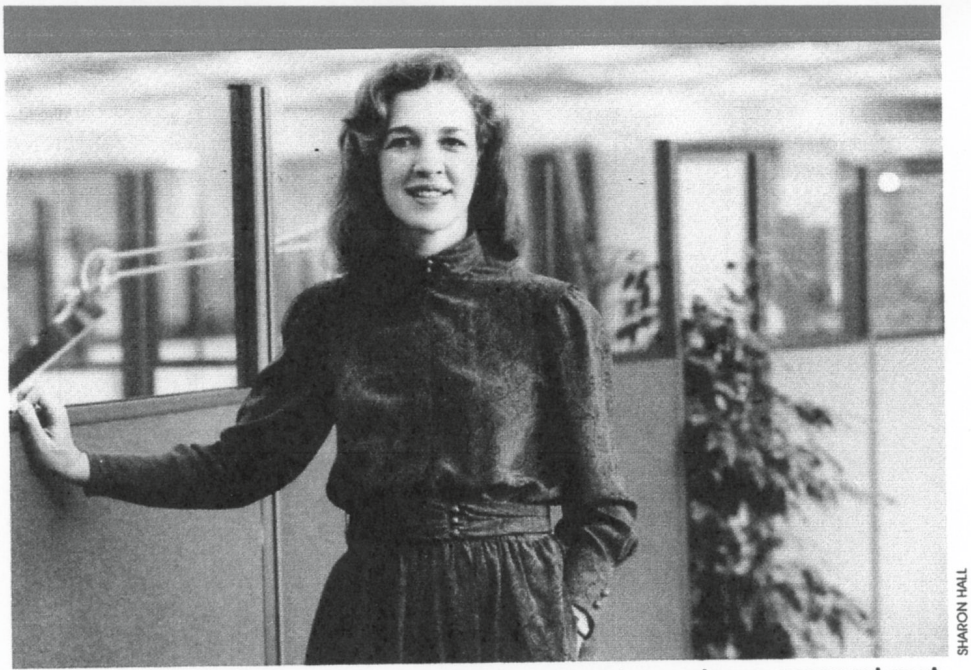
Top of the ladder

Some 50 women are currently ranked as functional managers or above, representing 5.6 percent of all top-level managers in the company worldwide and 6.2 percent in the U.S. (up from .5 percent in 1978). The first breakthrough in sizable numbers came in personnel. Today about half of HP's women executives head personnel departments. Recent months have brought a number of significant appointments such as the first woman operations manager, women R&D and manufacturing managers and the first woman area general manager in the field.

Even more women are knocking on that executive door. In the U.S., some 340 women make up 9.6 percent of middle-level managers. They are R&D project and section managers, product marketing managers, production and engineering managers, and district managers in the field.

They hold jobs in all functional areas, with many more in marketing (women make up 21 percent of all marketing middle-managers in divisions and in related jobs in the field) than in R&D (7 percent) and manufacturing (6 percent)—the three functional areas which have traditionally supplied HP's general managers. Women managers are 19 percent of the combined administration, finance and personnel middle-managers in the U.S.

One person who is frankly delighted to see women emerging into key roles is Pat Castro, director of the IC Processing Laboratory in HP Labs since 1979.



SHARON HALL

HP's first woman operations manager Laura Cory pauses on her way to a management meeting in Palo Alto. She heads the Semiconductor Productivity Network Operation.

She has been conspicuous as a highly-placed woman technical manager. "It's been no fun being the only lady at meetings," she says.

Pat believes in active guidance of women so they can know what skills they need to move upward in the organization and to deal with managers at higher levels. "But you can't choose your mentor," she warns. "Mentoring is never discussed but develops spontaneously." Given the present percentages of men to women managers, that coaching generally comes from a man.

When other women ask her for advice about getting into management, Pat suggests changing jobs "to learn new facets of the company." It's also wise to look for managers with different types of managerial strengths, such as giving good presentations, skillful negotiating and a clear understanding of the businesses HP is in.

Nancy Anderson, marketing manager for the Computer Systems Division, was one of Dick Anderson's appointees when he headed that division. (Quinn Cramer continues as personnel manager while Ilene Birkwood, who was quality manager, is now the director of software training for the company.) After getting degrees in math, she worked for two other companies before joining HP seven years ago.

"Because the computer industry is so young, it is very accepting of women," Nancy says. It is not unusual for customers visiting the Cupertino, California, site to hear women professionals give all the presentations on the

A TILT TO THE DISTAFF SIDE

HP's tilt toward computer systems and software—half of HP's design teams are working on software projects—will have an impact.

According to the National Center for Education Statistics, women earned 34 percent of bachelor's degrees in computer science in 1981-82 and 8 percent of the electrical engineering degrees with a computer-science component. HP has been recruiting heavily in these fields, which accounted for 28 percent of its U.S. college hires in 1984, and is getting far more than its share of available women graduates. And HP is hiring women professionals across the board in increasing numbers—they made up 29 percent of all undergraduate college hires last year.

Women chemists, for instance, are well represented in the Analytical Group's division and field marketing. Ginny Curtis, a former college chemistry teacher who began selling for HP in 1983, topped all Analytical field reps in the world last year with $3 million in sales.

It's just a matter of time, assuming that these women stay with the company, that they'll be competing for managerial jobs in large numbers.

Back to the Future in Microwave & Communications

In late 1983 or early 1984, I accepted the position of Microwave and Communications Group (MCG) General Manager. Some of this was a return to my roots and felt very familiar. Other parts were new to me and provided the opportunity for personal and career growth. The annual revenue of the group was over one billion dollars and growing rapidly. These were the years of the Reagan economic boom. The two largest divisions were the Signal Analysis Division which had grown from the original Spectrum Analyzer entry and the Network Measurements Division from the Network Analyzer. It was gratifying to see how much these first two products had contributed to the success of Hewlett Packard. These two divisions, together with an important technology center, were based in Santa Rosa, California. The other divisions derived from the former Microwave Division were the Spokane Division in Spokane Washington and the Stanford Park Division in Palo Alto. There was also a metals and plastic based fabrication center in Palo Alto. Over the years the group had also incorporated three additional divisions, the Colorado Telecommunications Division in Colorado Springs, the Queensferry Telecommunications Division in South Queensferry Scotland and the Kobe Instrument Division in Kobe, Japan. The group headcount peaked at over 10,000 people. It was a great opportunity for me, and in 1986, I was elected a Vice President of the Hewlett Packard Company along with my continuing responsibilities as General Manager of the Microwave and Communications Group.

The traditional microwave instrument business had been driven by military spending which peaked in the Reagan years. By 1986 it was clear that the defense growth driver would not continue and we needed to pursue opportunities in the rapid growth areas in all types of communications. In the coming years we investigated opportunities in cellular communications, satellite communications, packet switching networks, network television, global positioning networks, fiber optic communications, surveillance systems, wireless interconnection, classical telephony and too

Hewlett Packard Vice President. About 1980.

many more to list here. We also took initiatives in computer aided design, comprehensive test systems and network management.

As we searched for opportunities one thing seemed clear, it would take more than one new initiative to keep the business healthy and growing. We were unlikely to find another giant opportunity like Spectrum or Network Analyzers. To help our efforts we made a few strategic acquisitions. We acquired a protocol testing company in Edmonton, Canada; a telecom test joint venture in Padua, Italy; a microwave computer aided design (CAD) company in Northridge, California and entered into some joint venture projects in China, South Korea and Europe. To build on our historic strengths and success, we initiated new business directions in:

1. Wireless Transceiver (cell phone) Test
2. Fiber Optic Test
3. Microwave Computer Aided Design (CAD) Solutions
4. Microwave Test and Measurement Systems
5. Integrated Network Test and Management
6. Video System Test and Management

STANFORD UNIVERSITY, STANFORD, CALIFORNIA 94305-2391

ROBERT K. JAEDICKE
ENDOWED PROFESSOR AND DEAN
GRADUATE SCHOOL OF BUSINESS

September 25, 1985

Mr. Richard W. Anderson
Manager, Microwave and Communications
Group
Hewlett-Packard Company
3000 Hanover Street
Palo Alto, California 94304

Dear Dick:

"Who's News" was more interesting than usual. Congratulations on your new position as Vice President. I send you greetings and best wishes for every success from your GSB friends.

Best personal regards.

Sincerely,

Robert K. Jaedicke

RKJ:emd

VOL. 26, NO. 3 • MARCH 1987

Microwaves & RF

A HAYDEN PUBLICATION

Join us in celebrating 25 years of high-frequency technology!

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Hewlett-Packard's HP8562A portable spectrum analyzer

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- *Special Report: DBT, PBT, pmHEMT, and HBT —the future of high-frequency transistors*

FEATURES

New riches from superconductors

NEW YORK: A revolution in the field of superconductivity promises new riches for companies able to adapt the new technology to high-performance computers, medical devices, "flying trains" and nuclear fusion.

US companies are ahead in the search for new applications, but they are looking over their shoulders at Japan. Americans fear they could lose their edge in superconductors the same way it was left well behind in such technologies as the transistor and the integrated circuit.

"It (superconductivity) will be a very good litmus test of seeing which companies or countries can keep marching ahead," Mr Praveen Chaudhari, vice president for science at International Business Machines Corp, said in a recent interview.

"We're very sensitised to this issue in the United States," Mr Chaudhari said. "This is something we all ought to watch very carefully."

Superconductors are little-understood materials that lose all resistance to electricity below a certain temperature. The threshold used to be not far above absolute zero, which is a frigid 459 degrees below zero Fahrenheit (-359C).

Starting with a discovery last year by IBM scientists in Zurich, Switzerland, and accelerating this February, scientists around the world have been leapfrogging each other in raising the threshold temperature to levels that open new worlds of commercial possibilities.

Theoretically, with better superconductors, computers the size of a bread box could run at super speed without overheating; bullet trains could float on magnetic fields; cheap, clean and abundant energy could be created through nuclear fusion.

The commercial market for products using superconducting elements could range from US$11 billion to $36 billion a year by the year 2000, according to an article in Naval Research Reviews that was published in 1985, before the latest breakthroughs.

Superconductivity is still in its infancy, that tender age when corporate researchers still divulge their results at packed scientific meetings instead of hoarding potentially profitable findings.

In fact, some scientists say it is too soon to start developing products for sale because the state of the art is advancing so quickly that any device is likely to be out of date by the time it reaches the market.

Financial analysts say sizeable profits from superconductivity lie well into the 1990s or beyond.

"Speculation is moving light years ahead of the reality. I just don't see any impact right now," said Mr H P Smith, an electrical industry analyst for Smith Barney, Harris Upham and Co.

Nevertheless, dozens of companies in the United States are throwing money and people into the race.

"I can't imagine a major institution in this country that doesn't have a serious effort in this area," said Mr Robert Dynes, director of chemical physics research at A T and T Bell Laboratories in Murray Hill, New Jersey.

The Japanese government, following a proven formula, is planning a coordinated effort of corporations, universities and government labs.

"It seems like superconductivity is another thing they have targetted almost as a national focus," said Mr Thomas Chesser, a Japan watcher for Smith Barney.

Research is already under way at Hitachi Ltd, NEC Corp, Mitsubishi Electric Corp and other corporations as well as the University of Tokyo and labs run by the Ministry of International Trade and Industry, among other places.

The Japanese government's spending on superconductivity research is likely to increase tenfold this year, predicted Mr Kiichiro Yamagishi, past director of technology for the Japanese External Trade Organisation in New York.

He said he could not provide figures.

"In the past, Japanese companies were very skilful to commercialise new technologies, very quick," Mr Yamagishi said.

But Mr Yamagishi said it is too early to concentrate on commercialisation.

Scientists in the United States, Japan and elsewhere should share their findings for their mutual benefit, he said.

The United States is No 1, or at least tied for the lead in superconductivity research at this point, several scientists agreed.

Many companies — Hitachi, A T and T, IBM and General Electric Co, for example — long ago developed detailed plans for superconductors that they had to shelve because the economics weren't right with the old materials.

Those plans are being dusted off. But the biggest profits might come from products that have not even been dreamed of yet, Mr Chaudhari and others said.

"At this point we're definitely keeping an open mind," said Mr Michael Jefferies, manager of GE's research and development center in Schenectady, New York.

Varian Associates Inc of Palo Alto, California, hopes to become an early winner from superconductivity by selling equipment to other researchers.

Varian is modifying a chip-making machine so it can lay down superconducting materials on chips one molecule at a time.

Far larger companies — including the Japanese — are working on similar machines.

But Varian is counting on its expertise and its links with scientists from neighbouring Stanford University to come out ahead. — AP

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產品集中火力 客戶導向 人才優秀造就轉型成功

（記者詹惠珠/台北）

台揚科技公司股價在五個月內大漲四倍，外資持有台揚的股票從1,500張大幅增加到48,000張，台揚股價飆漲，反映台揚成功的轉型，而主導台揚轉型的安德森（Richard WatkinsAnderson，台揚公司提供）昨（28）日指出，在無線通訊時代來臨，全世界沒有一家公司像台揚的產品有多元化的組合，台揚有能力與世界級大廠進行策略聯盟，台揚的股價未來表現會比其他通訊股更好。

安德森是美國惠普公司前任副總裁，1992年至1997年是以美國惠普公司的法人代表，擔任台揚的董事，1997年擔任台揚的執行總裁（CEO），主導台揚的改造，將十餘種產品縮減為四種，使台揚不但轉虧為盈，更成為通訊產業的明日之星，安德森為現任台揚董事，他強調，台揚的轉型成功來自產品集中火力、客戶導向、以及優秀的人才三大因素，以下是訪談紀要：

問：通訊時代來臨，台揚在國際市場的競爭力和發展利基爲何？

答：台揚未來的發展潛力是無限（unlimited），其商機來自無線通訊、網際網路、手機上網、寬頻等，市場的需求相當大，而歐美等通訊大廠會釋出更多的委外訂單（outsourcing），而全球沒有一家公司像台揚具有相當獨特的利基，包括技術、研發、製造、產品領域的多元化，加上台揚所生產的產品進入障礙相當高，台揚在國際上的地位可以說是 second to none。

過去當我與世界級的大廠如朗訊、Netro 介紹台揚時，他們都樂於與台揚接洽，台揚也有能力與世界級的大廠進行策略聯盟，台揚已不是去「尋找」機會，而是從機會中去「篩選」合作夥伴的名單。

問：你是否可以談談台揚的轉型和台揚未來的發展？

答：三年前台揚的產品線相當多，並沒有集中火力，在看好無線通訊的市場，台揚進行組織重整，這是台揚轉型成功的關鍵因素；另一個則是並以客戶導向，生產線配合客戶做規畫，與客戶建立非常密切的關係；並配合對人才的訓練，以合理的報酬留住人才，台揚是少數高科技公司中推出股票選擇權的公司，並開辦員工持股信託。

未來無線通訊仍會出現大幅度的成長，台揚將可望爭取相當大的商機，而無線與有線的整合是台揚在未來將追蹤的發展。

Above: From a Newspaper in Hong Kong, 1987

Left: Global Marketing!

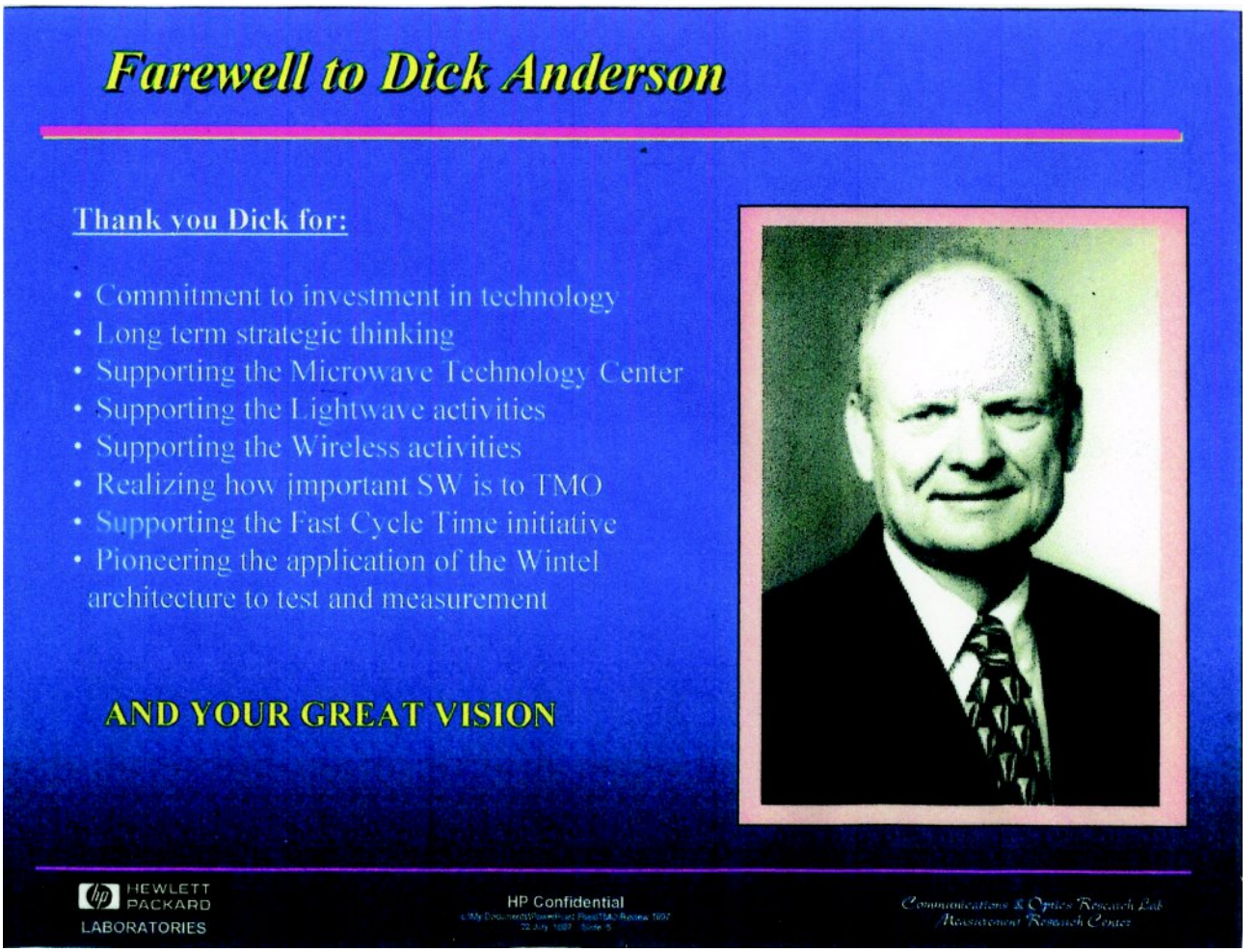
Over the fourteen years that I was the General Manager of the Microwave and Communications Group it was my privilege to work with and be supported by some very capable and dedicated people. The division managers included Bill Wurst, Byron Anderson, Duane Hartley, John Shanahan, Alan Seely, Rod Carlson, Al Steiner, Doug Scribner, Finley McKenzie, Ned Barnholt (who became my boss), Jim Olsen, Deborah Dunn, Scott Wright, Jim Rundle, Yoh Narimatsu and Don Summers. Staff members included Gil Reeser, Bob Allen, John Page, John Lemley, Marc Saunders, Russ Johnson, Chuck Acken and Candy Wehrcamp. I know some have slipped my mind after 23 to 37 years, so maybe some of my long time HP associates can jog my memory. I want to add here that I am forever grateful for the contribution and support of all of these exceptional people and for many others too numerous to list.

Over these wonderful years the group was always at the top of the company's profitability rankings. The group showed reasonable growth in spite of substantial decline in the traditional defense-based markets. This came from making valuable contributions in exciting new areas. Through it all, technological advances continued their historical pattern of excellence. I feel very honored and privileged to have been there. It was Camelot for sure!

During my years at HP I served on several external and internal boards including Conductus, Wireless Data, Gerber Scientific, Microcircuit Technology Inc., Hewlett Packard Ltd. (UK), HP India, and The Cupertino Chamber of Conference. Early in my career I was active in the Institute of Electrical & Electronic Engineers (I served in several elected offices).

In August of 1997, I formally retired from Hewlett Packard. I was honored by several friends and associates from all over HP worldwide. I am including some excerpts as part of this history. If you look through them please do it with the understanding that the lucky guy was me. I was blessed to work at the finest company in the world, founded by the two greatest leaders ever and employing the greatest work force in history.

Retirement event with HP Chairman Lewis Platt.



Top: A very kind farewell from the corporate laboratories.

Right: Grandchildren at retirement event.
Left to right: Devlin, Riley, Whitney, Tyler, Alexa

Selections from Richard's Retirement Album

Dick, when I think of the times I worked under you, no one event brings back more memories than the divestiture of the Palo Alto Fabrication Center. I have heard Lew Platt speak on two occasions where he specifically credited the success of this complex divestiture to the leadership of the management team. A team that was led by your sense of balance for what was fair for our shareholders, our customers and our people.

I will never forget sitting in Lew's staff meeting as you reviewed our plan, and having Lew ask who the heck ever recommended to put ALL PAFC employees on the excess list for VSI. If you remember, we decided to do this because we knew we would be announcing the plans to shut down PAFC right after the VSI announcement in 1992. Based on the way Lew asked the question, I though this might be one of those career defining moments, but before I could tell Lew that I made the recommendation, you jumped in and explained why WE made the decision. I really appreciated your support in that situation.

The PAFC divestiture is history, but the way we approached it has served as a model for most subsequent divestitures in HP. Thank you for setting high expectations and your unwavering support for achieving the right balance between what was right for our shareholders, customers and our people. Many people call it a class act. I call it the result of working with a class leader.

I wish you health and happiness in your retirement. I have certainly learned from your example and will apply what I have learned.

With fondest regards,
Doug Haller

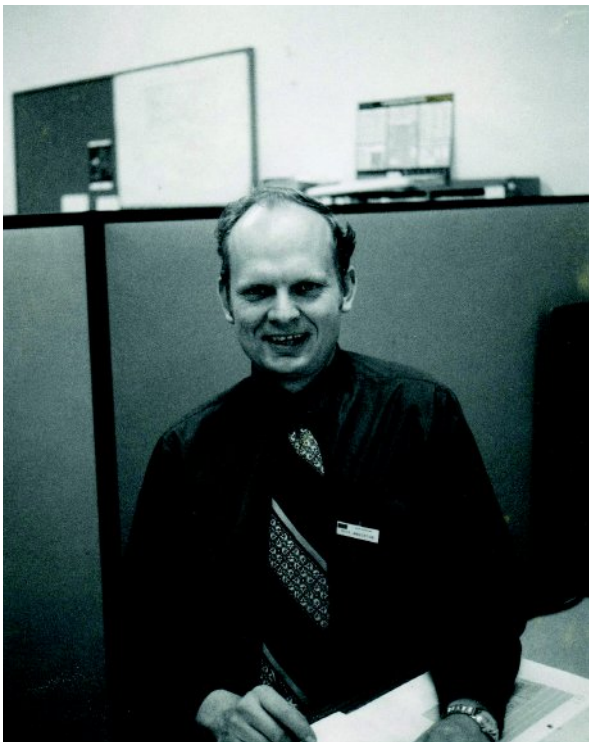
Dear Dick,

I regret that I will be out of town on the day of your retirement party. I'll miss seeing you and a lot of old friends and also learning of the fortunes of MTI.

I clearly remember the day I drove down to Cupertino to ask you to leave the glamorous world of computers and remember my pleasure when you said yes. You have kept and improved one of HP's strongest business and consistent profit contributors. I also appreciate your personal effort in making the microwave group an exciting place for many at HP.

I know you're going to enjoy the next career and I hope to see you soon.

Bill Terry



Cooking and serving steaks at a company picnic at Little Basin. 1971.

Hi Corny,

Back in the early 70s (1973 I believe), we had just moved into Bld 70 on Arques and I was coaching the division's softball team. At the division picnic at Little Basin that year I had formed two teams for a softball game and Dick played with us. Back then the ball field was down near the parking lot and there was a huge oak tree in dead center field. Most of the out fielders played in front of the tree because no one had ever hit the ball that far. I'll never forget when Dick came to bat and he promptly hit the ball OVER the tree. That Monday I cam into Dick's office and asked him if he would like to play on the division's team in the Industrial League in Palo Alto. Of course he politely declined due to time constraints, but I always thought he could have been the Mickey Mantel of our league.

Jim Bechtold

Dick:

When we first met, at an MDS review in Santa Rosa in the Summer of '93, I thought to myself, "This is a really beautiful setting; it's remarkable that people are getting paid for working here." Now I'm one of those fortunate people. And the beauty of the workplace isn't confined to its geography. HP-TMO in Santa Rosa is a technically strong, commercially successful organization of people who value excellent performance and personal responsibility. That description is a credit to the organization's leadership.

Thank you.

For everything.

Hans Mattes

Dick,

Congratulations on your impending career change:

HP Spotlight

1. Dick Anderson to retire, Bryon Anderson to succeed at MCG

Dick Anderson, HP vice president and general manager of the Microwave and Communications Group (MCG), will retire in August after 38 years of service with the company. He will be replaced at the helm of MCG by Byron Anderson, currently HP vice president and general manager of the Communications Test Solutions Group (CTSG). Tom White, general manager of the Computer Peripherals Bristol Division (CPD) in the United Kingdom, will succeed Byron Anderson.

I have enjoyed your help in several TMO efforts, including Motorola and Northrop. Thanks for everything...

Wishing you and your wife many happy times...

Bill Fritz, FE/TMO

Dear Dick:

Let me be one of the first to congratulate you on finishing an outstanding career at Hewlett-Packard. I have had the pleasure of knowing and working with you for quite a number of years, and I know this retirement is well-deserved.

I'm sure there will be a number of events regarding this soon and I look forward to attending at least one of them. I hope you and Moon-Yeen enjoy this new "adventure" in your lives.

Best personal regards,
George Cobbe

Greetings, Corny:

In response to Ned's note on Dick's retirement, I offer the following account. It may or may not be appropriate—you be the judge.

Back in the early seventies when Dick was GM for the Automatic Measurements Division, the division had a number of military contracts. Equal opportunity was the 'Affirmative Action' of the times, and we were told to expect an EEOC Inspector. All of the supervisors were gathered into our large conference room for a briefing by Dick.

When asked how we should respond to queries from this Inspector, Dick told us, "Be frank. Tell it like it is; call a spade a spade." Of course, the room erupted in a gale of laughter. Startled and taken aback, Dick said, "What did I say, what did I say?"

I'm sorry that I will miss the big reception for Dick, as my daughter and her family arrive about then from Pittsburgh, PA. Please convey my best wishes. I'm sure he will as busy in retirement as he is now (that has been my experience the past seven years).

Take care of yourself—
Bob Knapp

Hello Corny—

I can't believe so many of us still work for Hewlett-Packard after all these years! Guess that says some really good things about working for this great company!

I won't be able to attend the festivities, but I do remember an incident with Dick that for me was memorable. This happened shortly after I joined HP in late 1975, and if my brain hasn't failed me and I have the person right, it involved Dick and a swarm of bees. (I think it was Dick...Dick Love / Dick Anderson???)

I sat in Building 40 (when it still existed!), right next to the windows on the west side of the building. One day during the summer some bees began to swarm in one of the trees right outside my window. A number of us had watched with interest for a while, when all of a sudden, a wagon pulled up and out stepped Dick, all decked out in bee paraphernalia from his helmet to his heavy duty glove! Since I've always had an aversion to bees, I was fascinated that anyone I knew would be interested in retrieving their busy little bodies. What amazed me even more was that someone who was a high level manager in this international company I had just joined would don his "grubbies", and in front of everyone, scoop up this squirming mass of bees. I realized then what a people-oriented company I had just joined, if a manager at that level was willing to step out and just be a human being, enjoying what must have been a hobby for him.

So Dick, if my brain didn't fail me and it was you who scooped up those bees, I think you proved to me that day that the core of HP is it's people, and that I wasn't working with a bunch of "machines", but with warm, human beings. I hope you have many wonderful plans for your retirement and if you still keep bees, may your bees continue to prosper!

Best regards,
Kerry Pottery

Hi Corny,

Thanks for inviting contributions of Dick Anderson reminiscences!

I worked in Dick's organization for only a brief time in my HP career, but, nonetheless, he had a very positive impact upon me.

Dick probably recalls the dates better than me, but I believe he became F&T R&D Engineering Manager sometime in 1968. At that time, I had been with HP about two years, and I was only 24 years old. I was married and a father, but Dick looked and seemed so much older and wiser than me. Looking back now, I realize he must have been in his early 30's, but he might as well have been a senior citizen, as far as I was concerned!

As part of the DSA group, reporting into Skip Ross (through Charlies Trimble), I worked down the hill in Building 11, while Dick and most of his team resided in building 5M. With my first presentation to Dick, just prior to a scheduled B Checkpoint meeting for the Correlation Synchronizer addition to the 5480A Signal Averager, I recommended to Dick that my project be cancelled. That was a very scary thing for a young engineer to do, but Dick accepted the recommendation and gave me positive feedback. Dick Anderson Lesson #1: Tell the truth and do what is right for the business, and all will be well.

Shortly thereafter, Dick decided to bring back the DSA R&D team to 5M so that all the engineers could work together. Dick Anderson Lesson #2: Teamwork is a core value, and it works best when the team members are co-located.

I think we were still in 5M when Dick, Skip, and, I think, Jim Doub, invited me to an evening meeting at the old Cabana Hotel on El Camino Real. Room service dinners were ordered, and it quickly became clear to me that I would not be allowed to go home until I had agreed to their proposal that I become the Signal Averager Project Manager (Charlie had transferred to the IC Tester program). So I decided I had better go along with "the program." Dick Anderson Lesson #3: Drop down as far as is necessary (it was three levels from Dick to me) and give your personal time if you want to demonstrate your concern for employee and business welfare.

It was 1969 or 1970, and Signal Averager family sales were lagging. Dick had contacts with Microwaves magazine, and he volunteered Skip, Jim, and me to co-author a microwave application paper with him for publication. Dick Anderson Lesson #4: Leverage your previous experience for current returns.

The last encounter that I recall occurred in 1971. At the time, it was a somewhat negative happening, but the long-tern consequences were very positive. Another Project Manager approached me with the statement: "I understand you are looking for a job." Actually, I was not, so this statement was very upsetting. I talked with Skip, and he referred me to Dick. After about 20 minutes of discussion, I asked Dick if he wanted me to try something different. He responded affirmatively. With that advice in mind, I accepted a project management position in Logic Test R&D. Two years later, I moved to Personnel, and later transferred to Quality and then Manufacturing. While that initial job change could have been handled more gracefully, Dick successfully implanted in me the need to change responsibilities periodically. Today we would call that concept "Career Self-Reliance." Dick Anderson Lesson #5: Manage your own career before somebody else does it for you.

I thank Dick for all the help and guidance he gave me, and I wish him the best as he enters this next stage in his career.

Best regards,
Chuck Taubman

Dear Dick,

Congratulations on your upcoming retirement. It has been a real pleasure to work with you on the College's Advisory Board for the past several years. I hope that your "new-found freedom" will allow you to spend more time here in Cache Valley. We really enjoy your company.

Dick, I have really appreciated the kindness and hospitality you have shown to me over the years. You have been a very good example of how people who are busy and with demanding schedules can still take the time to talk on the phone, have dinner, or just visit. Of course, your support of our College in helping to sponsor or write letters of support for proposals to HP has been a great help to me in doing my job. I also appreciate your being a reference for me when I applied for a new position. I have also enjoyed getting to know your family; they are great.

Your leadership and style have always been a guide to me. It is no wonder you have done so well in every aspect of your work and other activities. You have been and are a great example.

I have also been impressed with your business knowledge and your view of the future. I'll always remember your speech to our engineering students about three years ago when you said how much our lives would be changing due to the electronic modes of interaction that were on the horizon. (Almost no one had heard of the web at that time.) Virtually everything you predicted has already happened.

It has been great to have you as a friend and associate. May I wish the very best to you and Moonyeen during the approaching years. I hope to see a lot of both of you.

Sincerely,
Robert L. Davis
(University of Utah)

Dick,

Retirement is just another job change but with more flexible time. Congratulations on your 38 year career at HP; it certainly must be a proud moment for you when you review all the accomplishments. The Spectrum Analyzer will always be one of the most memorable for me and I can still remember you at the bench working on the mixer (2GHz!). It was a great product family then and still is today. On a personal note, I want to thank you for the many times that you were there to support me. Our paths did cross quite often and I was very fortunate to have worked with you. Again, congratulations to you and Moonyeen on your retirement. Jane and I wish you both the best in the years ahead.

John Shanahan

Providing entertainment at the company outing at Marine World.

Dear Dick:

I can't believe you are really leaving! I've worked for or with you for 25 years and have always respected you. It is a great loss to HP to have you retire. You will be sorely missed.

I wish you and your family the very best. Please take care and God bless.

Best regards,
Ray Drost

Dear Dick,

I am sorry to miss your going away party, but Lynn and I will be in Scotland on a holiday. You and I have worked together for well over twenty years, and I look back on my HP days now with very fond memories. I know you will too. Remember, old cowboys never die, they just ride off into the sunset!

Best Wishes,
Gil

As Louix XIV with my good friend and boss, Paul Ely Grenoble. France 1979.

Dear Dick,

Congratulations on your retirement. I hope you and Mooneen enjoy it as much as Carol and I have. I have especially fond memories of the time we worked together at AMD, plus all the other times we had interactions. Sorry we couldn't be there for the formal event. I am sure it will be a wonderful event. Enjoy!

Sun Valley is on the way to Montana, so please come by and visit.

Best Personal Regards,
Ben L. Holmes

Dear Dick,

Corny called, and she wondered if I would contribute something to the scrapbook she's putting together. Well, I am honored, and hope this is not too late to be included in the book. But where to begin...

A bus ride to Miramar outside of San Diego. I was doing what passengers not engrossed in conversation often do (unintentionally, of course); I was hearing bits of conversation from those around me. Public Education was the discussion of two gentlemen behind me, and neither was impressed with its current status or eventual product. Though to hear from anyone, but when I found out later who the men were, I was concerned. It stayed with me for the next few weeks, so I asked Tim if I could write the gentlemen a letter. That poor guy has to live with me, knows how passionate I am on the subject of quality in education, and no doubt decided it'd be better

in the long run, so to heck with any future promotions!

You graciously accepted my invitation to come to the Tustin School District, truly impressive when considering how busy you were at the time. After all, we don't even know one another on a professional basis let alone a personal one. Dinner was good, and I learned about your many business trips to Asia, including a side trip to see the Cian pottery soldiers in China (my Ancient Civs class thought you must be incredibly wealthy to have seen something depicted in a history text!). You shared a bit about your personal life, including Tina's studies toward a degree in education and Moonyeen's prior teaching experience. In short, you put me at ease.

We went to a few schools in Tunstin and spoke with some of the administration. After talking again at lunch (cold pizza), it became clear that we were not as far apart in our perceptions about education as I had originally suspected. As a fact, we agreed that the current system is in need of revamping, and perhaps the most intelligent evolution at this time is to approach it as more of a business. I'm glad we were able to spend some time together outside the HP arena. I learned what the perspective of education is from a businessman's point of view, and I remain hopeful. The biggest surprise in this whole scenario was finding out just exactly where you ranked in terms of management (Yikes! I've never known anyone so important), and the generosity you displayed in personally funding the purchase of the Hewlett-Packard Printers for the Tustin Schools.

We ran into one another at this most recent Winner's Circle gathering, and I enjoyed visiting with you about recent developments in both Tina's careers and David's developing interest in photography (video and film). I was inspired to hear how Moonyeen handled the discouraging words about future employment by one of Tina's professors and how she addressed the issue with him. It's amazing how much I've learned from our short acquaintance.

Our most recent contact was when you agreed to write a letter of recommendation for me. You responded to yet another of my requests without hesitation, and I'm confident it will result in my future employment. I'm glad I was able to spend time getting to know you. You're an honest man with true integrity, the finest qualities any man can have, I think.

Enjoy your retirement, Dick. If you're ever in Phoenix, please look us up. We'd enjoy having you and your wife as our dinner guests.

Sincerely,
Peggy Cartier

After a hunting trip in Wyoming with another employee.

Dear Dick,

After so many years with HP I am sure you must have hundreds of letters wishing you "All the BEST".

I want to thank you for all the conversations over the years. You have always been very approachable, candid and full of that rare commodity: common sense. In particular I appreciated your sense of the difficulties the small countries face when living inside the BIG HP machine.

Your efforts to keep the flame going in the dark days of 1985-87 sales force 15 was an inspiration to me and all of the troops. I know how much courage that took at your level. Thank you.

I do not forget that through your leadership and contributions my stock in HP has educated my children, has given me wonderful experiences and will provide Ana and I a very comfortable life after HP.

I would not like to lose touch with you and your family. Even if it is only to exchange Christmas cards. When the dust settles and you all have decided where you'll live I would like to hear from you.

I wish you God Speed! May you always have the wind to your back and the face to the sun.

Warm person regards,
Bill Woehr
Geneva Switzerland

Greetings Dick,

I just wanted to send you my best wishes on your retirement. From my personal experience (over 7 years) I know that you will enjoy it and be even more busy than you are now. There isn't enough time to do everything! So do what YOU want to do and the rest will take care of itself.

Best regards,
Bob Knapp

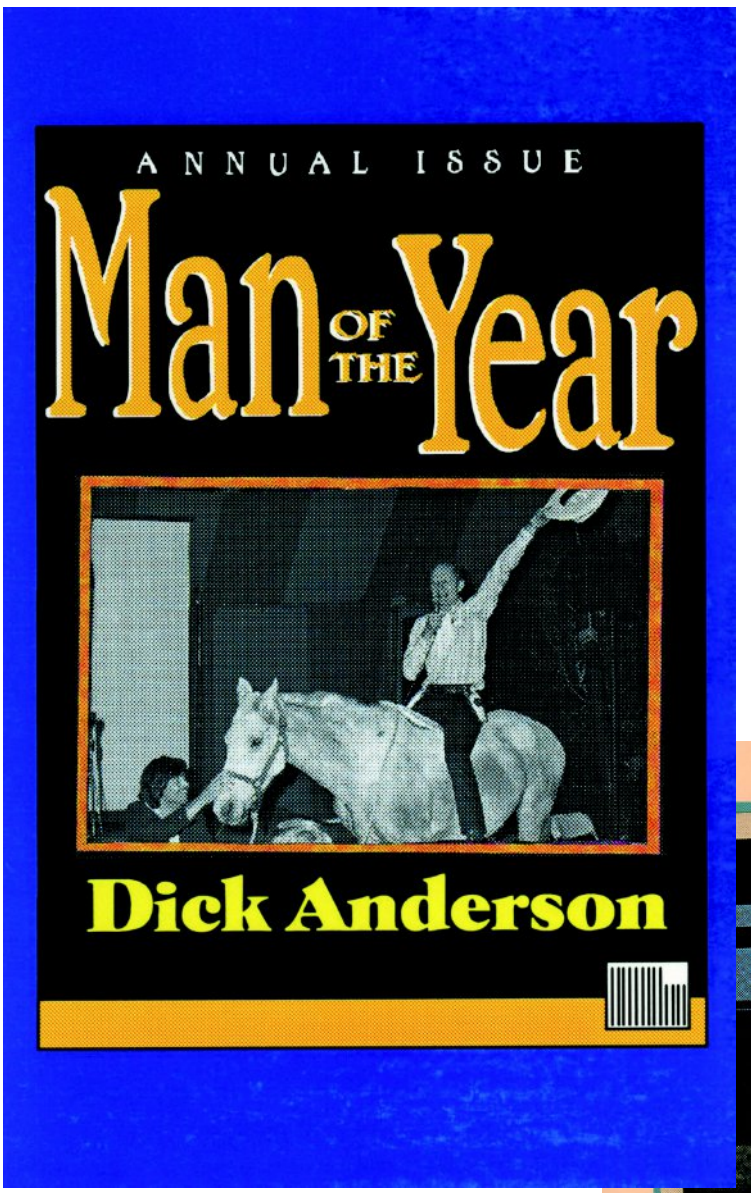
Leader of HP Posse! Work should be fun!

Dick, Byron:

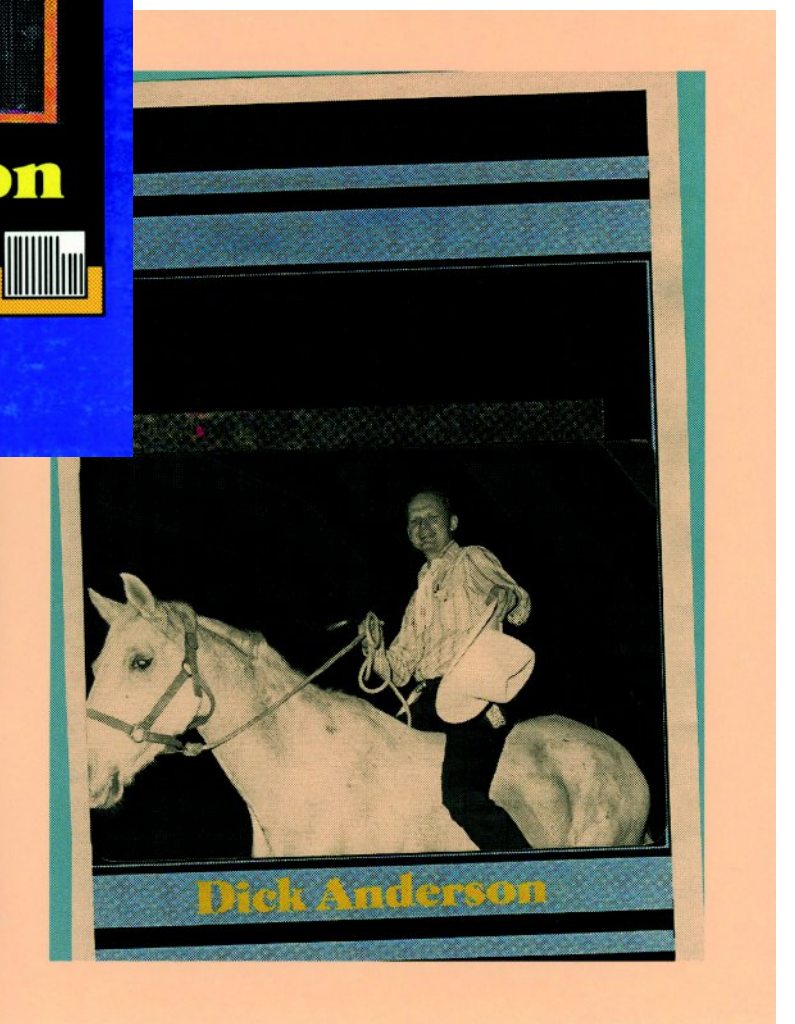
Congratulations to both of you on your respective moves: Dick, it's been great to work with you through my days in SPD and VID, and I hope you have a great time in your retirement. 38 years... Wow!

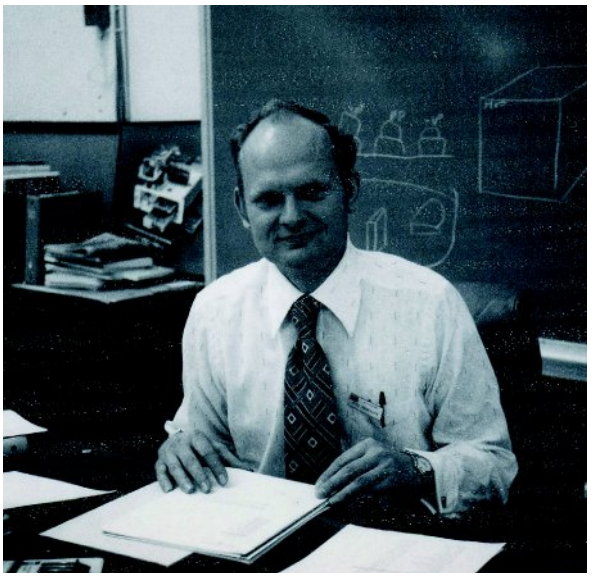
And Byron, best wishes as you move in to the MCG slot, and I'm sure you'll be able to provide the same great leadership for growth that you've brought to CTSG.

Best Regards,
Dana Kreitter



Managing on Horseback!
Round em up, Move em out!





Rare time at the desk, circa 1990.

Hi Dick,

As I read the announcement about your retireing, I had to send you a note. You had indeed had a very distinguished career at HP, and I am among the very many that greatly appreciate not only what you have accomplished, but also the manner in which you did it.

I haven't heard yet whether or not you have any specific plans for "life after HP". Our mutual associates tell me that:

- it really exists!
- the first Monday after retirement is the worst day.
- the greatest danger is that you will be too busy.
- you will wonder how you ever had time to work!

Whatever you do, I hope that the future is full of pleasant and fulfilling days for you and Moonyeen.

Best Regards,
Bill Kay

Please read this at the party:

Dick, please accept our sincerest thanks for your active support, encouragement and advice over the years. Your keen eye for detail, always on the prowl for opportunities, identified our need for microwave CAE focus a number of years ago – which subsequently has yielded much fruit. Your close questioning during Business Reviews always kept one alert and hence well prepared.

All of us in Canada again say a big thank you for your very direct involvement in the Purchase of Idacom, bringing a greater HP presence in our country which has provided jobs, excellent products and clearly demonstrates the Canadian Government HP's commitment to Canada. This has resulted in HP attaining favoured supplier status.

As a token of our thanks and to recognize the many outstanding contributions you have made to Hewlett-Packard's success over your 37 years please accept this book on Canada and we also bestow upon you the position of Honorary Canadian Field Engineer. (P.S. if you're looking for a part time job I'm sure we can carve out a territory for you with lots and lots of quota!!)

Dick on behalf of everyone in TMO Canada we wish you and Moonyeen many many healthy and happy retirement years.

From all your friends in the Great White North,

Alan Holdway

Hi Dick,

I am unable to stop by tomorrow afternoon but wanted to wish you well as you retire from HP. TMO has benefitted immensely from your visions on the future capabilities of technology. Your departure will leave a big void.

Best wishes in your new endeavors.

Becky Porter

Hi Dick,

I first want to thank you for hiring me into the F&T Division in 1969, and providing me some good coaching, support and advice several different times during my first years at HP.

I hope that you will enjoy this new phase of your life that you are beginning.

Sincerely,
John Stedman

Dear Corny,

Unfortunately, neither Carol nor I will be able to be in California for Dick's retirement. Please wish him and Moonyeen all the best from us.

As far as memorable events, there were many, here are just a few:

Dick's greatest fear: having to sign Joe Schoendorf or Bob Brannon's expense report.

After one trip to Europe, Dick asked Joe how he could have spent as much money as he had. Joe replied, "Only if you have small breakfasts, and order wine with every other lunch."

My best memory of a Dick and Joe's interaction is from a dinner we had an AMD for the then sales force 5. The new computer systems and organization had been formed but not announced, rumors were flying, but only a very few of us knew what ould happen. Paul invited himself to the dinner, and asked to speak to the AMD folks and to sales force 5. Joe was the host and was asked to introduce Paul as the Data Systems General Manager who assured him... "he had no territorial interests past Poland."

Dick was a great boss; we had lots of business successes and fun at AMD. The computer business was new, we were all kids, and had a great time. Many of the remembrances of those times are better left remembrances.

Probably my fondest personal remembrance of Dick involves Carol. Carol was offered the Microwave Marcom job while we were dating. After Carol took the job, Dick noticed I was hanging out around his group headquarters a lot. Since MPG had little to do with Microwave, he thought it somewhat peculiar. He told me later he had guessed our relationship, but had the sensitivity to keep it to himself. However, when Carol told Dick we were getting married and moving east, Dick warned Carol that I was a rather stubborn individual. Carol reported the conversation to me. The next time I saw Dick, I mentioned it to him, and stated, "That really is the pot calling the kettle black."

Sincerely,
Ben L. Holmes

Forbidden City, Beiing, China. Circa 1990.

With longtime, wonderful secretary, Corny Sluis.

Corny,

Sorry to be so late in responding, but I was trying to rearrange some schedules and wasn't able to work out attending. I do have the following story regarding the "miracles" of Dick Anderson.

Dick was good at customer calls and helping us close business. He visited Dr. Q. Balzano, a VP of Engineering and assured him that our uW CAE offering was the best in the business. We received several orders for the software along with the new "Risc" work stations from the Computer Group.

When Motorola couldn't get delivery, we had him visit with Walt Davis, a VP responsible for the IC development group and ultimate responsibility for the "Risc" decision. Walt needed to have Hewlett Packard new RISC architecture "spectrum" computers for his engineering group delivered in a HURRY.

Dick was able to get him the first two commercialized units before anybody from the Computer organization could do it. That convinced me that Dick could do two "miracles" per year.

My only question was, "Why didn't Dick move up the ladder in the Computer Group with power like this?" Maybe the answer will come out of someone else's war story. You will have to solve the mystery for me. I am really sorry I won't be able to attend.

Thank you for thinking of me.

Regards,
Bill Lovelace

Dick's association with Queensferry goes back a long way, back to the late sixties when Dick visited what was literally a green-field Queensferry site, on one leg of the 8410 Network Analyzer European introduction tour. Over the years, Dick's become a 'weel kent' face in Scotland, working first with the original Telecom Division, before going on to make one of his canniest and most successful HP investments with the start up of QMO in 1984.

As QMO Founding Father, Dick nurtured the fledgling operation through the tricky early years when so many start-ups founder. Dick has been a steadfast sponsor—even in years when business conditions were tough.

In 1992 Dick elevated QMD to Division status and laid the groundwork for five years of greater than 30% annualised growth rate.

Dick has always enjoyed a special relationship with QMD. Dick's bold vision for the Division succeeded beyond what any of us had dreamed of.

Dick, from all at QMD, our warm appreciation for your special contribution to our success and our best wishes on your retirement.

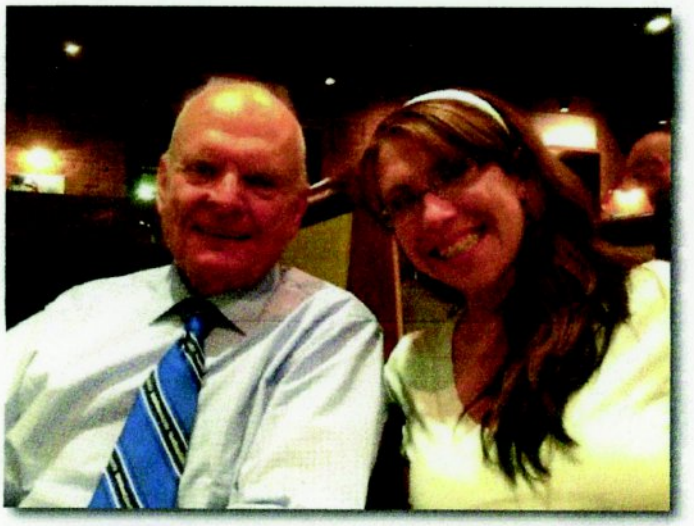
Haste ye back -
from Bill Savage and the QMD Team

My Return Visit to HP in 2000

In 1999 Lew Platt retired as Chairman and CEO of Hewlett Packard and the Board hired Carly Fiorina as it's new CEO. It became immediately obvious that the company would never be the same. In early 2000 Ms. Fiorina invited many retired HP executives to a meeting in the Cupertino Auditorium. I took the opportunity to join the meeting. After the meeting concluded I took the opportunity to have a several minute discussion with Carly.

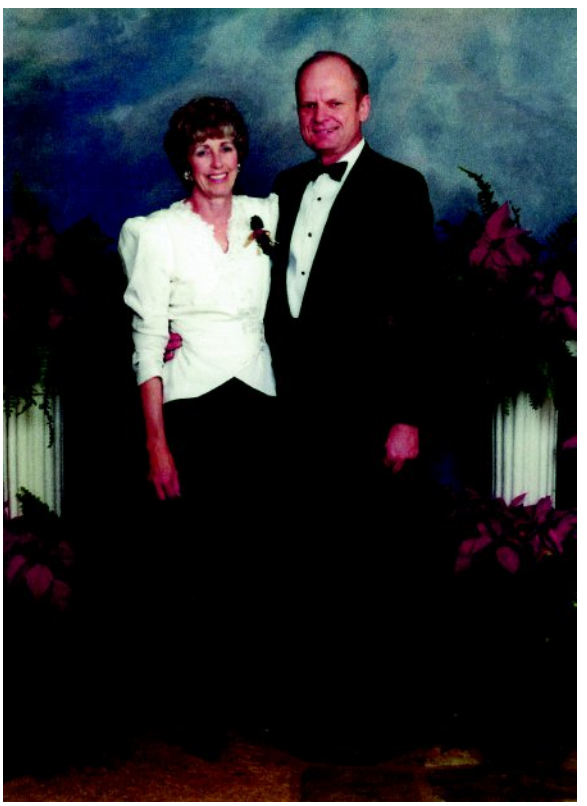
When I got home I decided to call Dick Hackborn at his home in Boise. Dick and I had worked together over many years, first on Automatic Network Analyzers and then in the Computer Operations. After exchange of pleasantries and a few laughs from old times, I told Dick where I had been and why I was calling. My message was four words: DON'T WAIT TOO LONG! I then explained that Carly was not a fit for the HP CEO job. Sooner or later she would have to be let go. Again, DON'T WAIT TOO LONG! My observation from the meeting was that her values were orthogonal to HP values. Orthogonal values will never get to satisfactory results. Sadly the HP Board waited too long. Momentum lost is impossible to retain.

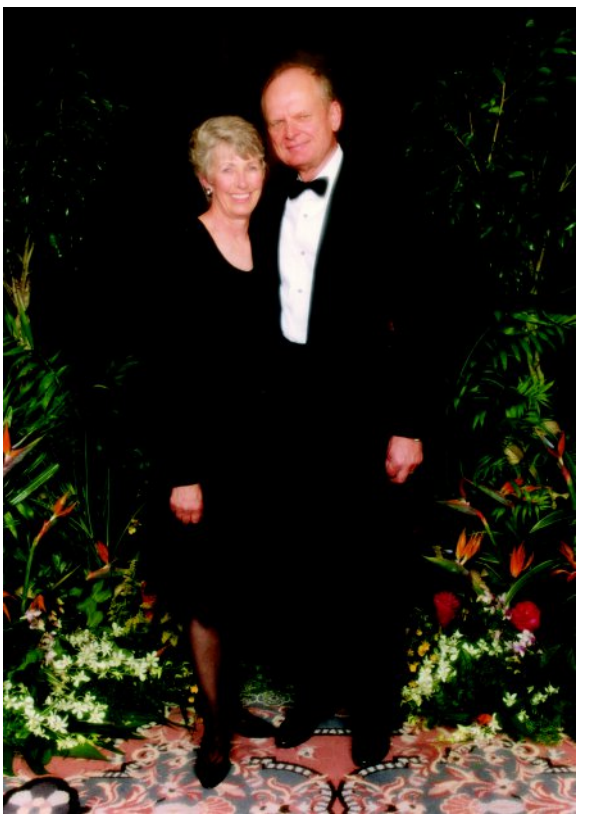
Sept. 23 - 24: Logan, Utah. Met with old HP boss, Dick Anderson, and did a presentation at Utah State University to a combined audience of engineering and MBA students.



Over dinner, Dick shared fabulous stories about his time at HP. One of the students, Kristen Sims sat next to Dick and soaked up his stories. I asked her what she got from the evening. Her response was remarkable:

"It was his humility, his view of leadership and the fact that he was part of HP during the 'golden age' that we've used as case studies in my MBA program." She continued, "I met a legend tonight. Now I want to go back and read those case studies again. The world became a little smaller. Someday I'll look back on today and realize I sat next to the great man."





Richard and Moonyeen at President's Club dinners through the years.

Retirement... Well, Almost

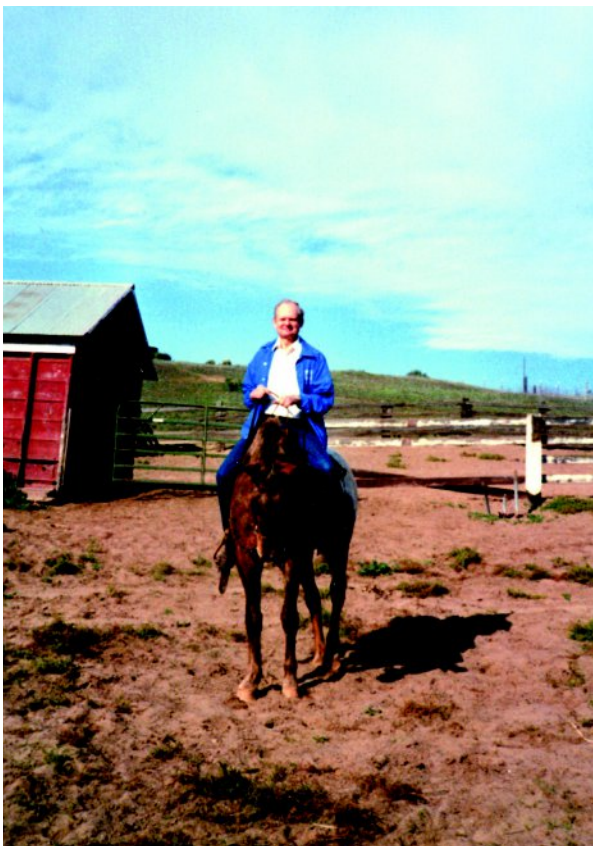
The Farm

As early as 1979 we started thinking about our later years and retirement. That year we bought a small farm in Monterey County. It was about five miles east of Moss Landing. It had a three-bedroom house and an adjacent building that we remodeled to be an apartment. There was a total of ten acres, with two barns, a metal shed, two small horse sheds and a well and well shed. The living room in the home had a great fireplace which was usable year around before California turned daffy. We had some fruit trees, grape vines and raspberries. We kept two or three horses there, some chickens and usually raised a beef or two. It was a great weekend retreat and we could be there in about an hour and fifteen minutes. Being near Monterey we had great seafood restaurants within minutes. We loved that place. We considered it for a retirement home but instead decided to sell it in 1996.

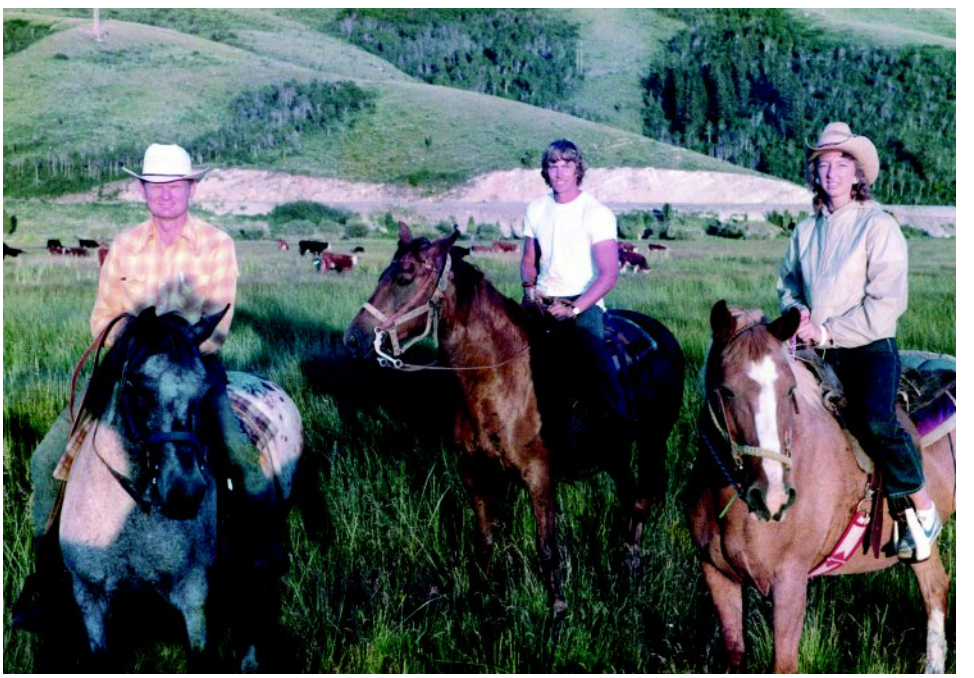
The Ranch

In 1983 we purchased a cattle ranch about ten miles north of Soda Springs, Idaho. We bought it as a partnership with Moonyeen's brother, Lawrence, and our oldest son, Mike. We bought it with a reasonable down payment and a fairly large mortgage from a rancher named Ross Rudd. The ranch consists of some 1240 acres of grazing and mountain land. We also lease some adjacent land from the Bureau of Land Management. It will usually hold over 300 animal units over three to four summer months. After a few years the note came due with a large balloon payment. We were the only ones able to cover it so we paid it off which increased our ownership substantially. Later we bought out Lawrence and Mike's remaining interest. About 2010 we gave the ranch to our grandchildren, for the most part. It is held in an LLC called Anderson Caribou Cattle Company. Each of our thirteen grandchildren are 7% members. Our five natural children are 1% members and Moonyeen and I are joint 4% members. We have enjoyed the ranch and spent many summer days and nights there in a motorhome. The first few years we ran it ourselves but now

The Anderson family, about 1989.
Children left to right: Tina, Sue, David, Shellie, Mike, Debbie



On the farm in Castroville.
December 1987



Life on the ranch. Richard on Monjuna, Mike on Sonny, Debbie on Nugget.

we lease it out for summer range to a couple of ranchers.

Utah homes and farm

In the early nineties it was becoming clear that California was in serious decline. It was no longer balanced politically and the wrong party was taking over. Homelessness, drug crimes, infrastructure deterioration, wealth distribution, quality of life, disaster management, and educational achievement were all going in the wrong direction. We needed to find other options.

In 1991 our son, Mike, started a small business in Logan, Utah. My parents were also still living in Brigham City. Over the years we had kept some attention in Utah. In particular, I had stayed actively involved with Utah State University and at that time I was a member of University President Stanford Cazier's National Advisory Board. I was also a member of the College of Engineering Advisory Board. I was also providing a little help and financing to help Mike get his business going. With all this going on, I asked Mike to look around and see if he could find something that Moonyeen and I would enjoy. He found a real winner. In late 1992 he found a large Tudor-style home between Wellsville and Hyrum on some 33 farmed acres. It took a couple months of negotiation but in early 1993 we consummated the deal and, it seems, put our retirement plan in place. Mike and Mindy then moved into the home which was fine with us since I was still working and would be for several years. By 1997 when I retired from HP we had sold the farm but still owned our Los Altos home, the Utah home and farm and our Idaho ranch interest.

Passing of my father, Norman H. Anderson—December 29, 1996.

Some eight months before I retired from Hewlett Packard my father passed away at age 88. He had spent the last five years of his life in a rest home in Brigham City. He hated it. We tried to visit him there as much as we could. The two years before I retired we spent a lot of weekends in Utah. That gave us time to spend with Dad and Mom and also to work with Mike getting his company, ScyTek Laboratories, going. Dad had been a very wise and frugal money manager but his rest home stay cut into his savings and investments. Nevertheless, he and Mom left a good amount on their death. Before Dad died, I asked them to bypass me in their wills and leave what they had intended for me to our six children. They did comply with that wish and I am sure our children appreciated it.

MTI and Taiwan

Immediately after retiring in August of 1997, I joined a Taiwan company, Microelectronics Technology Inc or MTI. In the 1960's I had been involved in hiring a young Taiwanese engineer by the name of Patrick Wang who had just completed a PhD at Stanford. Patrick worked for about twelve years in the Microwave Divisions and then got together with some of his Taiwan friends and started a company in Taiwan that they called MTI. Hewlett Packard was supportive of their endeavor and provided a good deal of HP instruments in return for a 23% common stock ownership. This ownership provided for a board seat. The last few years of my career at HP, I served on the MTI Board representing HP's shares and interests. Upon my pending retirement, I informed Patrick, who was at that time the chairman of MTI, that I was retiring and would no longer be HP's board representative. Patrick then asked if I would be willing to stay if they could come up with other shares, and additionally, would I be willing to work with MTI on some management issues that they were facing. After discussing it at length with Moonyeen, I agreed to work for MTI for eighteen months

and requested that all of my compensation would be in MTI stock.

Working in Taiwan

Soon after joining MTI in Taiwan, Patrick asked me to join him and the company CFO, Amy Ding, in a series of meetings with their bankers in Taipei. The objective of the meetings was to assure the various bank officials that MTI was on track and deserved continuing decent lines of credit. I can't recall which banks were providing lines of credit but I seem to recall Credit Agricole and Credit Lyonnais as being there. The meeting was a little testy as MTI had missed some financial objectives. Patrick introduced me and assured them that I would be a big help. I made a slide presentation on the direction I hoped to move the company. As I recall they gave Patrick the OK but wanted me to play a bigger role than just consulting. The MTI board took the step to appoint me Chairman of the Executive Council and CEO for the duration of my time there. A big part of MTI's difficulty was trying to do too many things at once. They had a business in digital radios of the type used in point to point microwave links. They built LNBs or block down converters for satellite television reception. They were doing a little bit of business in cellular base stations and looking for opportunities in diverse market areas. They were a little too spread out for the size of the organization and the dynamics of a fast changing market. With the reprieve from the bankers and me in a position of more responsibility it was time to go to work.

Top: MTI Management Team with HP visitors, Duane Hartley and Bill Wurst.

Bottom: MTI Board Dinner at Maddox. 1995.

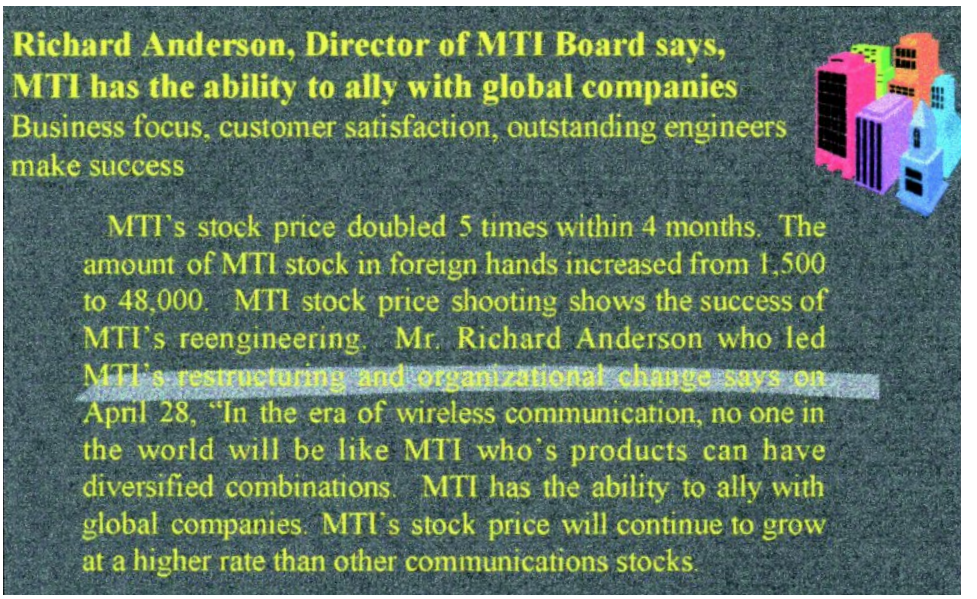
Our time in Taiwan was very interesting. Patrick had a reasonably nice home in Hsinchu Science Park, the Silicon Valley of Taiwan. It was a five minute drive from MTI headquarters. It was a short walk to a public school where we went every morning to run and exercise. About a quarter mile farther on was a market area where we could buy most of what we needed. There was also a very good Japanese-style sushi restaurant. We were provided a car and driver which took me to and from work each

day. Taiwan was a challenging place to drive with thousands of motor scooters competing with automobiles for a place on the road. We were also driven to church each Sunday. We attended an English speaking branch that was about 50% Americans working in Taiwan and 50% Filipino's working on the production lines in semiconductor plants. I taught the Gospel Doctrine class and really developed a love of the Filipino people. Usually after church our driver took us to a nice hotel restaurant for an excellent Sunday brunch.

One interesting learning was that even in a science park electric power was limited. Patrick apparently never did laundry at home. His wife lived most of the time in Taipei and Patrick was just in Hsinchu for the work week. Patrick bought us a washer and dryer. The first time we used the dryer, we lost our TV. It turns out the neighborhood cable TV was powered from our house on the same circuit as our dryer. After that we dried our clothes in the middle of the night after we unplugged the cable system. We figured the only ones watching at that time were dirty old men watching porn movies. It worked out very well for us. It wasn't a lot of upkeep work and I could put a lot of evening hours preparing for the next day with the MTI team.

Through the end of 1997 we held a lot of company meetings covering values, culture, objectives, strategy and tactics. We also worked better as a team to meet production and engineering schedules. We began to see a little better sales and profit performance. The bankers felt better and we all breathed a little better. By then we were better focused on a more coherent direction. We wanted to really excel at building excellent communication transceivers that would delight our customers. We were gaining confidence in our future. This led us to start thinking more about where the future should take us. After all, I only planned to be there another year. MTI would need new, committed leadership to achieve their vision.

Early in 1998 a cold wind of reality blew over us. Asia was gripped in sudden economic downturn that threatened to upset everything we had accomplished. We called on our sales champions to do all they could to fill the order pipeline. Our VP of marketing took up residency in the passenger cabins of the world's airlines. After a lot of soul searching we committed ourselves to saving every expense NT (New Taiwan Dollar) we could but keep the



initiatives in transceivers on track. This turned out to be the right decision. On the subject of succession planning, my success was mixed. I recommended that Allen Yen be promoted to President and CEO on my departure. As it turned out, MTI was unwilling to give the job to someone so young and with little tenure in the company. He would be skipping over people much his senior. Last I looked, MTI was about $250 million US and Allen Yen is Chairman of the Board. I also believe that MTI is now partially owned by Foxconn. All in all it was an enjoyable experience for both of us and my only regret is they didn't move faster on the organization suggestions.

Back to Zion

After we finished up at MTI in 1999 we kind of bounced back and forth between Utah and California. In August we had a large family reunion for the Heber and Judith Anderson descendants at our Wellsville home. Over one hundred family members were there. Mike and Mindy were moved into their beautiful new home by then. We still maintained a presence in both states.

Social Services

It was back in 1980 that we welcomed the last of our children to our family. During the 1970's we had taken in several distressed youth. As I recall we took in four unwed mothers through the LDS Social Services Program. They would live with us until their baby was due and then Moonyeen would take them to the hospital for delivery. Usually then the baby would be put up for adoption. As our children got a little older we decided it would be better to discontinue these acts of service and switch to a happier alternative. At this time California Law allowed for a mother giving up her baby for adoption to have a few days to change her mind. It would obviously be bad policy to place the baby with adoptive parents before the change of mind option had expired. So instead of caring for prospective mothers we provided care for pre-adoption babies. As I remember we also cared for about four newborn babies on this program. I would add that all was voluntary and we covered the living expenses for mothers and babies we cared for.

David

In late 1979 we were asked by the Church Social Services if we would take a baby boy about six months old whose parents were having marriage problems. We took the little guy that had the name of David Lewis Garrison. It was expected that the parents would get back together again. When he was brought to our home it was clear that he had been badly neglected. He couldn't even roll over by himself. Well, we showed him the attention and care that he had been denied. We taught him to roll over, then crawl and then to walk. He even learned to talk some and was doing quite well. The following summer when David was just over a year old we got a call from the Social Services that the family was reuniting and they would be by to pick David up. Right after that we left for a family vacation. When we returned from vacation we were home for about ten minutes when the phone rang. It was the county this time. The family had blown up again and they needed a place for David. Would we be willing to take him for a while under the county program since he knew us? We said yes and David was with us again. Again it was expected to be short term while adoptive parents were found. Well, it went on and on and soon it was obvious that David was developmentally delayed and had some other issues as well. It was also alleged that David's parents both used drugs when he was in vitro. 1981, '82, and '83 went by and no adoption. In 1984 the county finally informed us that they were unable to find placement for David and they asked if we would adopt him. The answer was yes and in

David at Edinburgh Castle, Edinburgh, Scotland.

1984 he became David Lewis Anderson. At that time Debbie was 25 and married, Mike was 23 and in college at Utah State, Shellie was 21 and in college, and Sue was 19 and at BYU. Tina was 10 years old and still at home. David was an issue for her because he wasn't always well behaved.

David had a very difficult time in school. He had a hard time with the basics (reading, writing and arithmetic) and was often disruptive in class. He did pretty well in sports but that only counted for so much. We worked with the Children's Health Council at Stanford and the Mountain View Los Altos School District to find some way to help him learn and grow. He attended special education classes all the way through junior high school. He also had weekly sessions with clinical psychologists and special education counselors. When he was fourteen we decided to go another route. He had started to strike out at Moonyeen and that was unacceptable. Moonyeen contracted with a special education resource consultant to do a nationwide search for effective residential schools that might work for David. After reviewing several options David enrolled at a residence school called Wide Horizons in Oak Run, California. It was a farm situation with a full-time special education program. David raised chickens and pigs there, winning some ribbons at the Shasta County Fair. It was a great choice for David.

After successfully completing the program at Wide Horizons, David enrolled at a trades-oriented institution in Phoenix, AZ called Life Development Institute (LDI). It was recognized by George H. W. Bush as one of 'The Thousand Points of Light.' David did fine the first couple of months and then things fell apart. David met a young lady who was not enrolled there and ran away with her. They lived sort of half time in her home

Wenjun Feng with David at the Farm.

with her father and half time on the streets or with friends. Shortly after their meeting she was found to be pregnant. They got married and we pretty much kept them from starving. They both found a little work but still needed a lot of help. We bought them an older trailer house in a trailer park in hopes that they could have a little stability in their housing needs.

TERRIBLE DAYS

On September 7, 1998 Trevor Quenton Anderson was born to David and his young wife. They continued to live in the trailer, the three of them, until December 1999. One evening a few days before Christmas we received a call from David's wife informing us that David was in jail. We learned later that a high school friend of hers had recently been paroled and had moved in with them. Her friend had been incarcerated for burglary and strong arm robbery. He had developed a method of robbing pizza delivery drivers before he was locked up. It turns out he got David to work with him to do the same but on one night they got caught and both went to jail.

We were already reeling from a hard blow. About a month earlier our youngest daughter, Tina, was diagnosed with a stage lll melanoma on her right flank. She had gone through extensive surgery to remove the tumor and strip out targeted lymph nodes. We didn't need that double-barrel shot, then or ever. But our hurting wasn't over. As I recall it was the night of December 19, 1999 and we were at our home in California. Shellie, Peter, Tina, Moonyeen and I were there. At approximately 8:00 pm the phone rang. It was Mike. They had just been in an accident. He was still at the accident site on the highway between Wellsville and Mendon. Mindy and Riley were badly injured. Mindy, in a coma, was being rushed by ambulance to Logan Regional Hospital. Riley, age 7, was near death. Mike was hurting, and London, 19 months, was fine. Mike and London were taken to the Logan Hospital for observation. We called Moonyeen's sister, Toni, and she and her husband, Richard Berntsen, went directly to the hospital as we waited prayerfully and tearfully for word. The word came in a call from Richard. Riley had passed away and Mindy was being flown by helicopter to University of Utah Hospital in Salt Lake City. I called Dale Bankhead, a neighbor and the Ward Bishop. He jumped into action and took Mike to be with Mindy and then called other members and neighbors to provide compassionate service to a hurting family. It was a long and very tearful night.

The next day we caught flights to Salt Lake and then drove to Wellsville. Moonyeen cared for London while I supported Mike. Together we made arrangements for a funeral and burial for Riley. I purchased some burial lots in the Wellsville Cemetery, worked with Bishop Bankhead on the funeral program, arranged for the mortuary services and viewing, arranged for flowers and grave preparation and took Mike when we could to visit Mindy. Mindy was in the ICU in an induced coma and would remain so until after the funeral and burial. Riley's viewing and funeral were well attended and very tender. Bishop Bankhead conducted the funeral, Collette Howard played the organ, Joyce Murray led the music numbers. Riley's Aunt Shellie read a very touching poem and both of his grandfathers spoke. I can tell you that no one wants to speak at a child's or grandchild's funeral. It is supposed to be the other way around. Years later I would have to do it again at David's daughter, Siri's, funeral. I pray that it will never happen to me again.

I would like to acknowledge Mindy's father, Brent McKinnon, who stayed almost continually by Mindy's side in the ICU while she was in the coma. I write this on November 23, 2020. Brent's funeral was today and Mindy spoke, giving a beautiful, heartfelt appreciation for the love and support of her father.

Retirement Life Goes On

After the funeral life got a little more manageable. Tina recovered from some tough therapies and surgeries and was able to resume her career as a school teacher. Mindy made good progress recovering from her ordeal and surprised and impressed us all with her resilience. With my Taiwan commitment long behind, we began to spend most of our time in Wellsville. Shellie and Peter were living in our home in Los Altos. About a year later, on December 12, 2000, they would be blessed with the first of two daughters. This would be Lauren. In April of 2000 my widowed mother turned 91. She still lived alone but needed lots of visits to make sure she was doing well. She loved to have us come every Sunday afternoon and bring fried chicken dinners for the three of us. We were able to help her realize a lifetime dream. We took her to Hawaii and she loved it. She was one great lady!

The downside of 2000 was David's trial in Arizona. As mentioned earlier, he and his wife's friend had pulled off a couple of pizza driver robberies. The drivers were roughed up but neither required medical care. All they got for it was some pocket change and a couple of pizza's. There was no need for David to do this—we were providing David, his wife, and Trevor with adequate food and essentials if their own means fell short. However we were not providing for her boarder friend, nor did we even know he was living with them. During the summer the case went to trial. The Assistant DA was determined to get a conviction and a maximum sentence. The evidence at the trial indicated that David was probably the driver as his fingerprints were not found on the victim's cars but his partners were. However, there is no doubt David was there and was involved. He was found guilty of strong arm robbery and sentenced to ten and one half years in the Arizona State Prison System. A very expensive pizza.

This situation left Trevor and his mother in a difficult situation. We helped her for a while. She was going from halfway house to halfway house, sometimes with Trevor and sometimes with him placed with friends. She sold the trailer we had bought for them and kept the money. We learned that she was

cohabitating with some man, so we arranged for an attorney to help facilitate a divorce. She did have a baby with this second man and the divorce from David went pretty smoothly. We tried to keep track of Trevor as he was our grandson and we cared about him. In the summer of 2001 we learned he was living with a family we knew and quite liked. We contacted his mother and arranged for Trevor to stay with us for a couple of weeks to give the family he was with a break. We flew to Phoenix and brought Trevor back with us. After about a week we got a call from Maricopa County Child Protective Services asking if we would keep Trevor longer since his mother was in legal trouble and that Trevor would be taken by CPS if he were returned to Arizona. Later we were granted full custody by the pertinent Arizona Court. We were now raising a three year old even though we were both in our mid sixties.

Actually, Trevor was one of our easiest children to raise. He did pretty well in school. He chose good friends. He was a good worker and turned out to be quite handy. He loved sports and skiing in particular. I will admit that as an only child he got a lot of special opportunities—several trips to Hawaii, a trip to Disney World and a trip to Barbados. We tried our best to keep his living standard about the same as what our other grandchildren enjoyed, especially Mike's kids because they were nearby.

9/11 and the Passing of my Mother, Esther Watkins Anderson, October 25, 2001

On September 11, 2001 a group of Islamic terrorists belonging to a terrorist network called Al Qaida hijacked four commercial jetliners and crashed two of them into the twin towers of the World Trade Center in New York City. A third jet was crashed into the Pentagon near Washington DC; the fourth went down in a farm field in Western Pennsylvania. The death toll of this dastardly attack, now referred to as 9/11, was 2977 persons. It changed everything, especially travel security.

My mother at that time was 92 years young. She was still living at home but having increasing difficulty caring for herself. Moonyeen and I were spending every Sunday with her and visiting her at other times during the week. On Sunday, October 5, we went over to watch General Conference with her. President Hinckley was speaking and with tears in his eyes he announced that the United States had attacked Al Qaida in Afghanistan and that bombing had commenced. It was a very emotional time for mother as she was also in a great deal of pain in her back. We decided then to take her to the ER in the Brigham City Hospital. The doctor there determined some of her blood chemicals were out of normal balance so he issued a couple of prescriptions for her. We picked up the prescriptions from Walmart and then insisted that she come to Wellsville and stay with us until we got her stable. She would never see her home again. Over the next twenty days she grew weaker and weaker. We fixed a bed for her in the small room adjacent to our bedroom. The evening of the 24th her niece, Eva Jane Marsh, and her daughter visited Mom. She recognized them but was too weak to talk. The next morning she passed away clinging to Moonyeen's hand. After her funeral, she was laid to rest next to Dad in the Brigham City Cemetery. An interesting note, our grandson Titan was born the day after Mother died. We often wondered if they passed in the passageway.

Life on our Beautiful Farm in Wellsville

We are blessed to own a very nice farm in Wellsville, Utah. We have raised sheep and hay for years. We have sold most of what we produced so the farm mostly carried itself. There is a lot of hard work involved. Helping

the ewes lamb out in March can be cold, wet and frustrating. Sometimes the ewes don't milk well and we end up with a 'bum lamb' that has to be bottle fed every few hours. And through the winter there is feeding twice a day.

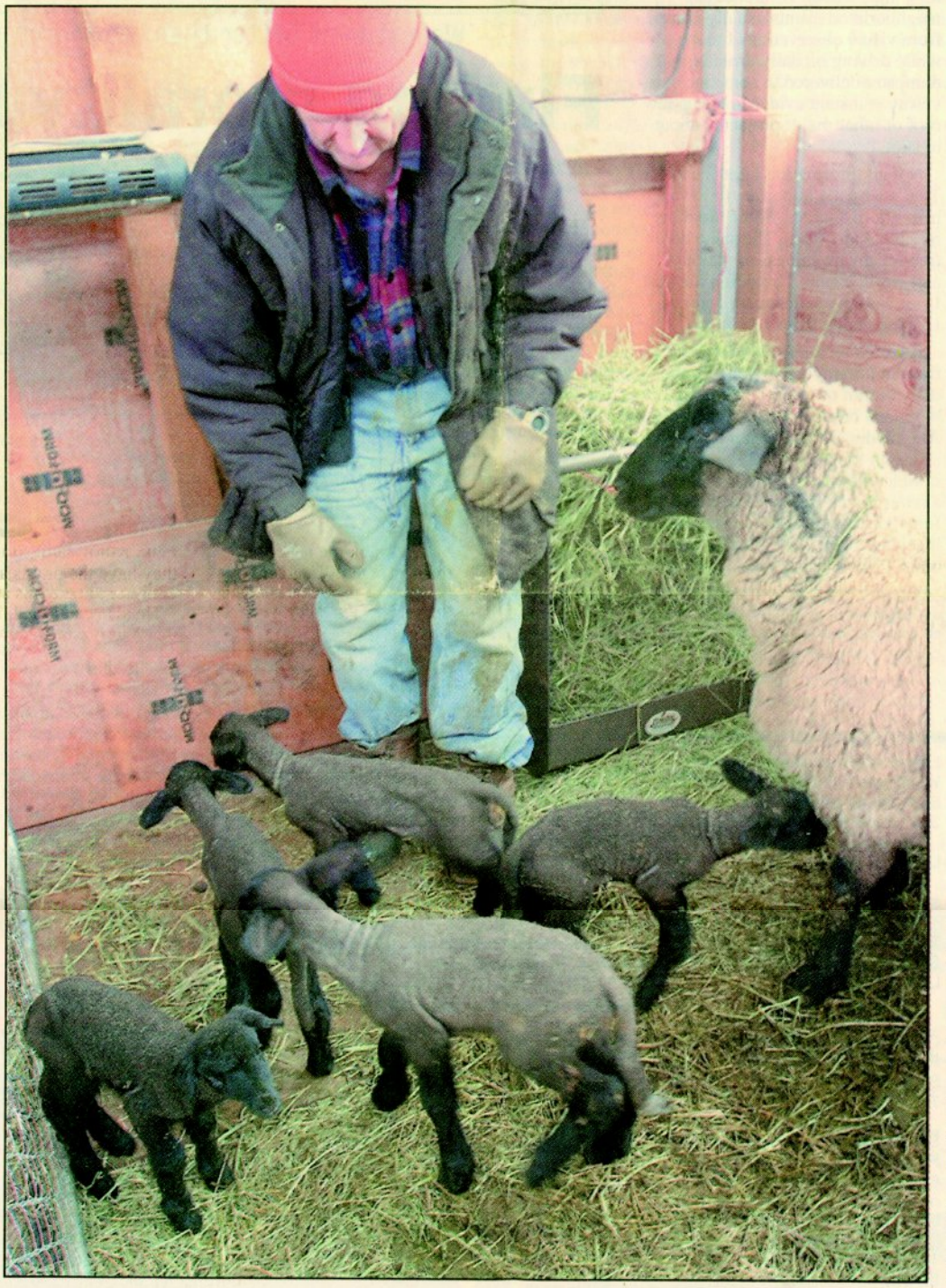
Growing hay is a lot of work including spraying the weeds, leveling the ground, discing and harrowing, fertilizing and drilling in the seed. Then it must be watered, maybe sprayed for weevil or other insects, maybe sprayed for weeds like foxtail. Then comes harvest time when it has to be swathed, raked, maybe raked again and then baled. To get good bales, the humidity needs to be in a certain range—too dry and the leaves come off, too wet and the bales will mold or maybe even combust. Sometimes the right humidity comes at one or two in the morning. Sometimes not at all. Then it all has to be picked up, hauled and stacked in a well-ventilated barn. Tough way to make a living!

My tractors.

We also have had some horses but I got out of horses when I got about seventy. To have a good horse you need to handle and ride it almost every day. If you don't, you are likely to get thrown when you do get on. Not good when you're seventy or eighty years old.

Entering the beautiful Sunset Years!

Spring's quintuplet surprise



Mitch Mascaro/Herald Journal

Richard Anderson is pictured here at his Wellsville property with his ewe and the five lambs she delivered last week. Giving birth to quintuplets is a rare event for this particular breed of sheep.

Event a rare circumstance for Suffolk sheep breed

By Rashae Ophus
staff writer

Twins or even triplets are not uncommon among sheep, especially in prolific breeds. But ovine quintuplets are rare from any breed. And when a Suffolk ewe near Wellsville delivered quintuplets, the birth fell into the amazing category.

"My hat's off to the Suffolk," said Lyle McNeal, Utah State professor and national sheep and wool specialist. "This is rarity for the breed. I'm really amazed."

Perhaps no one was more surprised than owner Richard Anderson. An accomplished engineer and retired vice president of Hewlett Packard, he is a novice shepherd. When his grandson, who was raising six sheep for a college project, died in an auto accident, Anderson adopted the orphaned ovines and entered the field by default. Now he has a few years of experience, 40 ewes and lambs arriving in multitudes.

He tended to the amazing mother and a pair of lambs — twins, he thought — after they were born Wednesday night. When he returned the next morning, the ewe and five lambs were snuggled in the pen where he had secured only three animals.

"I thought, 'What are all those lambs doing in there?" he recalled. "Lo and behold she had three more, had them all cleaned up."

He wasn't sure how rare ovine quintuplets are, but he began to realize when everyone he called for insight said: "Really? I've never heard of that."

The reproduction rate of American sheep averages 1.01 lambs annually per ewe, according to the U.S. Department of Agriculture's 2000 Agricultural Statistics survey. The more prolific breeds, such as the Finnish landrace, have

See SHEEP on A8

Sheep

Continued from A3

produced six or more per litter, and sheep ranchers cross Finnish landrace with other breeds to spur birthing rates as well. But the Suffolk, which is one of the most common breeds in Utah and formerly held breed association headquarters in Logan, is not known for multiples beyond two.

Ovine experts credit a good ewe more than rams for producing multiples.

"It takes two to tango, and the ram's got to have good sperm cells. We want to give him some credit," McNeal said. "But still, credit where credit's due — the bottom line is still the ewe."

Ranchers can further bolster a prolific ewe through a practice known as "flushing," optimizing their diets with corn or pellets to heighten ovulation and increase reproductivity. Fertility drugs and genetic manipulation also are possible in sheep. Anderson, however, didn't encourage this at all and would prefer two lambs to five any delivery.

Rather, "We got a ram here with a propensity to throw multiples," he speculated. "But the mothers are only outfitted for feeding two at time."

Last spring brought a rare set of quadruplets and this year, before these quintuplets arrived, Anderson already was bottle-feeding two runts from two (ordinarily) rare sets of triplets.

The mother is recovering well (McNeal advises six aspirin, an old shepherd's trick), and all five lambs are healthy. The most important aspect will be ensuring the ewe produces ample milk and the lambs share, but most everybody predicts Anderson will be bottle-feeding a couple of the quintuplets before long.

Bert watching over the ewes.

And I must not forget Bert. Bert was a llama. His job was to keep coyotes away from the lambs. If they came close he would spit on them and then stomp them with his sharp front hoofs. We sure missed old Bert when he died.

Venture Capital and Startups

For almost ten years after retirement I was active with two venture capital groups and served on boards of some startup companies. The two VC groups were Dynafund and Vanguard Ventures. Dynafund was headed by Denny Ko. Denny had been part of the MTI start up team. Vanguard Ventures was founded by Jack Gill. Some of the companies I served as a board member included Novalux, United Internetworks, and QuickTime. I invested in four different funds and a few of their supported companies. I did OK but not great. I tend to have a long term investment view and that doesn't work as well in small startups.

Utah State University

Our family, and me in particular, have a long relationship with USU. My father graduated with a bachelor's degree in education, with minors in history and languages. He also received his master's degree there in education. My uncle, Allan Anderson, graduated there in business and accounting. My aunt, Jeannine Anderson graduated in education. Moonyeen and I both earned our bachelor's degrees at USU.

So far, three of our children and three of our grandchildren have attended USU, with more to come. While I was at HP, I served on the President's National Advisory Board and the Engineering Advisory Board. Over the years USU has awarded Moonyeen and me with many alumni recognition awards including an Honorary Doctorate Degree to me in 1999.

Because USU played such a big role in helping us move forward in our careers, we have tried to be supportive of USU in both financial and non financial contributions. While at HP, I served as contact person between HP and USU. As such I was able to secure many equipment donations from HP to USU. Over the years it may have been close to $10 million in value. Personally, we have funded several million dollars in scholarships. We funded the Engineering Auditorium ($100K), the Choir Loft in the Arts center ($250K), an office for the women's basketball coach ($50K), a special scholarship endowment for engineer athletes (over $1M) and many gifts under $25K each. We also endowed the Anderson Center for Wireless Teaching and Research ($1M). I served on the USU Foundation Board from the time it was founded until 2019, making me the longest-serving and oldest member of that board. We have been loyal Aggie football and basketball fans, often sharing our suite and seats with friends and neighbors. In 2015, Utah State named the main Engineering Building the Richard and Moonyeen Anderson Engineering Building.

Utah State University

On the nomination of the Faculty and as authorized by law.
Utah State University has conferred on

Richard W. Anderson

the Honorary Degree of

Doctor of Engineering

together with all the honors, rights, privileges and responsibilities pertaining thereto.
Given at Logan in the State of Utah the Eighth day of May in the year of our Lord
nineteen hundred ninety-nine and the University's one hundred eleventh year.

Chairman of the
Utah State Board of Regents

Commissioner of Higher Education

UTAH STATE UNIVERSITY · 1888 ·

Chairman of the
Board of Trustees

President of the University

UtahStateUniversity.
FOUNDATION

RESOLUTION OF APPRECIATION AND COMMENDATION

Richard Anderson

Richard Anderson, for the past 14 years you have served as a distinguished member of the Utah State University Foundation Board.

Through your years of leadership, insight and dedication, your invaluable presence on the board elevated this university to what it is today. Your commitment to innovation, technological advancement and entrepreneurial spirit gave Utah State students the tools and facilities needed to excel in these fields, including the Richard and Moonyeen Anderson Wireless Communication Research and Education Center.

You have received both an honorary Doctor of Engineering degree and the Distinguished Service Award, our university's highest honors recognizing those who have given exemplary service to the university and the Aggie community. The impact of these accomplishments and contributions will be felt for generations to come.

Your generous support of the College of Engineering, the Caine College of the Arts and Utah State Athletics established a new standard of philanthropic giving. Your lifetime commitment to this university will forever benefit its students, faculty, alumni and members of this board.

On behalf of all those who have had opportunities opened to them because of your service, learned from your example, and felt inspired by your willingness to sacrifice time and resources to this great university, we extend our sincerest appreciation.

We are truly honored to have served with you on the Utah State University Foundation Board, and will always consider you among our best and dearest friends.

Noelle E. Cockett
President, Utah State University

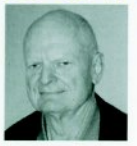
November 13, 2020

Mark T. White
President, USU Foundation

November 13, 2020

USU FOUNDATION BOARD


Stan Albrecht


Richard Anderson


Shari Badger


Gail Fisher Bedke


Robert Behunin

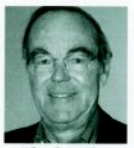

Jeannie Bennett


Michael Bingham


Brian Broadbent


David Cowley


Marshall Crawford


Clark Giles


Patricia Halaufia


Scott Harries


Jason Keller


Blake Kirby


Travis Lish
*incoming


Larry W. Miller
*outgoing


David Moore
*outgoing


Steve Mothersell
*outgoing


Suzanne
Pierce-Moore
*outgoing

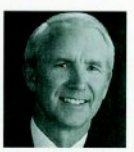

Brent Robinson


Randall Stockham


Peter Thomas


Craig Thorley


Scott Ulbrich


Kerry Wahlen
*incoming

I, Michael O. Leavitt, Governor of the State of Utah
do hereby appoint

Richard Anderson

as a member of the

Technology Initiative Advisory Board

Done in the City of Salt Lake this 18th day of April, 2001

By the Governor: Michael O. Leavitt

Attest: Olene S. Walker, Lt. Governor

Utah State University

Distinguished Alumnus Award

Richard & Moonyeen Anderson

Richard and Moonyeen Anderson have enjoyed a long and rich career of service, both to Utah State University and their community. Moonyeen graduated from Utah State in 1958 with a bachelor's degree in social work, while Richard followed a year later with a bachelor's degree in electrical engineering. Richard continued his education at Stanford University, receiving his master's degree in electrical engineering. Together, Richard and Moonyeen have done much to support Utah State and especially its College of Engineering. Richard began a long and distinguished career at Hewlett-Packard Company in 1959 as an engineer in the microwave division. He held a number of top management positions within the company prior to being named vice president and general manager of their Microwave and Communications Group. Richard was instrumental in working with Hewlett-Packard when Utah State's Engineering Department was awarded a special grant, giving the department much needed equipment. He currently serves as a member of the College of Engineering Advisory Board and a trustee for the Utah State University Foundation. Moonyeen used her education from Utah State to serve her family and her community. With her educational background in social work, she counseled unwed mothers while working with the Church of Jesus Christ of Latter-day Saints Social Service Program. Her support for Richard and their alma mater has been unwavering. The Anderson's support includes an endowed scholarship in the College of Engineering, numerous gifts for the new engineering building, and a gift for the new Richard and Moonyeen Anderson Wireless Communication Research and Training Center. This new facility provides an excellent environment to teach and conduct research in the technical and fast-growing area of wireless communication. They are also members of the Old Main Society. It is for this generosity and service that Utah State University is pleased to bestow the Distinguished Service Award upon Richard and Moonyeen Anderson.

Given this Fifth day of March, Two Thousand and Five
and the year of the University the One hundred and Seventeenth

Gayle McKeachnie
Chairman of the Board of Trustees

Stan L. Albrecht
President of the University

Randy Watts
President of the Alumni Association

Utah State Athletics Announces Largest-Ever Endowed Scholarship

LOGAN, Utah – Utah State University Vice President and Director of Athletics John Hartwell announced Thursday the Richard and Moonyeen Anderson Engineer Athlete Endowed Scholarship to assist USU student-athletes pursuing a degree in engineering.

"We are thrilled to support our two great passions at Utah State University by providing our amazing student-athletes the opportunity to pursue a degree in engineering," said Richard Anderson. "The skills and attributes required to compete in athletics at a high level are needed in the engineering field more than ever and we are excited to be in a position to give back to the place where it all began for us."

The $1.44 million gift is the largest endowed scholarship in the history of Aggie Athletics.

"This is a transformational gift that Richard and Moonyeen have generously given to Utah State University Athletics that will enhance our ability to offer greater academic opportunities for our student-athletes in perpetuity," said Hartwell. "This is a gamechanger in our ability to offer scholarship opportunities to our student-athletes who desire to pursue engineering degrees at this great university. We are so appreciative of the Anderson's for their vision, dedication and support of the Aggie Athletics."

Richard graduated from Utah State in 1959 with a bachelor's degree in electrical engineering and earned his master's degree in engineering from Stanford in 1963. He also completed the Stanford Executive Program in 1982.

Richard began what would become a distinguished professional career in 1959 as an engineer for Hewlett-Packard. During his career, he was promoted to Engineering Manager, Vice President and General Manager of the Microwave and Communication Group, which ultimately led to the position of Senior Vice President.

Moonyeen graduated from Utah State in 1958 with a bachelor's degree in social work and spent her professional years working as a counselor for the LDS Social Services program.

As life-long financial and personal supporters of Utah State University, Richard has served as the Director for the Utah State University Foundation since 2003 and has been a member of the College of Engineering Advisory Board since 1989. Richard received an honorary doctorate degree from Utah State University in 1999.

An endowed scholarship gift supplies the Utah State Athletics Department with a perpetual source of income that provides the educational resources needed to attract, develop, and retain the nation's most talented student-athletes. Endowments are long-term investments. The principal is invested, and earned income is distributed in accordance with the guidelines agreed upon by the donor, the Utah State Athletics Department and the USU Foundation.

By creating an endowment, donors will forever link their name to a championship tradition while making a direct impact on future generations of Utah State student-athletes.

For more information or to support Utah State student-athletes, contact the USU Athletics Development Office at 435-797-2583.

-USU-

From the Cache Valley Daily.
November 8, 2019

Congratulations Recipients of the 2016-2017 Richard and Moonyeen Anderson Scholarship

Jacob Cazier, Blaine Cook, Ember Fairbanks, Katie Glaittli, Levi Kearl, McKenna Sumrack, Carly Lofthouse, Alanna Nieves, Justin Pace, Brian Rex, Zakk Rhodes, Tyrel Rupp, Bradley Siler, Carson Sparks, Zeke Villarreal, Hanna Young, Joshua Larkin, Trevor Naumann

For Richard and Moonyeen Anderson, providing a student scholarship is a lot more than just writing a check. The Wellsville, Utah, couple – both alumni of USU – personally visit campus each year to meet the student recipients and treat them to lunch.

To date, nearly 200 engineering students from Cache and Box Elder counties have received scholarship funding from this generous couple. Thank you, Mr. and Mrs. Anderson. ▪

College of Engineering | Utah State University 21

Anderson Scholarship Recipients at their scholarship luncheon with us.

Enduring legacy

USU names flagship engineering building for local couple

By KEVIN OPSAHL
Staff writer

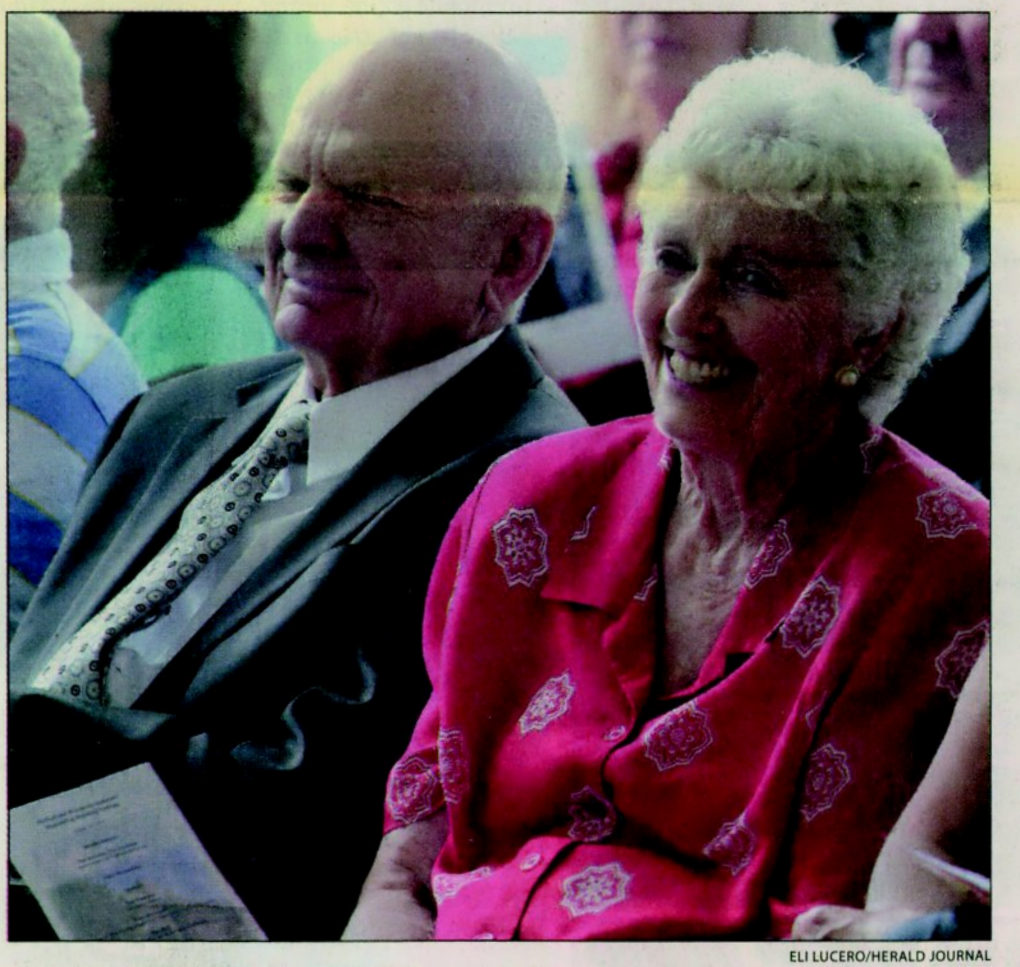
Utah State University alumnus Richard Anderson was happy to say a few words about what it meant for a building to be named for him and his wife in a ceremony Tuesday, but he couldn't do it without throwing in some pearls of wisdom about business and engineering.

Anderson, who spent 40 years at Hewlett-Packard before retiring as a senior vice president, held up his smartphone.

"If you had come to us 20 years ago and described this, we would have said, 'Why would you ever want something like that?'" Anderson, of Wellsville, said before taking down the curtain to reveal the flagship engineering classroom building now known as the Richard and Moonyeen Anderson Engineering Building. "But now, if I ask you, you'd say, 'I don't know how I'd get along without it.' That's the genius of contribution."

He said smartphones cost a lot, but one probably is worth much less if you only consider the materials that go into it.

"The unique contribution invites you to pay three or four times more because of the value that produced this," Anderson said. "Everybody on this campus is the result of somebody, somewhere, making profit. When you hear people run down the wonderful free enterprise system, please ignore that, because profit makes everything possible."



ELI LUCERO/HERALD JOURNAL

Richard and Moonyeen Anderson listen to a speaker during a ceremony where an engineering building was named after them, Tuesday on the USU campus.

The Andersons, university administrators, engineering students and friends filled the atrium of the Anderson Engineering Building to mark the occasion of the official naming for the 107,000-square-foot building constructed in 2003. University officials noted it did not have an official name until now.

The Anderson Engineering Building features "14 classrooms, eight teaching laboratories, a 'student success center' and computer lab," according to a USU news release.

More COUPLE | A12

Couple/fromA1

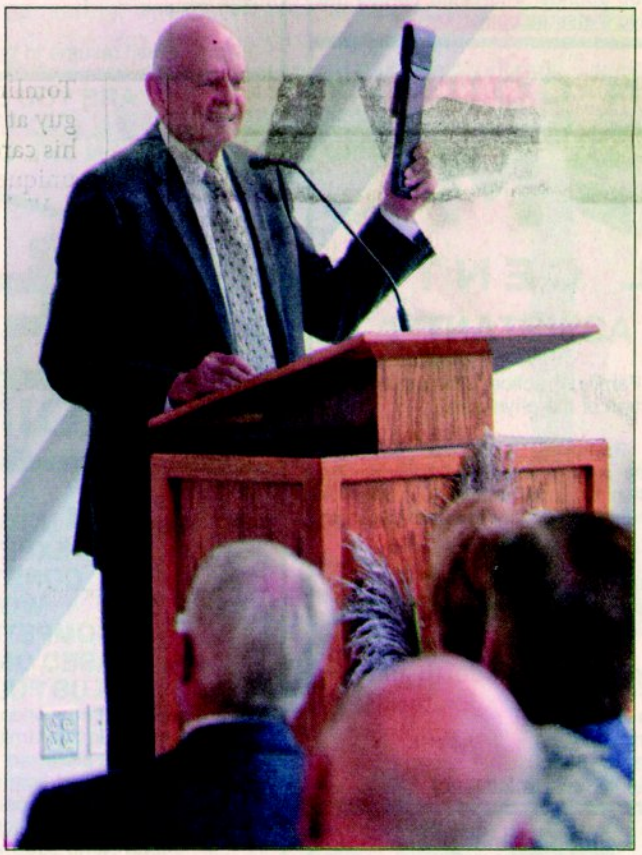
USU chose to name the building after the Andersons, who met at USU in the 1950s, in light of their $5 million in donations over many years. According to a USU news release, those contributions include the Wireless Research and Teaching Center and a classroom on the first floor of the engineering building, named in their honor. In 2005, the Andersons received the Distinguished Service Award and in 1999, Richard was awarded an honorary doctorate.

Moonyeen told attendees of Tuesday's event about her worldwide travels with her husband, why it's important to give back to today's generation of USU students and what she learned as a student at USU after transferring from Ricks College.

"You need to be educated and learn how to work," Moonyeen said. "No matter how good your education is, if you don't know how to work, you're not worth much."

Ryan Martineau, a Ph.D student at USU who took advantage of the Anderson scholarship while he was an undergraduate, spoke highly of the couple Tuesday.

"It was wonderful meeting them, because not only do they financially support students ... they talk with us," Martineau said, referring to a dinner he and other undergraduate engineering students had with the Andersons every year. "That was one of the great benefits of the program. What it meant was, to really put all of the energy we could into getting an education because of that support we had from the Andersons."



ELI LUCERO/HERALD JOURNAL

Richard Anderson holds up his slide rule while speaking during a ceremony where an engineering building was named after him and his wife Moonyeen Anderson, Tuesday on the USU campus.

Martineau said the new building name means a lot to him.

"They're the most deserving people to have this honor; they've helped so many people," Martineau said. "When I look up at that building name, and come into class, I want to remember that's another goal I have to pay it forward to other students in the future."

Robyn Nelson, a Wellsville neighbor of the Andersons, told The Herald Journal in an interview no couple is more deserving of the honor than the Andersons. Nelson has gotten to know the couple working with them on various charities.

"They've always donated," Nelson said. "I think it's great the building is being named after them to carry on their legacy."

USU President Stan Albrecht thanked the Andersons, whom he has known since before he became president in 2005. The USU president noted that while USU, as a public institution, receives state support, donations from the private sector are just as important.

"Your generosity is essential to who we are and what we are," the USU president said.

After the event, Richard Anderson spoke about the importance of having more young people take up engineering careers — and that starts with the inspiration the engineering building could bring.

"We hope they will see that engineering is a cardinal career," he said. "It's one if you apply yourself, you can do it; with that background you can take on all kinds of job opportunities and tasks. Maybe this shows that one person was able to do it and have some success."

kopsahl@hjnews.com-Twitter: KevJourno

A Legacy of *Gratitude...*

COLLEGE *of*
ENGINEERING

UtahStateUniversity

4100 Old Main Hill
Logan, Utah 84322-4100

College of Engineering Names Classroom Building in Honor of Richard and Moonyeen Anderson

It was standing room only at an Aug. 25 special event where the College of Engineering honored two fellow Aggies and longtime supporters who are helping more young people graduate with a degree in engineering.

Faculty, students and university officials gathered to celebrate the ongoing support of Richard and Moonyeen Anderson of Wellsville, Utah. At the special ceremony, Mr. Anderson and USU President Stan Albrecht pulled the cords on a 30-foot-wide veil, uncovering the new name of the 12-year-old engineering classroom building.

The newly-named Richard and Moonyeen Anderson Engineering Building is home to approximately 2,680 undergraduate and graduate students who represent six academic departments. The take-home message from the event was 'gratitude.' College of Engineering Dean Christine Hailey jokingly told the crowd that she got the last word at the ceremony, saying she wanted those in attendance to walk away with a sense of thankfulness.

The Andersons' lifetime giving and most recent financial commitment total more than $5 million – a level of support that will ensure the long-term success of the Richard and Moonyeen Anderson Scholarship fund.

The Andersons have maintained a strong relationship with Utah State University throughout their nearly 40-year career at Hewlett-Packard. Val Potter, executive director of development for the college, said through their involvement with USU, the Andersons have recognized an opportunity to expand student scholarship funding and provide support for faculty research and facility improvements.

"Many years ago, the Andersons made a decision to give back to USU and established a scholarship fund for incoming freshman from high schools in Cache and Box Elder counties in Utah," said Potter. "What a great incentive for high school students to excel in their studies knowing that a scholarship in engineering is available to them. Through this scholarship fund nearly 100 students from Northern Utah have graduated from USU with degrees in engineering. Richard and Moonyeen have ensured that the scholarship fund will continue to offer assistance to engineering students for years to come. This is a legacy that will live on forever in the lives of our successful engineering graduates."

Potter said the Anderson scholars he has known over the year have expressed a deep sense of gratitude for the help they

Richard and Moonyeen Anderson pause for a photo with four of their six children (left to right) Tina Rosenthal, Deborah Justeen, Michael Anderson and Suzette Eickman. Lower left: Ryan Martineau, a recipient of the Anderson Scholarship, speaks about his experience getting to know the Anderson family.

received in paying for their education.

"It allows them to focus on maintaining their grades and college pursuits without the worry of excessive outside debt," he added. "The College of Engineering is a much better institution thanks to the support from generous people like Richard and Moonyeen."

Prior to the naming event, the Andersons spoke with Potter about their motivation for giving.

"There are so many young, wonderful people in the world today who just need a little help, a little boost and a little understanding of the opportunities that are out there," said Mr. Anderson. "And for those of us who have enjoyed some success, we would be derelict in our responsibilities if we didn't share and give something back."

Mrs. Anderson has also played an active role at USU. She's been a strong advocate for the scholarship fund, and in 2005 she and her husband received the university's Distinguished Service Award.

"I fully support Richard on this because when I was school, I went all four years on a scholarship," she said. "Without it, I probably wouldn't have had that opportunity."

The College of Engineering is honored to name our flagship classroom building after the Andersons. Their example, generosity and kindness are a lasting legacy for the many students who will walk these halls and aspire to the many opportunities an engineering degree can bring.

The Andersons say providing the scholarship fund has been a joy, knowing their assistance is helping Aggies complete their engineering degree.

"I promise you from personal experience that which you give with a spirit of love and thanksgiving for what you have, you'll never miss," said Mr. Anderson. "You'll never miss it at all."

A Legacy of Gratitude

Hewlett-Packard executive, ECE alumnus leaves lasting legacy for USU's College of Engineering

In August, faculty, students and university officials gathered to celebrate the ongoing support of Richard and Moonyeen Anderson of Wellsville, Utah. At the special event, Mr. Anderson and USU President Stan Albrecht pulled the cords on a 30-foot-wide veil, uncovering the new name of the 12-year-old engineering classroom building.

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USU alumni Richard Anderson and his wife, Moonyeen, have left a lasting endowment that will help many engineering students. Below, Anderson and USU President Stan Albrecht unveil the name for the Engineering Building.

"Many years ago, the Andersons made a decision to give back to USU and established a scholarship fund for incoming freshmen from high schools in Cache and Box Elder counties in Utah," said Potter. "What a great incentive for high school students to excel in their studies knowing that a scholarship in engineering is available to them. Through this scholarship fund, nearly 100 students from Northern Utah have graduated from USU with degrees in engineering. Richard and Moonyeen have ensured that this scholarship fund will continue to offer assistance to engineering students for years to come. This is a legacy that will live on forever in the lives of our successful engineering graduates."

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Richard and Moonyeen Anderson

Richard and Moonyeen Anderson
Engineering Building Naming

August 25, 2015

Opening Remarks

Rob Behunin, Vice President
Advancement and Commercialization

Video Presentation

Speakers

Pete Knudson
Utah State Senator

Ryan Martineau
College of Engineering Student and Anderson Scholarship Recipient

Don Hull
Close Friend of Richard & Moonyeen Anderson

Moonyeen Anderson
Donor

Richard Anderson
Donor

Closing Remarks

Stan Albrecht, President
Utah State University

Christine Hailey, Dean
College of Engineering

Unveiling Ceremony

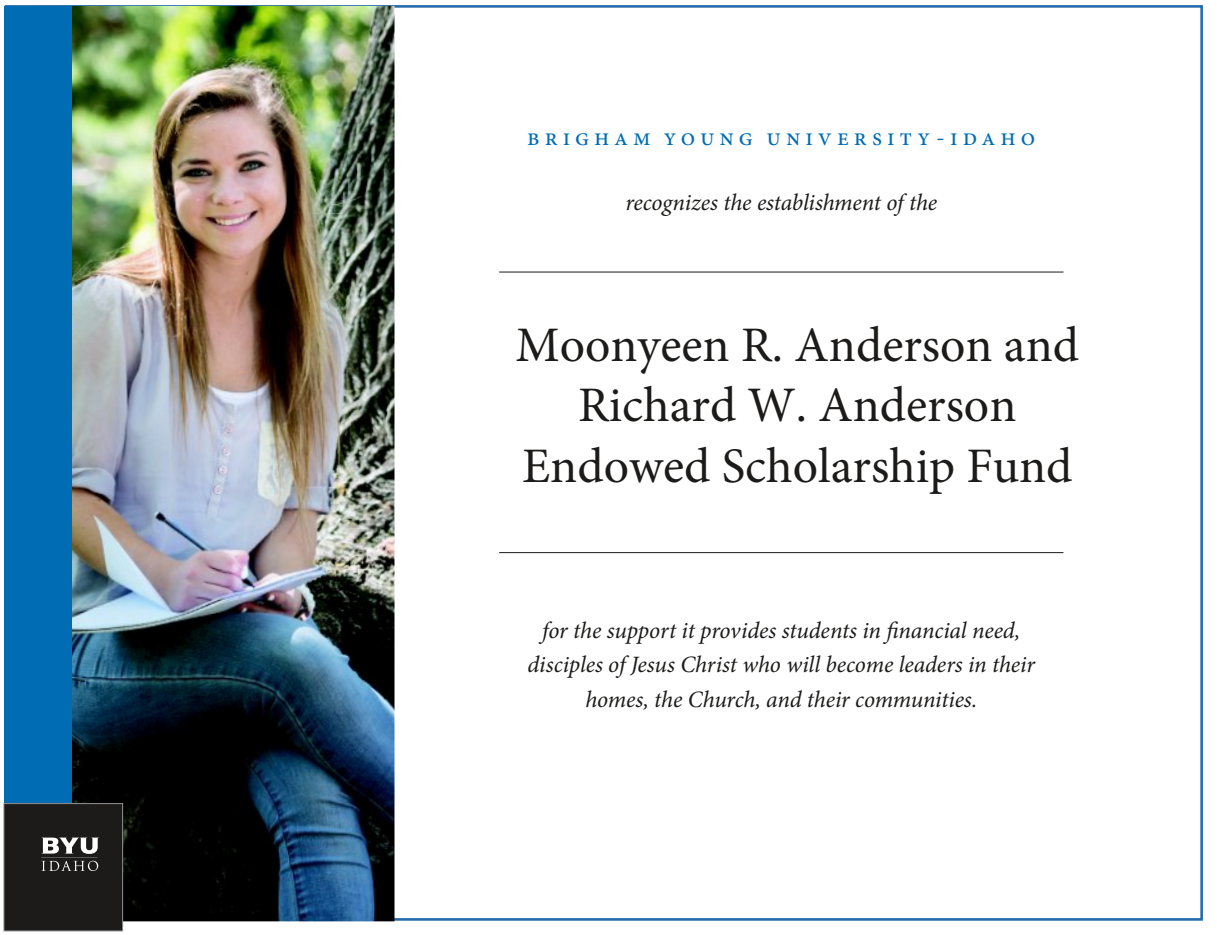
Refreshments will be served
on the 3rd floor

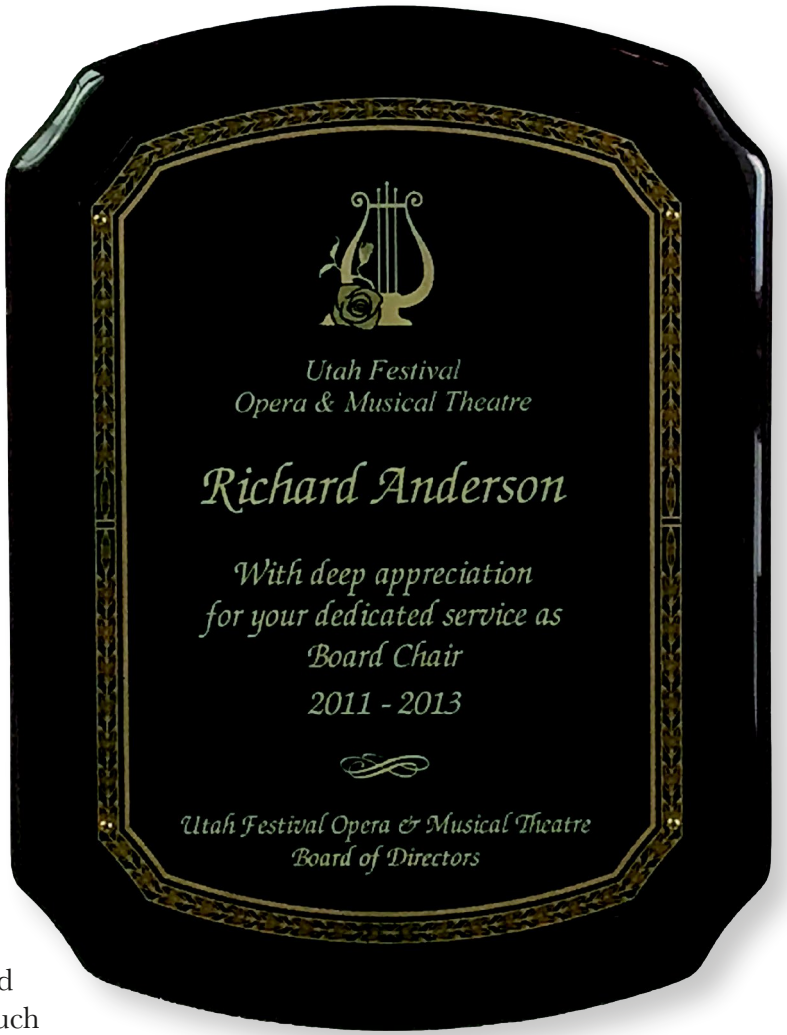
BYU Idaho

We have also sponsored scholarships at BYU Idaho. Moonyeen attended there from 1954 through 1956. One of the ordinal founders of the then Ricks College was Moonyeen's great-grandfather, William F. Rigby. Her grandmother, Essie Price, also attended Ricks. In addition, three of our grandchildren attended BYU Idaho.

Utah Festival Opera and Musical Theater

About 2002 we learned a little about an arts organization in Logan. At that time it was called the Utah Festival Opera Company. We decided to try it out. It was summer and the performance season was in full swing. We bought a pair of tickets for The Barber of Seville which was playing that day. We enjoyed it immensely, especially the signature rendition of Figaro. We went home and I couldn't get that rendition out of my mind. I think that was the only thing we saw that year but the following year we jumped in all the way. We decided we would buy tickets for everything. But first I made a call at the office on First West where I met a nice lady named Lila Geddes. It turned out that she was the Development Director. I gave her a check for $10,000 and told her it was a contribution from Moonyeen and me and that we also wanted to buy two tickets for each of that season's programs. She seemed shocked but said she would do better than that and gave us complimentary tickets for each one of the year's shows. We were sold!





I started a long relationship with the Opera company, first as an annual donor and patron. After a couple of years I joined the Board serving as Vice Chair for two years and Chairman for two years (2012 & 2013). I continued on the Board through 2019 making me the longest serving Board member after the Founding Director, Michael Ballam. We were also one of the largest financial contributors. Over those years the Company presented many wonderful Operas and Musicals including *Carmen*, *La Traviata*, *Nabucco*, *Madama Butterfly*, *The Marriage of Figaro*, *les Miserables*, *Sound Of Music*, *South Pacific*, *Oliver*, *Fiddler on the Roof* and many more. All were outstanding, fully choreographed and with a full professional orchestra. Michael Ballam is a unique talent and has brought much joy and culture to Cache Valley. His assistant Gary Griffin, and many others have also contributed much to this musical success. In 2020 the program was shut down by the Covid 19 pandemic. I worry if it will recover after such a disruptive catastrophe. I hope so!

Cancer and Huntsman Cancer Institute

On March 9, 2015 I received a big hit to my health. Moonyeen and I had just gotten home from a neighborhood potluck dinner. I went into our bathroom to take care of some business and was shocked to see a bright red stream. We went immediately to the ER at Logan Regional to see what was going on. I couldn't learn much that night because the internal bleeding was hampering observation so they made me an appointment to see a local urologist the next day. I actually had to wait a couple of days before I was clear enough for observation. When the doctor examined me, he determined that I had a very bad case of bladder cancer. The next day, which I believe was Friday, he performed a Transurethral Resection of the Bladder (TURB) on me and removed a great deal of tumor material. He didn't completely clean me out, concluding that my bladder was too far gone to be saved.

When I got home a neighbor that had been through bladder cancer recommended that I see a Dr. Dechet at the Huntsman Cancer Institute. When I had my follow up visit with the Logan doctor, he recommended that I go to Salt Lake and have my bladder removed. I then asked him if he knew Dr. Dechet at Huntsman. He said he did and that Dr. Dechet was very good. He asked if I would like him to make an appointment. I told him yes and he did. Shortly thereafter I went to Huntsman in SLC and was examined

Endowed Chairs

Endowed chairs show the important role philanthropy plays in advancing cancer research. Huntsman Cancer Institute uses the resources provided by an endowed chair to attract and retain top faculty, fund lab trainees, and support innovative research. The prestige surrounding each endowed chair is shared by its holder and the donor whose gift makes it possible. By establishing an endowed chair, donors create a lasting impact that can advance research for generations to come.

CHRISTOPHER DECHET, MD

Associate Professor, Urology and Surgery, University of Utah
Richard and Moonyeen Anderson Endowed Chair in Genitourinary Malignancies Disease-Oriented Research

Research interest: Robotic surgery for urological cancers; quality-of-life databases for improved surgical outcomes

When Richard Anderson was diagnosed with bladder cancer, he received such good care, attention, and treatment from his team at Huntsman Cancer Institute that he and his wife, Moonyeen, made a $1 million donation to create an endowed chair in their name. The Richard and Moonyeen Anderson Endowed Chair in Genitourinary Malignancies Disease-Oriented Research was created in 2018.

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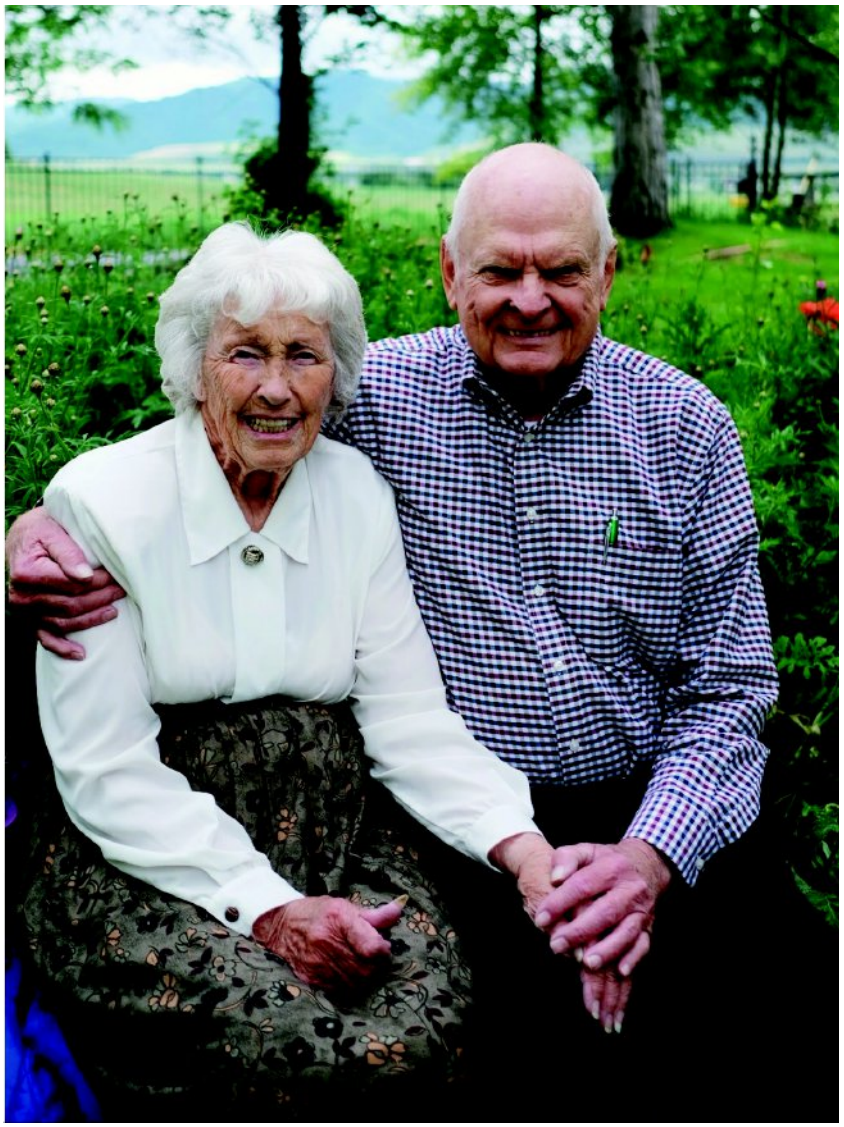
by Dr. Dechet. He said that I would probably lose my bladder, but let's first finish the tumor clean out and then biopsy the wall muscle to see if the cancer had spread to there. So I went through the second TURB procedure and awaited word on the biopsies. You can imagine my relief when the call came that the biopsies were all negative and therefore I was eligible for a therapy called Bacille Calmette-Guerin (BCG) injection. BCG is actually a tuberculosis vaccine that sometimes stimulates antibodies that fight certain types of cancer. I then received several injections of BCG into my bladder at the rate of one per week. So far it has kept me cancer free for over five years. Today is November 13, 2020 and it turns out my next check up is this coming Monday.

After my success at Huntsman, we decided we would make a substantial contribution to the Huntsman Foundation to fight this type of cancer. With the approval of the University of Utah and the Huntsman Foundation we agreed to endow a chair in the Medical School for Research on urological cancers. And, incidentally, Dr. Christopher Dechet is the first to occupy that chair. We have also committed half of our Charitable Remainder Trust to fund a second chair.

We actually have a long time relationship with the Huntsman Family. We were in the same ward in Los Altos as Jon's parents, A. Blaine and Kathleen R. Huntsman. Jon and I are the same age but we didn't know each other in California. He was either at Wharton or USC when we were there. We did get acquainted here in Utah before he died in 2018. In fact, we were privileged to attend his 80th birthday party. Jon is survived by his widow, Karen Haight Huntsman. Karen's father, David B. Haight, was our Stake President and later an Apostle of The Church of Jesus Christ of Latter Day Saints.

It is now November of 2020. I don't know if Moonyeen and I will have any more chapters in our book of life. We hope we will, but maybe someone else will have to write them. Suffice it to say, we both have deep and abiding testimonies of our Lord and Savior, Jesus Christ. We know that only through him, after we do all we can do, can we gain Salvation and Eternal Life. We have both held Temple Recommends, continuously, for over sixty years. We have held many callings to provide service to our God and to our fellow men. We have tried to be generous with our time and our resources. We love our family and families, including those come and gone, those here now and those yet to come. Today we have six children, thirteen living grandchildren, with two more deceased and three (soon to be four) great-grandchildren. In June 2021 we will have been married 63 years. We believe that is a record for both sides of our greater family.



Moonyeen and Richard today.
2020

APPENDIX

Our Heritage

Top: Great-grandsons Asher and Julian Wheatly.

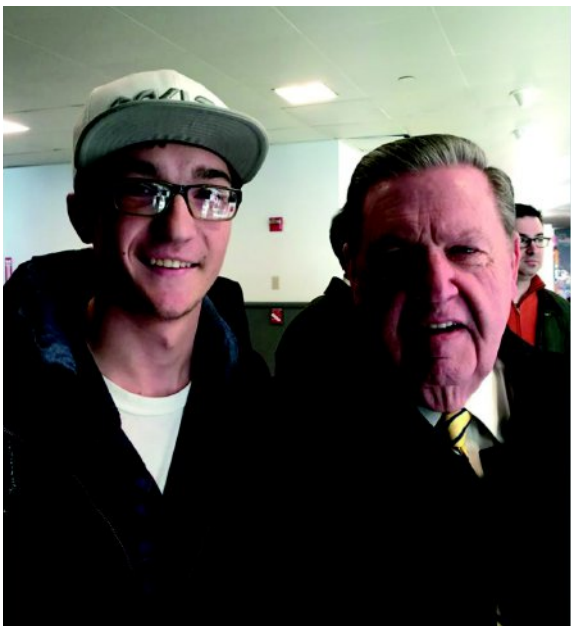
Center: Debbie's Family

Bottom: Great-grandpa, Grandpa, Mike, and Riley. 1992.

Right: Debbie and family, 2019.

Bottom Left: Great time with my college grandsons at the USU vs. BYU game. USU 40 BYU 24. September 29, 2017

Bottom Right: Trevor and Elder Holland, 2017.



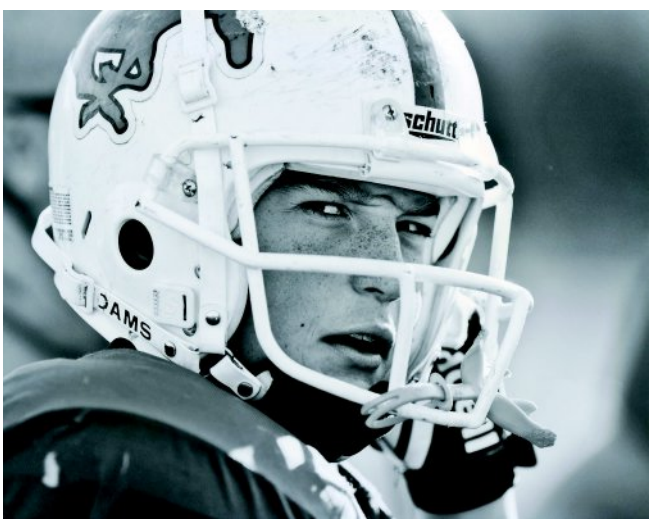
Top: My granddaughters, Lauren and Hannah Ashby, with Mia Motley, the Prime Minister of Barbados. December 2020 at the horse races in Barbados.

Left: Lauren Ashby

Right: Lauren and Hannah at Castilleja in 2014.

Right: Mike and Mindy, 2019.

Below: Great-granddaughter Jane Justesen, 2021.



Above: Sue, Richard, Mike, Tina, and Moonyeen at Trevor's Wedding, 2019.

Left: Trevor, High School Football, 2014.

Top: Richard's Angels

Bottom Left: Scotty, Mike's daughter, our figure skater.

Bottom Right: Titan, 2019.

Right: Richard, Shellie, Sue and Tina about 1990.

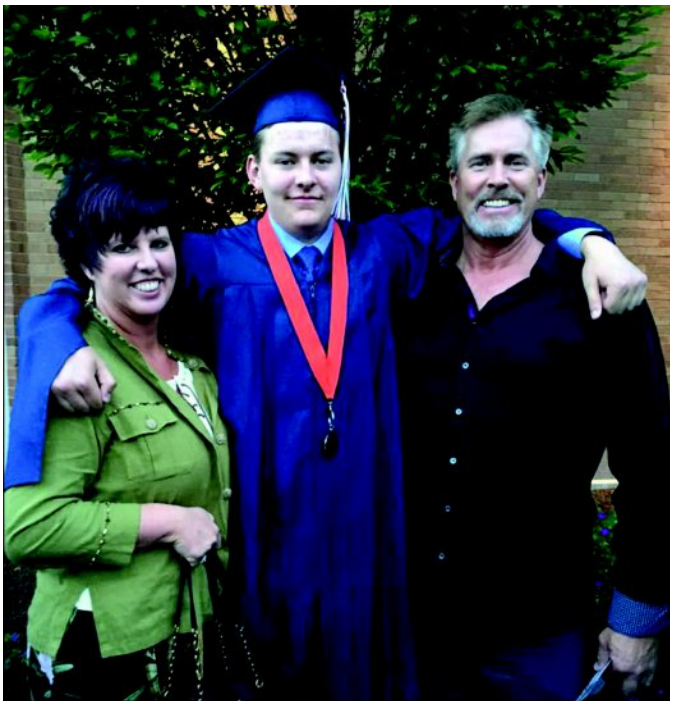
Below: Great-grandson Asher Wheatley, on Battleship Missouri. 2021.

Opposite

Top Left: Mike and Mindy and Family about 2012

Top Right: Mike, Mindy, and London, 2016.

Bottom: The Eickmans—Jack, Sue, Bradley, Ashley and Nick, about 2018.




MINNESOTA
VIKING
Anderson Eickman. See More
Donahue Eickman and 43 others
13 Comments

Top Left: Shellie, Peter, Lauren, and Hannah.

Top Right: First married granddaughter, Alexa Justesen Wheatly.

Bottom: Trevor and Kayla, September 13, 2019. "I now pronounce you man and wife!"

Top: Debbie's Wedding, 1960.

Left: Hannah Ashby and her date.

Bottom: Scotty

Top: First great-grandees, 2018.

Right: Nick, Ashley, Hannah, Lauren and Jack.

Bottom: Titan, chip off the old block.

Church Activities and Callings

My parents, both sets of grandparents and three of four sets of my great-grandparents were members of the Church of Jesus Christ of Latter Day Saints. My blessing and naming ordinance was performed by my grandfather, Heber A. Anderson. I was baptized in 1945 by my father, Norman H. Anderson. My father also confirmed me and ordained me to the first four priesthood offices. Moonyeen's story is much the same, being blessed by her grandfather, Alfred Hansen. All of her great-grandparents were Church members.

Priesthood Offices Held

Deacon	Elder
Teacher	Seventy
Priest	High Priest

Callings

Stake High Council Member
President of Stake Seventies Quorum (one of seven)
Stake Mission Presidency
Ward Clerk
Ward Financial Clerk
Seminary Teacher
Ward Mission Leader
Ward Executive Secretary
Aaronic Priesthood General Secretary
Elders Quorum Presidency
High Priest Quorum Presidency
Stake Missionary
Ward Missionary
Deacons Quorum President
Teachers Quorum President
Priests Quorum First Assistant (to Bishop)
Ward Teacher
Home Teacher
Family Minister
Priesthood Quorum Teacher
Boy Scout Troop Committee Chairman
Stanford Area and Pacific Skyline Council Boy Scouts of America Executive Board. Not a Church Calling but close.
Sunday School Teacher (youth and adult)
Gospel Doctrine Teacher (several times)

As I write this I am 83 years and 4 months old. I am currently one of the assigned Gospel Doctrine Teachers in the Wellsville 11th Ward. This past Sunday (November 15, 2020) I taught the adult Sunday School class using Zoom technology.

Moonyeen and I have held temple recommends continuously for over sixty years. We have been full tithe payers as we understand the law of tithing. We have contributed a generous fast offering and for many years we have tried to contribute to the cost of keeping a missionary in the field. We have tried to attend the temple regularly though that is not now possible due to the global pandemic.

Moonyeen's Callings

Ward Dance Director
Young Women's President
Primary Teacher
Primary Presidency
Sunday School Teacher
Gospel Doctrine Teacher
Ward Emergency Preparedness Specialist
Cub Scout Leader (Den Mother)
Primary, Young Women and Sunday School Class Officer
Relief Society Visiting Teacher

Moonyeen has always been an ardent reader of scripture and temple attender. In California she attended the temple in Oakland as often as possible with her good friend, Marge Catale. Even now when temples are closed she spends much of her time reading the scriptures.

Political Views

My political views took form over many years. According to my parents, my first political observations and expressions started in 1940 when Wendell Lewis Wilkie ran as the Republican candidate against the incumbent, Franklin D. Roosevelt. My favorite expression was, "We want Wilkie!" I am not quite sure today if I would be a Wilkie supporter. But at the age of three, I was your typical, idealistic youth, just like we see today.

My first serious look came in 1948. My father was my sixth grade teacher and he took the teaching of history and civics very seriously. I got a much better grasp of government then than from my high school history or college political science classes. Dad had everyone in the class take part by choosing their preferred candidate and then becoming an advocate for their chosen candidate. In 1948, Harry S. Truman, a Democrat, was the incumbent. He became president on the death of Roosevelt in April 1945. The challenger was Thomas E. Dewey, a Republican and Governor of New York. There were also two minor candidates, Strom Thurmond, a Dixiecrat and Henry Wallace, a Progressive. Thurmond was a hard core segregationist of the type that typified Southern Democrats at that time. Wallace, the Progressive, was highly supportive of the Soviet Union and might be considered the Bernie Sanders of his day. Like Sanders, he was a 'Closet Communist.'

I visited the local campaign headquarters of both the Democrats and the Republicans and obtained copies of their platforms and campaign literature. Frankly, I thought the Democrats were a mess. They reeked of the one-party, KKK-enforced, Jim Crow, segregated South on one hand, and the pro-Communist, pro-union, tax-payers-be-damned Liberals on the other. I couldn't support a party that messed up, and I still can't. I see the Democratic Party as being in opposition to almost everything I believe in as pertaining to religion, philosophy, culture, human dignity and values.

A Constitutional Republic with Division of Powers

'Power corrupts. Absolute power corrupts absolutely!' The wisdom of the Constitution is the division of power. That division is intended to avoid corruption and avoid putting the government in control of the people. The United States Constitution puts the people in control of the government. First, the powers are divided between the states and the federal government. Then, power in the federal government is divided between the Legislative branch, the Executive branch and the Judicial branch. The Democrats have consistently worked to remove these safeguards and concentrate power and control. See attempts to pack the Supreme Court by Roosevelt and the push to create Democrat States as they did before the Civil War. And especially serious would be throwing out the Electoral College.

Blessed with a Divinely Inspired Constitution

I hold the United States Constitution in reverence on par with the Holy Scriptures. We know by modern revelation that the Constitution was established by Jesus Christ for the benefit of all mankind (D&C 101:77). I favor interpreting the Constitution as it was written, under inspiration by the Lord, and not as what some judge wishes it said. Democrats have vehemently

opposed interpreting the Constitution as written. They want Democrat sympathetic judges that will legislate their agenda from the Bench.

God-Given Rights

From the Declaration of Independence: "...All men are created equal, that they are endowed by their Creator with certain unalienable rights among these are Life, Liberty, and the pursuit of Happiness." I believe that the natural rights of man come from God. I also believe that the rights of government come from the citizens and not the other way around. The Covid 19 Pandemic has shown the Democrats desire to have it government-first as the dispenser and controller of all rights.

Socialism, the End of Liberty, Lucifer's (Satan's) Plan!

We know from the Book of Revelation that there was a great Council in Pre-mortal times where plans for peopling the earth were presented and compared. One plan was presented by Christ. His plan provided for mankind to be endowed with agency which allowed for growth and improvement but also the risk of not doing well. The second was presented by Lucifer, the devil, and proposed equal treatment for all with no agency, no growth, no improvement, no winners, no losers and no glory. The glory would all go to Lucifer, the ultimate monarch. For many centuries the rights of man were infringed by monarchs and despots. In the late eighteenth and early nineteenth century, one monarchy after another fell in revolutions. Unfortunately about that same time various forms of socialism tried to fill the vacuum left by toppled despots. The parallels are profound.

Birds of a feather and their failed and cruel socialist systems!

Socialist Regime	Dictator
Lucifer's Plan	Lucifer
Soviet Union	Stalin et. al.
Nazi Germany	Hitler
Fascist Italy	Mussolini
Red China	Mao
Cuba	Castro
North Korea	Kim Family
Venezuela	Chavez/Madura
Democratic Socialism	Bernie Sanders?

In my view, the power behind the throne (Dictator) in all of these Socialist Regimes, is Lucifer, or Satan, that old devil, himself.

Taxes

'The Power to Tax is the Power to Destroy!' High taxes are a form of slavery. The Democrats are the party of Taxing, Spending and Debt. Very destructive, especially to the elderly and less well off.

Racism

Which party is the party of slavery, the Ku Klux Klan, Jim Crow, Dred Scott, Japanese Internment? And, don't forget, Blacks that don't vote for me (Joe Biden) aren't really Black? The Democrats seem to see everything through the prism of race. Meanwhile, almost entirely white, Utah just elected a Black man with entirely Republican votes. The Democrats opposed him 100%. Who are the real racists?

Gender

There are only two genders, male and female. That is how God created us and that is what God has declared. Who are we to contradict God? Anything else is the creation of men and is false and divisive.

Abortion

Every human being is a child of God. Every child is precious to God. It is not Which Lives Matter? Each life is precious. Democrats favor abortion by an overwhelming majority. They talk about a fetus rather than a baby. What's the difference between a fetus and a baby? About a minute! The baby in the womb is no more a part of the woman's body than a baby in her arms. Roe vs Wade was a tragically wrong decision on par with Dred Scott. Both depreciated a human soul and child of God to the category of property to be used or cast aside by the 'owner'.

Climate Change

The man-caused climate change thing shows how dumb people can be! Will someone explain how a one part increase in 10,000 parts of atmospheric CO2 can cause a one part increase in 288 degrees of temperature? It is all about trying to control the world. I am very much in favor of carefully reducing pollution but not at the expense of destroying our liberties and quality of life on the basis of a hoax. The California fires of the last two years put more pollution in the air than all the fossil fuel burning, world-wide, over the entire two year time period. The fires were the result of the misguided environmental policies of California's foolish political leaders.

Redistribution of Wealth

The best way to distribute wealth is through voluntary and free exchange. I have a good or service that I want to sell, trade or donate. You have a need for that which I wish to sell, trade or donate. If we get together and voluntarily agree to the terms of exchange, we both go away happier than before. This is the definition of win-win. Government-mandated terms of exchange are never satisfying for anyone but the government operatives. Government-mandated terms of exchange always lead to less exchange and severe maldistribution. Socialism, like monarchism, is the epitome of governmental mandates.

I am proud to say that I have never, knowingly, voted for a Democrat. In actuality, I can find no principle or policy of that party that I agree with, and, unless they change on these and other very important issues, I never will vote that ticket. It is the policies and principles, not the personality and demeanor, that count with me.

Two Significant Technical Papers

During my career as an engineer and manager I had the opportunity to work with some very interesting and important technologies. Some that I will mention include digital computers, integrated circuits, computer software, computer networks, fiber optics, automatic test and measurement, linear and digital circuits, signal analyzers, microwave devices and computer aided design. Over the years I wrote or presented papers or reports on most of these and many others. I am presenting here two of the most significant technologies that I was involved with. In 1966/1967 I authored and coauthored these papers presenting the world's first really capable microwave network analyzer and a companion paper on how to effectively utilize network analyzer measurements to design wireless devices and systems. These capabilities truly revolutionized the wireless world.

Without this first network analyzer and others that followed it is very unlikely that there would have been such remarkable innovations such as global position satellite systems (GPS), stealth aircraft, fast radar, sophisticated cellular networks and powerful smart phones. And, fifth generation networks (5G) with such things as self-driving cars would just be a pipe dream. It is with profound satisfaction that I present these two 1967 papers so that you, my descendants, can know what your grandfather spent some of his time thinking about. After all, you are the ones for whom this project was undertaken.

Richard Watkins Anderson
April 15, 2021

HEWLETT PACKARD

S-Parameter Techniques for Faster, More Accurate Network Design

ABSTRACT. Richard W. Anderson describes s-parameters and flowgraphs and then relates them to more familiar concepts such as transducer power gain and voltage gain. He takes swept-frequency data obtained with a network analyzer and uses it to design amplifiers. He shows how to calculate the error caused by assuming the transistor is unilateral. Both narrow band and broad band amplifier designs are discussed. Stability criteria are also considered.

This article originally appeared in the February 1967 issue of the Hewlett-Packard Journal.

LINEAR NETWORKS, OR NONLINEAR NETWORKS operating with signals sufficiently small to cause the networks to respond in a linear manner, can be completely characterized by parameters measured at the network terminals (ports) without regard to the contents of the networks. Once the parameters of a network have been determined, its behavior in any external environment can be predicted, again without regard to the specific contents of the network.

S-parameters are being used more and more in microwave design because they are easier to measure and work with at high frequencies than other kinds of parameters. They are conceptually simple, analytically convenient, and capable of providing a surprising degree of insight into a measurement or design problem. For these reasons, manufacturers of high-frequency transistors and other solid-state devices are finding it more meaningful to specify their products in terms of s-parameters than in any other way. How s-parameters can simplify microwave design problems, and how a designer can best take advantage of their abilities, are described in this article.

Two-Port Network Theory

Although a network may have any number of ports, network parameters can be explained most easily by considering a network with only two ports, an input port and an output port, like the network shown in Fig. 1. To characterize the performance of such a network, any of several parameter sets can be used, each of which has certain advantages.

Each parameter set is related to a set of four variables associated with the two-port model. Two of these variables represent the excitation of the network (independent variables), and the remaining two represent the response of the network to the excitation (dependent variables). If the network of Fig. 1 is excited by voltage sources V_1 and V_2, the network currents I_1 and I_2 will be related by the following equations (assuming the network behaves linearly):

$$I_1 = y_{11}V_1 + y_{12}V_2 \quad (1)$$

$$I_2 = y_{21}V_1 + y_{22}V_2 \quad (2)$$

In this case, with port voltages selected as independent variables and port currents taken as dependent variables, the relating parameters are called short-circuit admittance parameters, or y-parameters. In the absence of additional information, four measurements are required to determine the four parameters y_{11}, y_{21}, y_{12}, and y_{22}. Each measurement is made with one port of the network excited by a voltage source while the other port is short circuited. For example, y_{21}, the forward transadmittance, is the ratio of the current at port 2 to the voltage at port 1 with port 2 short circuited as shown in equation 3.

$$y_{21} = \left.\frac{I_2}{V_1}\right|_{V_2 = 0 \text{ (output short circuited)}} \quad (3)$$

If other independent and dependent variables had been chosen, the network would have been described, as before, by two linear equations similar to equations 1 and 2, except that the variables and the parameters describing their relationships would be different. However, all parameter sets contain the same information about a network, and it is always possible to calculate any set in terms of any other set.

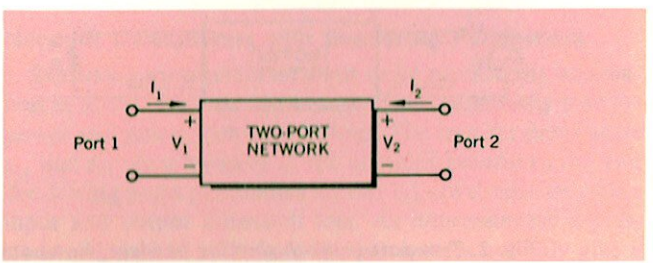


Fig. 1. *General two-port network.*

S-Parameters

The ease with which scattering parameters can be measured makes them especially well suited for describing transistors and other active devices. Measuring most other parameters calls for the input and output of the device to be successively opened and short circuited. This is difficult to do even at RF frequencies where lead inductance and capacitance make short and open circuits difficult to obtain. At higher frequencies these measurements typically require tuning stubs, separately adjusted at each measurement frequency, to reflect short or open circuit conditions to the device terminals. Not only is this inconvenient and tedious, but a tuning stub shunting the input or output may cause a transistor to oscillate, making the measurement difficult and invalid. S-parameters, on the other hand, are usually measured with the device imbedded between a 50Ω load and source, and there is very little chance for oscillations to occur.

Another important advantage of s-parameters stems from the fact that traveling waves, unlike terminal voltages and currents, do not vary in magnitude at points along a lossless transmission line. This means that scattering parameters can be measured on a device located at some distance from the measurement transducers, provided that the measuring device and the transducers are connected by low-loss transmission lines.

Generalized scattering parameters have been defined by K. Kurokawa.[1] These parameters describe the interrelationships of a new set of variables (a_i, b_i). The variables a_i and b_i are normalized complex voltage waves incident on and reflected from the i^{th} port of the network. They are defined in terms of the terminal voltage V_i, the terminal current I_i, and an arbitrary reference impedance Z_i, as follows

[1] K. Kurokawa, 'Power Waves and the Scattering Matrix,' IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-13, No. 2, March, 1965.

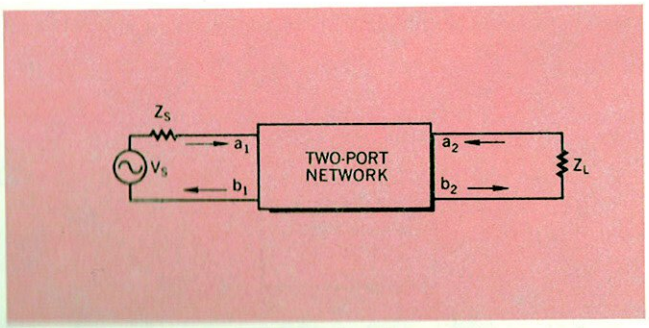


Fig. 2. Two-port network showing incident (a_1, a_2) and reflected (b_1, b_2) waves used in s-parameter definitions.

$$a_i = \frac{V_i + Z_i I_i}{2\sqrt{|\mathrm{Re}\, Z_i|}} \qquad (4)$$

$$b_i = \frac{V_i - Z_i^* I_i}{2\sqrt{|\mathrm{Re}\, Z_i|}} \qquad (5)$$

where the asterisk denotes the complex conjugate.

For most measurements and calculations it is convenient to assume that the reference impedance Z_i is positive and real. For the remainder of this article, then, all variables and parameters will be referenced to a single positive real impedance Z_o.

The wave functions used to define s-parameters for a two-port network are shown in Fig. 2. The independent variables a_1 and a_2 are normalized incident voltages, as follows:

$$a_1 = \frac{V_1 + I_1 Z_o}{2\sqrt{Z_o}} = \frac{\text{voltage wave incident on port 1}}{\sqrt{Z_o}} = \frac{V_{i1}}{\sqrt{Z_o}} \qquad (6)$$

$$a_2 = \frac{V_2 + I_2 Z_o}{2\sqrt{Z_o}} = \frac{\text{voltage wave incident on port 2}}{\sqrt{Z_o}} = \frac{V_{i2}}{\sqrt{Z_o}} \qquad (7)$$

Dependent variables b_1 and b_2 are normalized reflected voltages:

$$b_1 = \frac{V_1 - I_1 Z_o}{2\sqrt{Z_o}} = \frac{\text{voltage wave reflected (or emanating) from port 1}}{\sqrt{Z_o}} = \frac{V_{r1}}{\sqrt{Z_o}} \qquad (8)$$

$$b_2 = \frac{V_2 - I_2 Z_o}{2\sqrt{Z_o}} = \frac{\text{voltage wave reflected (or emanating) from port 2}}{\sqrt{Z_o}} = \frac{V_{r2}}{\sqrt{Z_o}} \qquad (9)$$

The linear equations describing the two-port network are then:

$$b_1 = s_{11} a_1 + s_{12} a_2 \qquad (10)$$

$$b_2 = s_{21} a_1 + s_{22} a_2 \qquad (11)$$

The s-parameters s_{11}, s_{22}, s_{21}, and s_{12} are:

$$s_{11} = \left.\frac{b_1}{a_1}\right|_{a_2 = 0} = \text{Input reflection coefficient with the output port terminated by a matched load } (Z_L = Z_o \text{ sets } a_2 = 0). \qquad (12)$$

$$s_{22} = \left.\frac{b_2}{a_2}\right|_{a_1 = 0} = \text{Output reflection coefficient with the input terminated by a matched load } (Z_S = Z_o \text{ and } V_S = 0). \qquad (13)$$

$$s_{21} = \left.\frac{b_2}{a_1}\right|_{a_2 = 0} = \text{Forward transmission (insertion) gain with the output port terminated in a matched load.} \quad (14)$$

$$s_{12} = \left.\frac{b_1}{a_2}\right|_{a_1 = 0} = \text{Reverse transmission (insertion) gain with the input port terminated in a matched load.} \quad (15)$$

Notice that

$$s_{11} = \frac{b_1}{a_1} = \frac{\frac{V_1}{I_1} - Z_o}{\frac{V_1}{I_1} + Z_o} = \frac{Z_1 - Z_o}{Z_1 + Z_o} \quad (16)$$

and

$$Z_1 = Z_o \frac{(1 + s_{11})}{(1 - s_{11})} \quad (17)$$

where $Z_1 = \frac{V_1}{I_1}$ is the input impedance at port 1.

This relationship between reflection coefficient and impedance is the basis of the Smith Chart transmission-line calculator. Consequently, the reflection coefficients s_{11} and s_{22} can be plotted on Smith charts, converted directly to impedance, and easily manipulated to determine matching networks for optimizing a circuit design.

The above equations show one of the important advantages of s-parameters, namely that they are simply gains and reflection coefficients, both familiar quantities to engineers. By comparison, some of the y-parameters described earlier in this article are not so familiar. For example, the y-parameter corresponding to insertion gain s_{21} is the 'forward transadmittance' y_{21} given by equation 3. Clearly, insertion gain gives by far the greater insight into the operation of the network.

Another advantage of s-parameters springs from the simple relationships between the variables a_1, a_2, b_1, and b_2, and various power waves:

$|a_1|^2$ = Power incident on the input of the network.
= Power available from a source of impedance Z_o.

$|a_2|^2$ = Power incident on the output of the network.
= Power reflected from the load.

$|b_1|^2$ = Power reflected from the input port of the network.
= Power available from a Z_o source minus the power delivered to the input of the network.

$|b_2|^2$ = Power reflected or emanating from the output of the network.
= Power incident on the load.
= Power that would be delivered to a Z_o load.

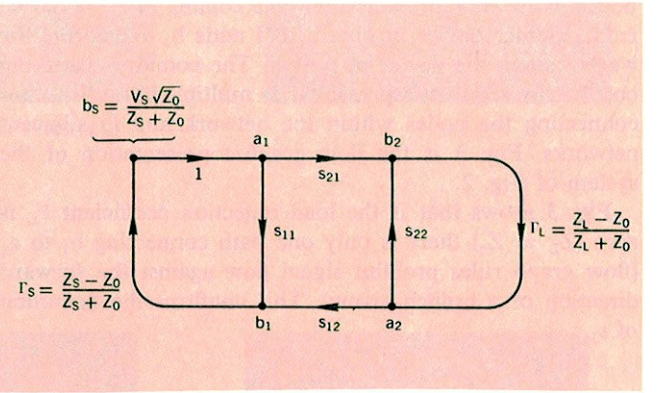


Fig. 3. *Flow graph of network of Fig. 2.*

Hence s-parameters are simply related to power gain and mismatch loss, quantities which are often of more interest than the corresponding voltage functions:

$$|s_{11}|^2 = \frac{\text{Power reflected from the network input}}{\text{Power incident on the network input}}$$

$$|s_{22}|^2 = \frac{\text{Power reflected from the network output}}{\text{Power incident on the network output}}$$

$$|s_{21}|^2 = \frac{\text{Power delivered to a } Z_o \text{ load}}{\text{Power available from } Z_o \text{ source}}$$
= Transducer power gain with Z_o load and source

$|s_{12}|^2$ = Reverse transducer power gain with Z_o load and source.

Network Calculations with Scattering Parameters

Scattering parameters turn out to be particularly convenient in many network calculations. This is especially true for power and power gain calculations. The transfer parameters s_{12} and s_{21} are a measure of the complex insertion gain, and the driving point parameters s_{11} and s_{22} are a measure of the input and output mismatch loss. As dimensionless expressions of gain and reflection, the parameters not only give a clear and meaningful physical interpretation of the network

performance but also form a natural set of parameters for use with signal flow graphs[2,3]. Of course, it is not necessary to use signal flow graphs in order to use s-parameters, but flow graphs make s-parameter calculations extremely simple, and I recommend them very strongly. Flow graphs will be used in the examples that follow.

In a signal flow graph each port is represented by two nodes. Node a_n represents the wave coming into the device from another device at port n and node b_n represents the wave leaving the device at port n. The complex scattering coefficients are then represented as multipliers on branches connecting the nodes within the network and in adjacent networks. Fig. 3 is the flow graph representation of the system of Fig. 2.

Fig. 3 shows that if the load reflection coefficient Γ_L is zero ($Z_L = Z_o$) there is only one path connecting b_1 to a_1 (flow graph rules prohibit signal flow against the forward direction of a branch arrow). This confirms the definition of s_{11}:

$$s_{11} = \left.\frac{b_1}{a_1}\right|_{a_2 = \Gamma_L b_2 = 0}$$

The simplification of network analysis by flow graphs results from the application of the "non-touching loop rule." This rule applies a generalized formula to determine the transfer function between any two nodes within a complex system. The non-touching loop rule is explained in footnote 4.

[2] J. K. Hunton, 'Analysis of Microwave Measurement Techniques by Means of Signal Flow Graphs,' IRE Transactions on Microwave Theory and Techniques, Vol. MTT-8, No. 2, March, 1960.
[3] N. Kuhn, 'Simplified Signal Flow Graph Analysis,' Microwave Journal, Vol. 6, No. 11, Nov., 1963.

[4] The nontouching loop rule provides a simple method for writing the solution of any flow graph by inspection. The solution T (the ratio of the output variable to the input variable) is

$$T = \frac{\sum_k T_k \Delta_k}{\Delta}$$

where T_k = path gain of the k^{th} forward path

Δ = 1 − (sum of all individual loop gains) + (sum of the loop gain products of all possible combinations of two nontouching loops) − (sum of the loop gain products of all possible combinations of three nontouching loops) + ...

Δ_k = The value of Δ not touching the k_{th} forward path.

A path is a continuous succession of branches, and a forward path is a path connecting the input node to the output node, where no node is encountered more than once. Path gain is the product of all the branch multipliers along the path. A loop is a path which originates and terminates on the same node, no node being encountered more than once. Loop gain is the product of the branch multipliers around the loop.

For example, in Fig. 3 there is only one forward path from b_S to b_2 and its gain is s_{21}. There are two paths from b_S to b_1; their path gains are $s_{21}s_{12}\Gamma_L$ and s_{11} respectively. There are three individual loops, only one combination of two nontouching loops, and no combinations of three or more nontouching loops; therefore, the value of Δ for this network is

$$\Delta = 1 - (s_{11}\Gamma_S + s_{21}s_{12}\Gamma_L\Gamma_S + s_{22}\Gamma_L) + (s_{11}s_{22}\Gamma_L\Gamma_S).$$

The transfer function from b_S to b_2 is therefore

$$\frac{b_2}{b_S} = \frac{s_{21}}{\Delta}$$

Using scattering parameter flow-graphs and the non-touching loop rule, it is easy to calculate the transducer power gain with arbitrary load and source. In the following equations the load and source are described by their reflection coefficients Γ_L and Γ_S, respectively, referenced to the real characteristic impedance Z_o.

Transducer power gain

$$G_T = \frac{\text{Power delivered to the load}}{\text{Power available from the source}} = \frac{P_L}{P_{avS}}$$

$$P_L = P(\text{incident on load}) - P(\text{reflected from load})$$
$$= |b_2|^2 (1 - |\Gamma_L|^2)$$

$$P_{avS} = \frac{|b_S|^2}{(1 - |\Gamma_S|^2)}$$

$$G_T = \left|\frac{b_2}{b_S}\right|^2 (1 - |\Gamma_S|^2)(1 - |\Gamma_L|^2)$$

Using the non-touching loop rule,

$$\frac{b_2}{b_S} = \frac{s_{21}}{1 - s_{11}\Gamma_S - s_{22}\Gamma_L - s_{21}s_{12}\Gamma_L\Gamma_S + s_{11}\Gamma_S s_{22}\Gamma_L}$$
$$= \frac{s_{21}}{(1 - s_{11}\Gamma_S)(1 - s_{22}\Gamma_L) - s_{21}s_{12}\Gamma_L\Gamma_S}$$

$$G_T = \frac{|s_{21}|^2 (1 - |\Gamma_S|^2)(1 - |\Gamma_L|^2)}{|(1 - s_{11}\Gamma_S)(1 - s_{22}\Gamma_L) - s_{21}s_{12}\Gamma_L\Gamma_S|^2} \qquad (18)$$

Two other parameters of interest are:

1) Input reflection coefficient with the output termination arbitrary and $Z_S = Z_o$.

$$s'_{11} = \frac{b_1}{a_1} = \frac{s_{11}(1 - s_{22}\Gamma_L) + s_{21}s_{12}\Gamma_L}{1 - s_{22}\Gamma_L}$$
$$= s_{11} + \frac{s_{21}s_{12}\Gamma_L}{1 - s_{22}\Gamma_L} \qquad (19)$$

2) Voltage gain with arbitrary source and load impedances

$$A_V = \frac{V_2}{V_1} \qquad V_1 = (a_1 + b_1)\sqrt{Z_o} = V_{i1} + V_{r1}$$
$$V_2 = (a_2 + b_2)\sqrt{Z_o} = V_{i2} + V_{r2}$$
$$a_2 = \Gamma_L b_2$$
$$b_1 = s'_{11} a_1$$

$$A_V = \frac{b_2(1 + \Gamma_L)}{a_1(1 + s'_{11})} = \frac{s_{21}(1 + \Gamma_L)}{(1 - s_{22}\Gamma_L)(1 + s'_{11})} \qquad (20)$$

On p. 11 is a table of formulas for calculating many often-used network functions (power gains, driving point characteristics, etc.) in terms of scattering parameters. Also included in the table are conversion formulas between s-parameters and h-, y-, and z-parameters, which are other parameter sets used very often for specifying transistors at

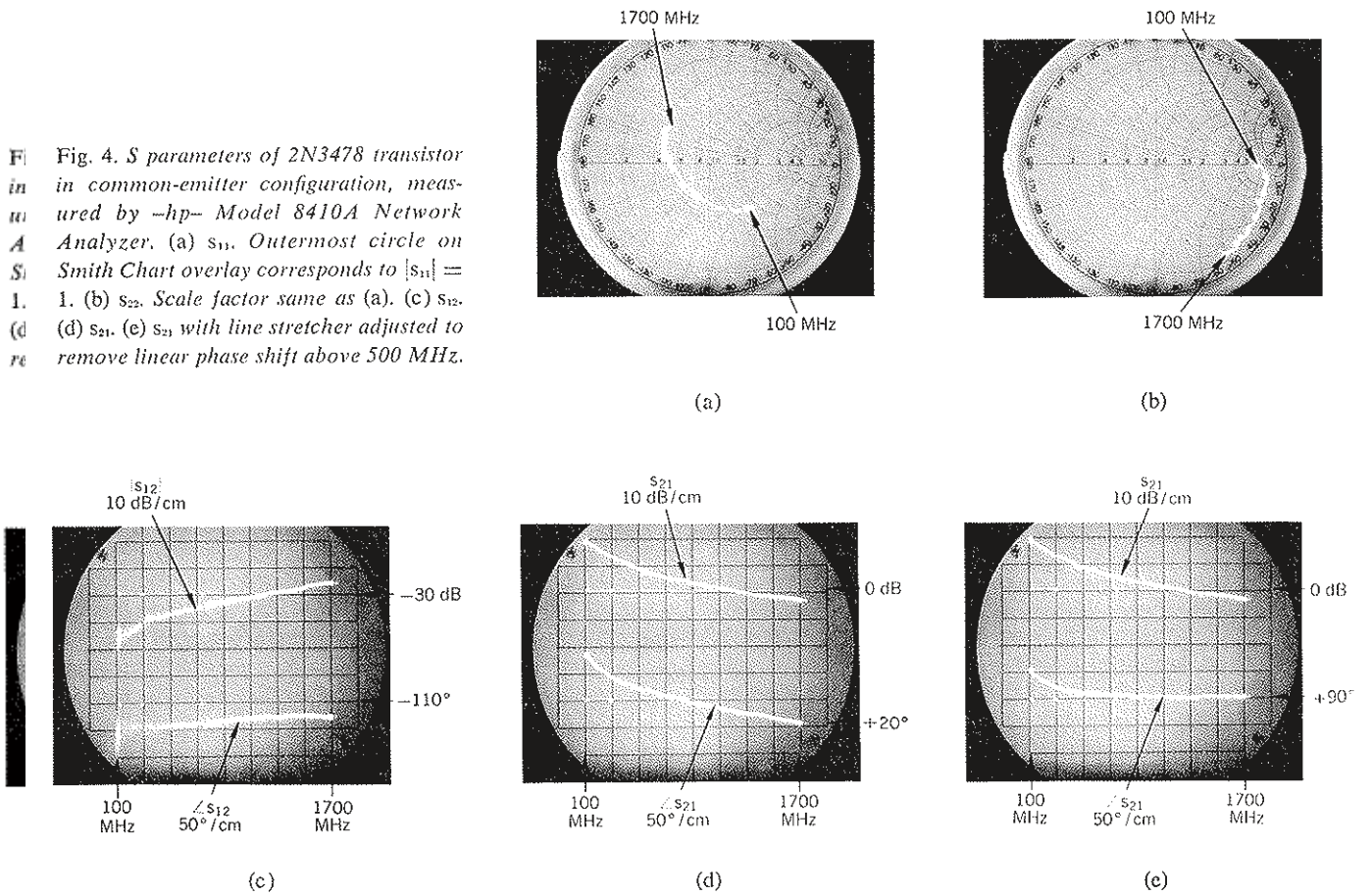


Fig. 4. *S parameters of 2N3478 transistor in common-emitter configuration, measured by –hp– Model 8410A Network Analyzer.* (a) s_{11}. *Outermost circle on Smith Chart overlay corresponds to* $|s_{11}| = 1$. (b) s_{22}. *Scale factor same as* (a). (c) s_{12}. (d) s_{21}. (e) s_{21} *with line stretcher adjusted to remove linear phase shift above 500 MHz.*

lower frequencies. Two important figures of merit used for comparing transistors, f_t and f_{max}, are also given, and their relationship to s-parameters is indicated.

Amplifier Design Using Scattering Parameters

The remainder of this article will show by several examples how s-parameters are used in the design of transistor amplifiers and oscillators. To keep the discussion from becoming bogged down in extraneous details, the emphasis in these examples will be on s-parameter design *methods*, and mathematical manipulations will be omitted wherever possible.

Measurement of S-Parameters

Most design problems will begin with a tentative selection of a device and the measurement of its s-parameters. Fig. 4 is a set of oscillograms containing complete s-parameter data for a 2N3478 transistor in the common-emitter configuration. These oscillograms are the results of swept-frequency measurements made with the new microwave network analyzer described elsewhere in this issue. They represent the actual s-parameters of this transistor between 100 MHz and 1700 MHz.

In Fig. 5, the magnitude of s_{21} from Fig. 4(d) is replotted on a logarithmic frequency scale, along with additional data on s_{21} below 100 MHz, measured with a vector voltmeter. The magnitude of s_{21} is essentially constant to 125 MHz, and then rolls off at a slope of 6 dB/octave. The phase angle of s_{21}, as seen in Fig. 4(d), varies linearly with frequency above about 500 MHz. By adjusting a calibrated line stretcher in the network analyzer, a compensating linear phase shift was introduced, and the phase curve of Fig. 4(e) resulted. To go from the phase curve of Fig. 4(d) to that of Fig. 4(e) required 3.35 cm of line, equivalent to a pure time delay of 112 picoseconds.

After removal of the constant-delay, or linear-phase, component, the phase angle of s_{21} for this transistor [Fig. 4(e)] varies from 180° at dc to +90° at high frequencies, passing through +135° at 125 MHz, the −3 dB point of the magnitude curve. In other words, s_{21} behaves like a single pole in the frequency domain, and it is possible to write a closed expression for it. This expression is

$$s_{21} = \frac{-s_{21_0} e^{-j\omega T_0}}{1 + j\frac{\omega}{\omega_0}} \qquad (21)$$

where

$$T_0 = 112 \text{ ps}$$

$$\omega = 2\pi f$$

$$\omega_0 = 2\pi \times 125 \text{ MHz}$$

$$s_{21_0} = 11.2 = 21 \text{ dB}$$

The time delay $T_0 = 112$ ps is due primarily to the transit time of minority carriers (electrons) across the base of this npn transistor.

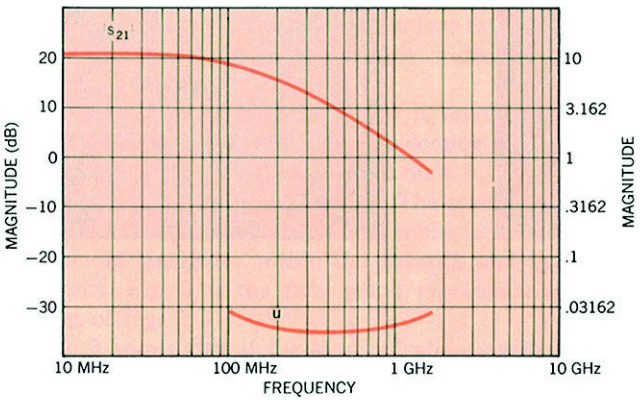


Fig. 5. *Top curve:* $|s_{21}|$ *from Fig. 4 replotted on logarithmic frequency scale. Data below 100 MHz measured with –hp– 8405A Vector Voltmeter. Bottom curve: unilateral figure of merit, calculated from s parameters (see text).*

Narrow-Band Amplifier Design

Suppose now that this 2N3478 transistor is to be used in a simple amplifier, operating between a 50Ω source and a 50Ω load, and optimized for power gain at 300 MHz by means of lossless input and output matching networks. Since reverse gain s_{12} for this transistor is quite small — 50 dB smaller than forward gain s_{21}, according to Fig. 4 — there is a possibility that it can be neglected. If this is so, the design problem will be much simpler, because setting s_{12} equal to zero will make the design equations much less complicated.

In determining how much error will be introduced by assuming $s_{12} = 0$, the first step is to calculate the unilateral figure of merit u, using the formula given in the table on p. 11, i.e.

$$u = \frac{|s_{11}s_{12}s_{21}s_{22}|}{|(1 - |s_{11}|^2)(1 - |s_{22}|^2)|} \quad . \qquad (22)$$

A plot of u as a function of frequency, calculated from the measured parameters, appears in Fig. 5. Now if G_{Tu} is the transducer power gain with $s_{12} = 0$ and G_T is the actual transducer power gain, the maximum error introduced by using G_{Tu} instead of G_T is given by the following relationship:

$$\frac{1}{(1 + u)^2} < \frac{G_T}{G_{Tu}} < \frac{1}{(1 - u)^2} \quad . \qquad (23)$$

From Fig. 5, the maximum value of u is about 0.03, so the maximum error in this case turns out to be about ±0.25 dB at 100 MHz. This is small enough to justify the assumption that $s_{12} = 0$.

Incidentally, a small reverse gain, or feedback factor, s_{12}, is an important and desirable property for a transistor to have, for reasons other than that it simplifies amplifier design. A small feedback factor means that the input characteristics of the completed amplifier will be independent of the load, and the output will be independent of the source impedance. In most amplifiers, isolation of source and load is an important consideration.

Returning now to the amplifier design, the unilateral expression for transducer power gain, obtained either by setting $s_{12} = 0$ in equation 18 or by looking in the table on p. 11, is

$$G_{Tu} = \frac{|s_{21}|^2(1 - |\Gamma_s|^2)(1 - |\Gamma_L|^2)}{|1 - s_{11}\Gamma_s|^2|1 - s_{22}\Gamma_L|^2} \quad . \qquad (24)$$

When $|s_{11}|$ and $|s_{22}|$ are both less than one, as they are in this case, maximum G_{Tu} occurs for $\Gamma_S = s^*_{11}$ and $\Gamma_L = s^*_{22}$ (table, p. 11).

The next step in the design is to synthesize matching networks which will transform the 50Ω load and source impedances to the impedances corresponding to reflection coefficients of s^*_{11} and s^*_{22}, respectively. Since this is to be a single-frequency amplifier, the matching networks need not be complicated. Simple series-capacitor, shunt-inductor networks will not only do the job, but will also provide a handy means of biasing the transistor — via the inductor — and of isolating the dc bias from the load and source.

Values of L and C to be used in the matching networks are determined using the Smith Chart of Fig. 6. First, points corresponding to s_{11}, s^*_{11}, s_{22}, and s^*_{22} at 300 MHz are plotted. Each point represents the tip of a vector leading away from the center of the chart, its length equal to the magnitude of the reflection coefficient being plotted, and its angle equal to the phase of the coefficient. Next, a combination of constant-resistance and constant-conductance circles is found, leading from the center of the chart, representing 50Ω, to s^*_{11} and s^*_{22}. The circles on the Smith Chart are constant-resistance circles; increasing series capacitive reactance moves an impedance point counter-clockwise along these circles. In this case, the circle to be used for finding series C is the one passing through the center of the chart, as shown by the solid line in Fig. 6.

Increasing shunt inductive susceptance moves impedance points clockwise along constant-conductance circles. These circles are like the constant-resistance circles, but they are on another Smith Chart, this one being just the reverse of the one in Fig. 6. The constant-conductance circles for shunt L all pass through the leftmost point of the chart rather than the rightmost point. The circles to be used are those passing through s^*_{11} and s^*_{22}, as shown by the dashed lines in Fig. 6.

Once these circles have been located, the normalized values of L and C needed for the matching networks are calculated from readings taken from the reactance and susceptance scales of the Smith Charts. Each element's reactance or susceptance is the difference between the scale readings at the two end points of a circular arc. Which arc corresponds to which element is indicated in Fig. 6. The final network and the element values, normalized and unnormalized, are shown in Fig. 7.

Broadband Amplifier Design

Designing a broadband amplifier, that is, one which has nearly constant gain over a prescribed frequency range, is a matter of surrounding a transistor with external elements in order to compensate for the variation of forward gain $|s_{21}|$ with frequency. This can be done in either of two ways — first, negative feedback, or second, selective mismatching of the input and output circuitry. We will use the second method. When feedback is used, it is usually convenient to convert to y- or z-parameters (for shunt or series feedback respectively) using the conversion equations given in the table, p. 12, and a digital computer.

Equation 24 for the unilateral transducer power gain can be factored into three parts:

$$G_{Tu} = G_0 G_1 G_2$$

where

$$G_0 = |s_{21}|^2$$

$$G_1 = \frac{1 - |\Gamma_S|^2}{|1 - s_{11}\Gamma_S|^2}$$

$$G_2 = \frac{1 - |\Gamma_L|^2}{|1 - s_{22}\Gamma_L|^2} .$$

When a broadband amplifier is designed by selective mismatching, the gain contributions of G_1 and G_2 are varied to compensate for the variations of $G_0 = |s_{21}|^2$ with frequency.

Suppose that the 2N3478 transistor whose s-parameters are given in Fig. 4 is to be used in a broadband amplifier which has a constant gain of 10 dB over a frequency range of 300 MHz to 700 MHz. The amplifier is to be driven from a 50Ω source and is to drive a 50Ω load. According to Fig. 5,

$$|s_{21}|^2 = 13 \text{ dB at } 300 \text{ MHz}$$
$$= 10 \text{ dB at } 450 \text{ MHz}$$
$$= 6 \text{ dB at } 700 \text{ MHz}.$$

To realize an amplifier with a constant gain of 10 dB, source and load matching networks must be found which will decrease the gain by 3 dB at 300 MHz, leave the gain the same at 450 MHz, and increase the gain by 4 dB at 700 MHz.

Although in the general case both a source matching network and a load matching network would be designed, $G_{1\,max}$ (i.e., G_1 for $\Gamma_S = s^*_{11}$) for this transistor is less than 1 dB over the frequencies of interest, which means there is little to be gained by matching the source. Consequently, for this example, only a load-matching network will be designed. Procedures for designing source-matching networks are identical to those used for designing load-matching networks.

The first step in the design is to plot s^*_{22} over the required frequency range on the Smith Chart, Fig. 8. Next, a set of constant-gain circles is drawn. Each circle is drawn for a single frequency; its center is on a line between the center of the Smith Chart and the point representing s^*_{22} at that frequency. The distance from the center of the Smith Chart to the center of the constant gain circle is given by (these equations also appear in the table, p. 11):

$$r_2 = \frac{g_2|s_{22}|}{1 - |s_{22}|^2(1 - g_2)}$$

where

$$g_2 = \frac{G_2}{G_{2\,max}} = G_2(1 - |s_{22}|^2).$$

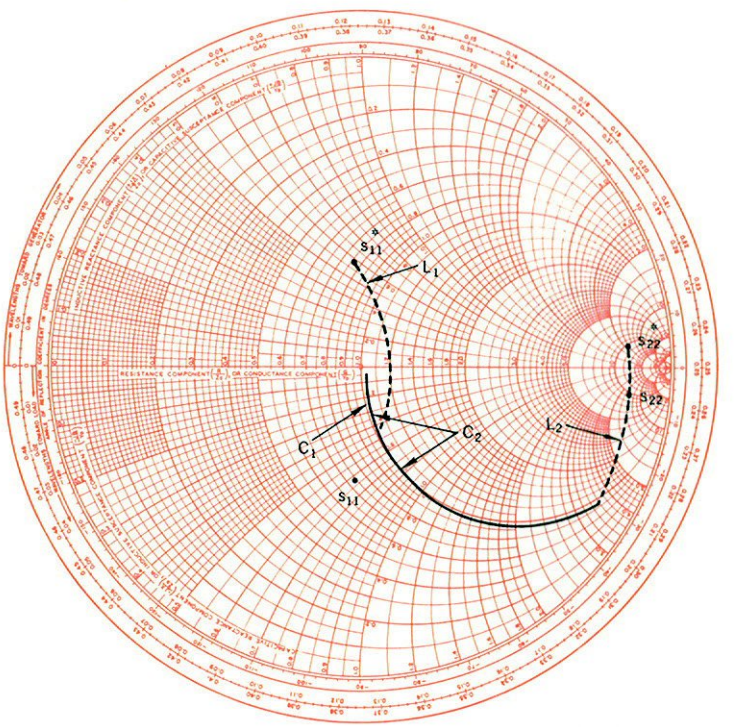


Fig. 6. *Smith Chart for 300-MHz amplifier design example.*

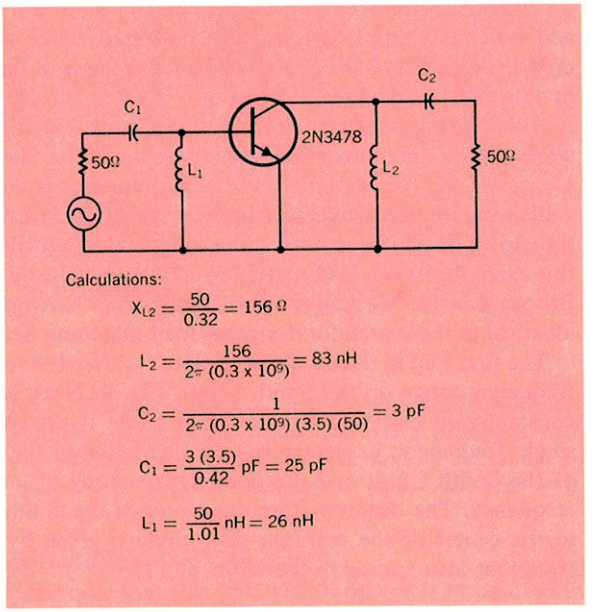


Fig. 7. *300-MHz amplifier with matching networks for maximum power gain.*

The radius of the constant-gain circle is

$$\rho_2 = \frac{\sqrt{1 - g_2}\,(1 - |s_{22}|^2)}{1 - |s_{22}|^2\,(1 - g_2)}.$$

For this example, three circles will be drawn, one for $G_2 = -3$ dB at 300 MHz, one for $G_2 = 0$ dB at 450 MHz, and one for $G_2 = +4$ dB at 700 MHz. Since $|s_{22}|$ for this transistor is constant at 0.85 over the frequency range [see Fig. 4(b)], $G_{2\,max}$ for all three circles is $(0.278)^{-1}$, or 5.6 dB. The three constant-gain circles are indicated in Fig. 8.

The required matching network must transform the center of the Smith Chart, representing 50Ω, to some point on the −3 dB circle at 300 MHz, to some point on the 0 dB circle at 450 MHz, and to some point on the +4 dB circle at 700 MHz. There are undoubtedly many networks that will do this. One which is satisfactory is a combination of two inductors, one in shunt and one in series, as shown in Fig. 9.

Shunt and series elements move impedance points on the Smith Chart along constant-conductance and constant-resistance circles, as I explained in the narrow-band design example which preceded this broadband example. The shunt inductance transforms the 50Ω load along a circle of constant conductance and varying (with frequency) inductive susceptance. The series inductor transforms the combination of the 50Ω load and the shunt inductance along circles of constant resistance and varying inductive reactance.

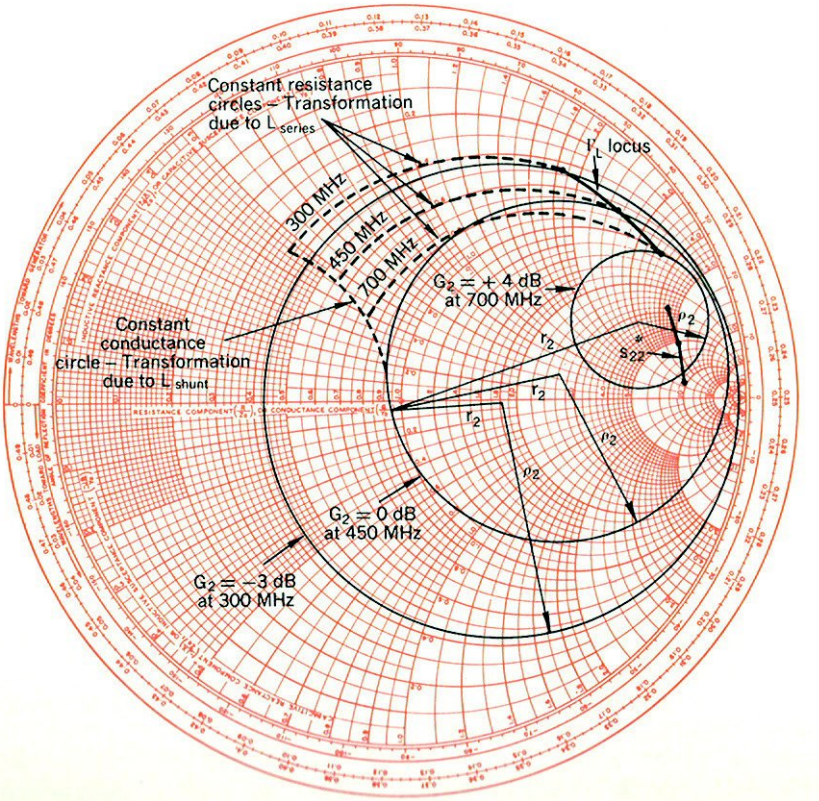


Fig. 8. *Smith Chart for broadband amplifier design example.*

Optimizing the values of shunt and series L is a cut-and-try process to adjust these elements so that

—the transformed load reflection terminates on the right gain circle at each frequency, and

—the susceptance component decreases with frequency and the reactance component increases with frequency. (This rule applies to inductors; capacitors would behave in the opposite way.)

Once appropriate constant-conductance and constant-resistance circles have been found, the reactances and susceptances of the elements can be read directly from the Smith Chart. Then the element values are calculated, the same as they were for the narrow-band design.

Fig. 10 is a schematic diagram of the completed broadband amplifier, with unnormalized element values.

Stability Considerations and the Design of Reflection Amplifiers and Oscillators

When the real part of the input impedance of a network is negative, the corresponding input reflection coefficient (equation 17) is greater than one, and the network can be used as the basis for two important types of circuits, reflection amplifiers and oscillators. A reflection amplifier (Fig. 11) can be realized with a circulator—a nonreciprocal three-port device — and a negative-resistance device. The circulator is used to separate the incident (input) wave from the larger wave reflected by the negative-resistance device. Theoretically, if the circulator is perfect and has a positive real characteristic impedance Z_0, an amplifier with infinite gain can be built by selecting a negative-resistance device whose input impedance has a real part equal to $-Z_0$ and an imaginary part equal to zero (the imaginary part can be set equal to zero by tuning, if necessary).

Amplifiers, of course, are not supposed to oscillate, whether they are reflection amplifiers or some other kind. There is a convenient criterion based upon scattering parameters for determining whether a device is stable or potentially unstable with given source and load impedances. Referring again to the flow graph of Fig. 3, the ratio of the reflected voltage wave b_1 to the input voltage wave b_S is

$$\frac{b_1}{b_S} = \frac{s'_{11}}{1 - \Gamma_S s'_{11}}$$

where s'_{11} is the input reflection coefficient with $\Gamma_S = 0$ (that is, $Z_S = Z_0$) and an arbitrary load impedance Z_L, as defined in equation 19.

If at some frequency

$$\Gamma_S s'_{11} = 1 \qquad (25)$$

the circuit is unstable and will oscillate at that frequency. On the other hand, if

$$|s'_{11}| < \left|\frac{1}{\Gamma_S}\right|$$

the device is unconditionally stable and will not oscillate, whatever the phase angle of Γ_S might be.

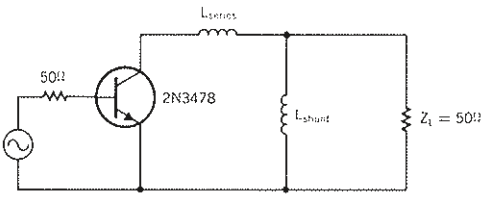
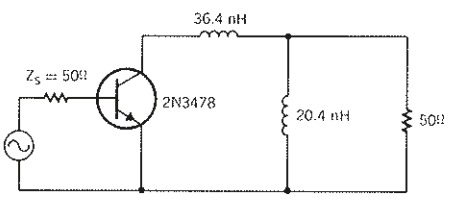


Fig. 9. *Combination of shunt and series inductances is suitable matching network for broadband amplifier.*



Inductance calculations:

From 700 MHz data, $\frac{j\omega L_{series}}{Z_0} = j(3.64 - 0.44) = j3.2$

$$L_{series} = \frac{(3.2)(50)}{2\pi(0.7)}\text{ nH} = 36.4\text{ nH}$$

From 300 MHz data, $\frac{Z_0}{j\omega L_{shunt}} = -j1.3$

$$L_{shunt} = \frac{50}{(1.3)(2\pi)(0.3)} = 20.4\text{ nH}$$

Fig. 10. *Broadband amplifier with constant gain of 10 dB from 300 MHz to 700 MHz.*

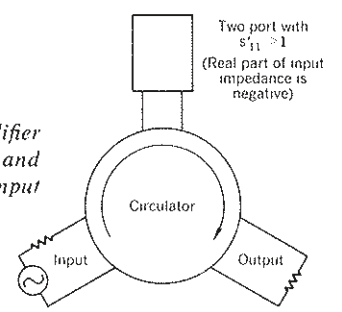


Fig. 11. *Reflection amplifier consists of circulator and transistor with negative input resistance.*

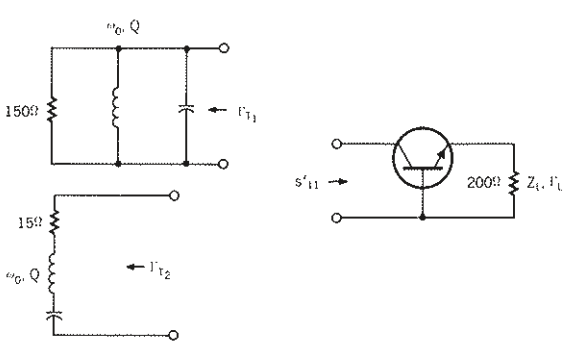


Fig. 12. *Transistor oscillator is designed by choosing tank circuit such that* $\Gamma_T s'_{11} = 1$.

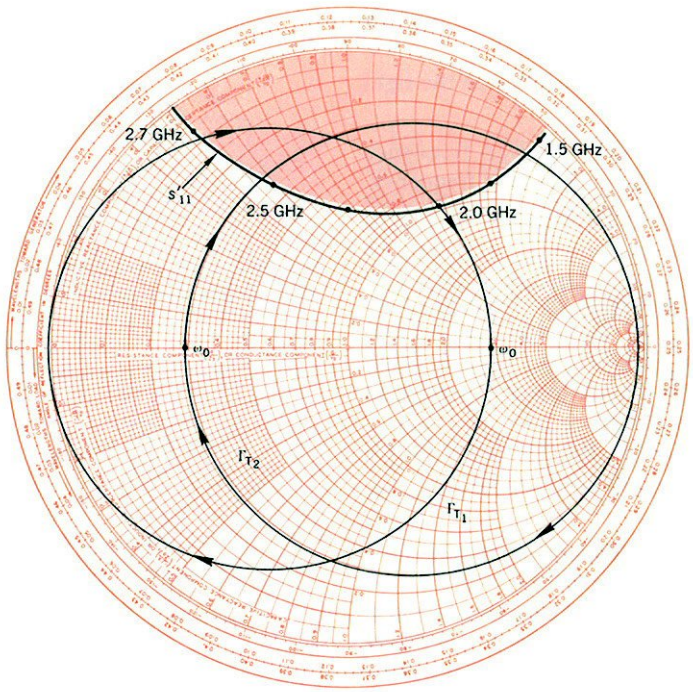


Fig. 13. *Smith Chart for transistor oscillator design example.*

As an example of how these principles of stability are applied in design problems, consider the transistor oscillator design illustrated in Fig. 12. In this case the input reflection coefficient s'_{11} is the reflection coefficient looking into the collector circuit, and the 'source' reflection coefficient Γ_S is one of the two tank-circuit reflection coefficients, Γ_{T1} or Γ_{T2}. From equation 19,

$$s'_{11} = s_{11} + \frac{s_{12}\, s_{21}\, \Gamma_L}{1 - s_{22}\, \Gamma_L}$$

To make the transistor oscillate, s'_{11} and Γ_S must be adjusted so that they satisfy equation 25. There are four steps in the design procedure:

—Measure the four scattering parameters of the transistor as functions of frequency.

—Choose a load reflection coefficient Γ_L which makes s'_{11} greater than unity. In general, it may also take an external feedback element which increases $s_{12}\, s_{21}$ to make s'_{11} greater than one.

—Plot $1/s'_{11}$ on a Smith Chart. (If the new network analyzer is being used to measure the s-parameters of the transistor, $1/s'_{11}$ can be measured directly by reversing the reference and test channel connections between the reflection test unit and the harmonic frequency converter. The polar display with a Smith Chart overlay will then give the desired plot immediately.)

—Connect either the series or the parallel tank circuit to the collector circuit and tune it so that Γ_{T1} or Γ_{T2} is large enough to satisfy equation 25 (the tank circuit reflection coefficient plays the role of Γ_S in this equation).

Fig. 13 shows a Smith Chart plot of $1/s'_{11}$ for a high-frequency transistor in the common-base configuration. Load impedance Z_L is 200Ω, which means that Γ_L referred to 50Ω is 0.6. Reflection coefficients Γ_{T1} and Γ_{T2} are also plotted as functions of the resonant frequencies of the two tank circuits. Oscillations occur when the locus of Γ_{T1} or Γ_{T2} passes through the shaded region. Thus this transistor would oscillate from 1.5 to 2.5 GHz with a series tuned circuit and from 2.0 to 2.7 GHz with a parallel tuned circuit.

—*Richard W. Anderson*

Additional Reading on S-Parameters

Besides the papers referenced in the footnotes of the article, the following articles and books contain information on s-parameter design procedures and flow graphs.

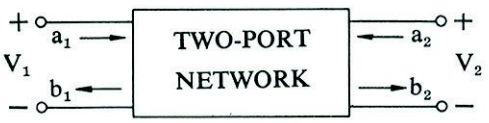
—F. Weinert, 'Scattering Parameters Speed Design of High-Frequency Transistor Circuits,' Electronics, Vol. 39, No. 18, Sept. 5, 1966.

—G. Fredricks, 'How to Use S-Parameters for Transistor Circuit Design,' EEE, Vol. 14, No. 12, Dec., 1966.

—D. C. Youla, 'On Scattering Matrices Normalized to Complex Port Numbers,' Proc. IRE, Vol. 49, No. 7, July, 1961.

—J. G. Linvill and J. F. Gibbons, 'Transistors and Active Circuits,' McGraw-Hill, 1961. (No s-parameters, but good treatment of Smith Chart design methods.)

Useful Scattering Parameter Relationships



$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Input reflection coefficient with arbitrary Z_L

$$s'_{11} = s_{11} + \frac{s_{12}s_{21}\Gamma_L}{1 - s_{22}\Gamma_L}$$

Output reflection coefficient with arbitrary Z_s

$$s'_{22} = s_{22} + \frac{s_{12}s_{21}\Gamma_S}{1 - s_{11}\Gamma_S}$$

Voltage gain with arbitrary Z_L and Z_s

$$A_V = \frac{V_2}{V_1} = \frac{s_{21}(1 + \Gamma_L)}{(1 - s_{22}\Gamma_L)(1 + s'_{11})}$$

$$\text{Power Gain} = \frac{\text{Power delivered to load}}{\text{Power input to network}}$$

$$G = \frac{|s_{21}|^2(1 - |\Gamma_L|^2)}{(1 - |s_{11}|^2) + |\Gamma_L|^2(|s_{22}|^2 - |D|^2) - 2\,\mathrm{Re}\,(\Gamma_L N)}$$

$$\text{Available Power Gain} = \frac{\text{Power available from network}}{\text{Power available from source}}$$

$$G_A = \frac{|s_{21}|^2(1 - |\Gamma_S|^2)}{(1 - |s_{22}|^2) + |\Gamma_S|^2(|s_{11}|^2 - |D|^2) - 2\,\mathrm{Re}\,(\Gamma_S M)}$$

$$\text{Transducer Power Gain} = \frac{\text{Power delivered to load}}{\text{Power available from source}}$$

$$G_T = \frac{|s_{21}|^2(1 - |\Gamma_S|^2)(1 - |\Gamma_L|^2)}{|(1 - s_{11}\Gamma_S)(1 - s_{22}\Gamma_L) - s_{12}s_{21}\Gamma_L\Gamma_S|^2}$$

Unilateral Transducer Power Gain ($s_{12} = 0$)

$$G_{Tu} = \frac{|s_{21}|^2(1 - |\Gamma_S|^2)(1 - |\Gamma_L|^2)}{|1 - s_{11}\Gamma_S|^2\,|1 - s_{22}\Gamma_L|^2}$$

$$= G_o G_1 G_2$$

$$G_0 = |s_{21}|^2$$

$$G_1 = \frac{1 - |\Gamma_S|^2}{|1 - s_{11}\Gamma_S|^2}$$

$$G_2 = \frac{1 - |\Gamma_L|^2}{|1 - s_{22}\Gamma_L|^2}$$

Maximum Unilateral Transducer Power Gain when $|s_{11}| < 1$ and $|s_{22}| < 1$

$$G_u = \frac{|s_{21}|^2}{|(1 - |s_{11}|^2)(1 - |s_{22}|)^2|}$$

$$= G_o\, G_{1\,\max}\, G_{2\,\max}$$

$$G_{i\,\max} = \frac{1}{1 - |s_{ii}|^2} \qquad i = 1, 2$$

This maximum attained for $\Gamma_S = s^*_{11}$ and $\Gamma_L = s^*_{22}$

Constant Gain Circles (Unilateral case: $s_{12} = 0$)

—center of constant gain circle is on line between center of Smith Chart and point representing s^*_{ii}

—distance of center of circle from center of Smith Chart:

$$r_i = \frac{g_i|s_{ii}|}{1 - |s_{ii}|^2(1 - g_i)}$$

—radius of circle:

$$\rho_i = \frac{\sqrt{1 - g_i}\,(1 - |s_{ii}|^2)}{1 - |s_{ii}|^2(1 - g_i)}$$

where: $i = 1, 2$

$$\text{and } g_i = \frac{G_i}{G_{i\,\max}} = G_i(1 - |s_{ii}|^2)$$

Unilateral Figure of Merit

$$u = \frac{|s_{11}s_{22}s_{12}s_{21}|}{|(1 - |s_{11}|^2)(1 - |s_{22}|^2)|}$$

Error Limits on Unilateral Gain Calculation

$$\frac{1}{(1 + u^2)} < \frac{G_T}{G_{Tu}} < \frac{1}{(1 - u^2)}$$

Conditions for Absolute Stability

No passive source or load will cause network to oscillate if a, b, and c are all satisfied.

a. $|s_{11}| < 1, |s_{22}| < 1$

b. $\left| \frac{|s_{12}s_{21}| - |M^*|}{|s_{11}|^2 - |D|^2} \right| > 1$

c. $\left| \frac{|s_{12}s_{21}| - |N^*|}{|s_{22}|^2 - |D|^2} \right| > 1$

Condition that a two-port network can be simultaneously matched with a positive real source and load:

$K > 1$ or $C < 1$

$C =$ Linvill C factor

Linvill C Factor

$$C = K^{-1}$$

$$K = \frac{1 + |D|^2 - |s_{11}|^2 - |s_{22}|^2}{2\,|s_{12}s_{21}|}$$

Source and Load for Simultaneous Match

$$\Gamma_{mS} = M^* \left[\frac{B_1 \pm \sqrt{B_1^2 - 4\,|M|^2}}{2\,|M|^2} \right]$$

$$\Gamma_{mL} = N^* \left[\frac{B_2 \pm \sqrt{B_2^2 - 4\,|N|^2}}{2\,|N|^2} \right]$$

Where $B_1 = 1 + |s_{11}|^2 - |s_{22}|^2 - |D|^2$

$B_2 = 1 + |s_{22}|^2 - |s_{11}|^2 - |D|^2$

Maximum Available Power Gain

If $K > 1$,

$$G_{A\,max} = \left| \frac{s_{21}}{s_{12}} (K \pm \sqrt{K^2 - 1}) \right|$$

$K = C^{-1}$

$C =$ Linvill C Factor

(Use minus sign when B_1 is positive, plus sign when B_1 is negative. For definition of B_1 see 'Source and Load for Simultaneous Match,' elsewhere in this table.)

$$D = s_{11}s_{22} - s_{12}s_{21}$$

$$M = s_{11} - D\,s^*_{22}$$

$$N = s_{22} - D\,s^*_{11}$$

s-parameters in terms of h-, y-, and z-parameters	h-, y-, and z-parameters in terms of s-parameters
$s_{11} = \frac{(z_{11} - 1)(z_{22} + 1) - z_{12}z_{21}}{(z_{11} + 1)(z_{22} + 1) - z_{12}z_{21}}$	$z_{11} = \frac{(1 + s_{11})(1 - s_{22}) + s_{12}s_{21}}{(1 - s_{11})(1 - s_{22}) - s_{12}s_{21}}$
$s_{12} = \frac{2z_{12}}{(z_{11} + 1)(z_{22} + 1) - z_{12}z_{21}}$	$z_{12} = \frac{2s_{12}}{(1 - s_{11})(1 - s_{22}) - s_{12}s_{21}}$
$s_{21} = \frac{2z_{21}}{(z_{11} + 1)(z_{22} + 1) - z_{12}z_{21}}$	$z_{21} = \frac{2s_{21}}{(1 - s_{11})(1 - s_{22}) - s_{12}s_{21}}$
$s_{22} = \frac{(z_{11} + 1)(z_{22} - 1) - z_{12}z_{21}}{(z_{11} + 1)(z_{22} + 1) - z_{12}z_{21}}$	$z_{22} = \frac{(1 + s_{22})(1 - s_{11}) + s_{12}s_{21}}{(1 - s_{11})(1 - s_{22}) - s_{12}s_{21}}$
$s_{11} = \frac{(1 - y_{11})(1 + y_{22}) + y_{12}y_{21}}{(1 + y_{11})(1 + y_{22}) - y_{12}y_{21}}$	$y_{11} = \frac{(1 + s_{22})(1 - s_{11}) + s_{12}s_{21}}{(1 + s_{11})(1 + s_{22}) - s_{12}s_{21}}$
$s_{12} = \frac{-2y_{12}}{(1 + y_{11})(1 + y_{22}) - y_{12}y_{21}}$	$y_{12} = \frac{-2s_{12}}{(1 + s_{11})(1 + s_{22}) - s_{12}s_{21}}$
$s_{21} = \frac{-2y_{21}}{(1 + y_{11})(1 + y_{22}) - y_{12}y_{21}}$	$y_{21} = \frac{-2s_{21}}{(1 + s_{11})(1 + s_{22}) - s_{12}s_{21}}$
$s_{22} = \frac{(1 + y_{11})(1 - y_{22}) + y_{12}y_{21}}{(1 + y_{11})(1 + y_{22}) - y_{12}y_{21}}$	$y_{22} = \frac{(1 + s_{11})(1 - s_{22}) + s_{12}s_{21}}{(1 + s_{22})(1 + s_{11}) - s_{12}s_{21}}$
$s_{11} = \frac{(h_{11} - 1)(h_{22} + 1) - h_{12}h_{21}}{(h_{11} + 1)(h_{22} + 1) - h_{12}h_{21}}$	$h_{11} = \frac{(1 + s_{11})(1 + s_{22}) - s_{12}s_{21}}{(1 - s_{11})(1 + s_{22}) + s_{12}s_{21}}$
$s_{12} = \frac{2h_{12}}{(h_{11} + 1)(h_{22} + 1) - h_{12}h_{21}}$	$h_{12} = \frac{2s_{12}}{(1 - s_{11})(1 + s_{22}) + s_{12}s_{21}}$
$s_{21} = \frac{-2h_{21}}{(h_{11} + 1)(h_{22} + 1) - h_{12}h_{21}}$	$h_{21} = \frac{-2s_{21}}{(1 - s_{11})(1 + s_{22}) + s_{12}s_{21}}$
$s_{22} = \frac{(1 + h_{11})(1 - h_{22}) + h_{12}h_{21}}{(h_{11} + 1)(h_{22} + 1) - h_{12}h_{21}}$	$h_{22} = \frac{(1 - s_{22})(1 - s_{11}) - s_{12}s_{21}}{(1 - s_{11})(1 + s_{22}) + s_{12}s_{21}}$

The h-, y-, and z-parameters listed above are all normalized to Z_o. If h′, y′, and z′ are the actual parameters, then		
$z_{11}' = z_{11}Z_o$	$y_{11}' = \frac{y_{11}}{Z_o}$	$h_{11}' = h_{11}Z_o$
$z_{12}' = z_{12}Z_o$	$y_{12}' = \frac{y_{12}}{Z_o}$	$h_{12}' = h_{12}$
$z_{21}' = z_{21}Z_o$	$y_{21}' = \frac{y_{21}}{Z_o}$	$h_{21}' = h_{21}$
$z_{22}' = z_{22}Z_o$	$y_{22}' = \frac{y_{22}}{Z_o}$	$h_{22}' = \frac{h_{22}}{Z_o}$

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Fig. 1. *Automatic Network Analyzer for measuring complex impedances, gain, loss, and phase shift from 0.11 to 12.4 GHz consists of (l. to r.), Model 8411A Harmonic Frequency Converter, Model 8410A Main Frame, and a plug-in display module (either Model 8413A Phase-Gain Indicator or Model 8414A Polar Display). Network Analyzer makes swept or single-frequency measurements. See Fig. 8 for other system components.*

An Advanced New Network Analyzer for Sweep-Measuring Amplitude and Phase from 0.1 to 12.4 GHz

The information obtainable with a new network analyzer greatly improves microwave design practices, especially where phase information is important.

A NEW MICROWAVE NETWORK ANALYZER developed in the -hp- microwave laboratory promises to be of major importance in many electronic fields, especially those concerned with the phase properties of microwave systems and components. The new instrument sweep-measures the magnitude and phase of reflection and transmission coefficients over the range from 110 MHz to 12.4 GHz. This makes it possible for the analyzer to completely characterize active and passive devices, since nearly every parameter of interest for high-frequency devices can be measured including gain, attenuation, phase, impedance, admittance and others.

The new analyzer represents a major step in the continuing trend to automation in microwave measurements, a trend recognized in several articles in this publication and elsewhere*. Systems that are especially aided by the kinds of automated measurements the analyzer makes are the modern systems that emphasize phase properties, such as electronically-scanned radar and monopulse and doppler radar. Similarly, optimum use of the new high-frequency solid-state devices that make systems such as phased-array radars economically practical is dependent on sophisticated measurements. The reason for this de-

* See references on page 9.

-hp- Journal readers:

We believe you who work with frequencies above 100 MHz will be especially interested in this issue because it discusses an important new system that measures gain, phase, impedance, admittance and attenuation on a swept basis *from 110 MHz to 12.4 GHz. In other words the system will measure all network parameters not only of passive networks and devices but also of transistors and even of negative real impedances. Readout is on a meter or on a scope which presents measured performance over a whole frequency band at a glance.*

The new system leads to wider use of the familiar quantities we usually call reflection and transmission coefficients. These coefficients are also known as 'scattering parameters', and using them in combination with the new system leads to more sophisticated design techniques including computerized design. An informative article about scattering parameters begins on p. 13.

Obviously, the new system is a powerful tool for the engineer. In addition, it has important implications for the whole microwave engineering field in the future. This is also discussed in this issue (p. 11) by Paul Ely, engineering manager of our microwave laboratory.

I invite your attention to what we believe is unusually important microwave information.

Sincerely, Editor

pendence is that these solid-state devices can best be utilized in new functions if they can be completely characterized and understood.

The analyzer characterizes networks by measuring their complex small-signal parameters. The particular types of parameters measured are called the scattering or "s" parameters. These parameters have proved a valuable tool for the design engineer because of their inherent ease of measurement, their design advantages and the intuitive insight they provide. A separate article in this issue deals with their theory and describes new design practices developed with them at Hewlett-Packard.

Network Analyzer Concept

The concept of the network analyzer follows naturally from network-parameter theory. Measuring s-parameters is a matter of measuring (a) the ratio of the magnitudes and (b) the relative phase angles of response and excitation signals at the ports of a network with the other ports terminated in a specified 'characteristic' or reference impedance. It is not difficult to define the basic elements of a network analyzer system to perform these measurements (Fig. 3). First, a source of excitation is required. Then a transducer instrument is needed to convert the excitation signal and the response signals produced by the unknown to a set of output signals containing the network information (a dual-directional coupler for measuring the complex reflection coefficient s_{11} is illustrated). Next, an instrument capable of measuring magnitude ratio and phase difference is used to extract the pertinent information from the test signals. A readout mechanism to present the data completes the basic network analyzer.

The above is the concept that has been followed in designing the new network analyzer. A further refinement of the concept is the use of a plug-in readout. Although the network parameter data are the same for each application (i.e., magnitude and phase), the form in which the data are most useful depends upon the application.

Table I System Components

MODEL	FUNCTION	RANGE
8410A Network Analyzer Main Frame	Mainframe for readout modules, includes tuning circuits, IF amplifiers, and precision IF attenuator.	0.11 to 12.4 GHz when used with Model 8411A.
8411A Harmonic Frequency Converter	Converts 2 RF input signals 0.11 to 12.4 GHz into 20-MHz IF signals.	0.11 to 12.4 GHz when used with the 8410A. Impedance 50 ohms.
8413A Phase-Gain Indicator	Plug-in module for 8410A Mainframe provides meter display of relative amplitude and phase between input signals, auxiliary outputs for scope or X-Y recorder.	Full scale ±3, 10, 30 dB and ±6, 18, 60, 180 degrees. Auxiliary outputs 50 mV/dB and 10 mV/degree.
8414A Polar Display Unit	Plug-in module for 8410A Mainframe. CRT polar display of amplitude and phase. X-Y outputs for high resolution polar and Smith Chart impedance plots.	Internal graticule CRT for nonparallax viewing. Amplitude calibration in five linear steps. Phase in 10° intervals through 360°. Smith Chart overlays for direct impedance readout (normalized to 50 ohms).
8740A Transmission Test Unit	Simplifies RF input and test device connection for attenuation or gain test. Accepts RF input signal from source and splits into reference and test channels for connection to 8411A and the unknown device. Calibrated line stretcher balances out linear phase shift when test device is inserted.	0.11 to 12.4 GHz. Impedance 50 ohms.
8741A Reflection Test Unit	Wide-band reflectometer, phase balanced for swept or spot frequency impedance tests below 2 GHz. Accepts RF input and provides connections for unknown test device and 8411A. Movable reference plane.	0.11 to 2.0 GHz.
8742A Reflection Test Unit	Ultra-wide band reflectometer, phase balanced for impedance tests above 2.0 GHz. Movable reference plane.	2.0 to 12.4 GHz

Fig. 2. *Typical test setup using new Network Analyzer (top center) to sweep-measure transmission of microwave filter. Magnitude and phase are measured on Analyzer meter and presented as a function of frequency on oscilloscope. Magnitude and phase can also be presented in polar form on a Polar Display scope which plugs in, in place of Phase Gain Indicator and will feed external recorder.*

Other pieces of auxiliary equipment will, in general, be added to complete a specific measurement. Examples would be bias supplies for active devices and matched loads for termination purposes.

Here then is a very flexible system that defines completely the complex parameters of an active or passive network. It provides this information, much of which was previously very difficult or prohibitively expensive to obtain, over a huge frequency range with an ease and rapidity that consistently intrigues those who see it the first time. Specific features of the network analyzer are the following:

1. One system measures both magnitude and phase of all network parameters from 110 MHz to 12.4 GHz. The measurements can be made at a single frequency or on a swept frequency basis over octave bandwidths.

2. The analyzer combines wide dynamic range with high measurement resolution. Direct dynamic display range is 60 dB in magnitude and 360° of phase. Precise internal attenuators and a calibrated phase offset allow expanded measurements with better than 0.1 dB resolution in magnitude and 0.1° in phase.

3. It is accurate. Precision components are used throughout to assure basic accuracy. The two-channel comparative technique removes error terms caused by the source and variations common to both channels.

4. A choice of display allows the data to be presented in the most useful form for the specific measurement. The measured data are also provided in analog form for external oscilloscope, recorder, or digital display.

Frequency Translation by Sampling

Figs. 1 and 8 show the elements of the analyzer system and Table I lists the elements, their functions, and their frequency ranges. The basic analyzer (Fig. 1) consists of three units: a main frame, either of two plug-in display modules, and a harmonic frequency converter. The transducer instruments for reflection and transmission (Fig. 8) complete the system.

The key technique that allows the new microwave network analyzer to measure complex ratio is the technique of frequency translation by sampling. The block diagram of the basic analyzer shown in Fig. 4 is helpful to understand this technique. Sampling as used in this system is a special case of heterodyning, which translates the input signals to a lower, fixed IF frequency where normal circuitry can be used to measure amplitude and phase relationships. The principle is to exchange the local oscillator of a conventional heterodyne system with a pulse generator which generates a train of very narrow pulses. If each pulse within the train is narrow compared to a period of the applied RF signal, the sampler becomes a harmonic mixer with equal efficiency for each harmonic. Thus sampling-type mixing has the advantage that a single system can operate over an extremely wide input frequency range. In the case of the network analyzer this range is 110 MHz to 12.4 GHz.

In order to make the system capable of swept frequency operation, an internal phase-lock loop keeps one channel of the two-channel network analyzer tuned to the incoming signal. Tuning of the phase-lock loop is entirely automatic. When the loop is unlocked, it automatically tunes back and forth across a portion of whatever octave-wide frequency band has been selected by the user. When any harmonic of the tracking-oscillator frequency falls 20 MHz below the input frequency, i.e., when $f_{in} - nf_{osc} = 20$ MHz, the loop stops searching and locks. Search and lock-on are normally completed in

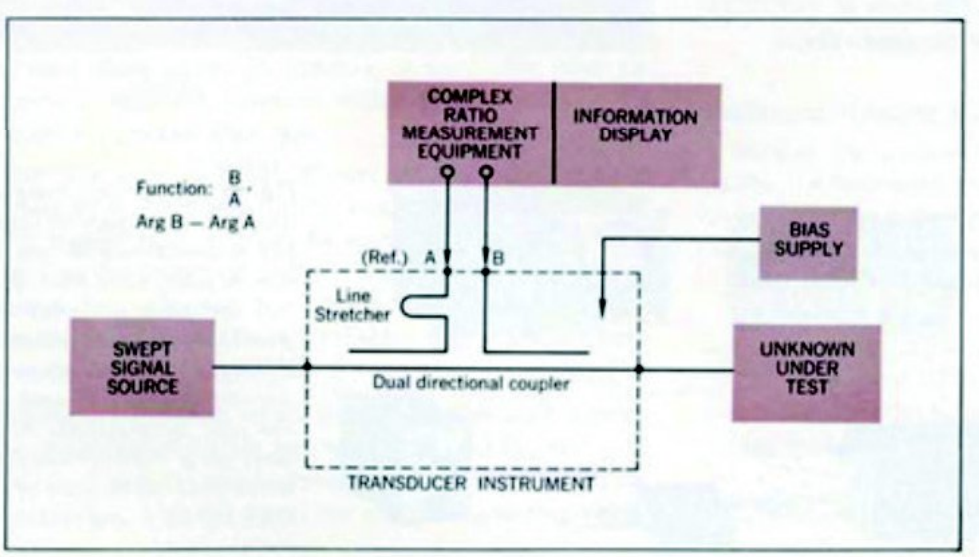


Fig. 3. Network Analyzer concept follows from network theory, as explained in text.

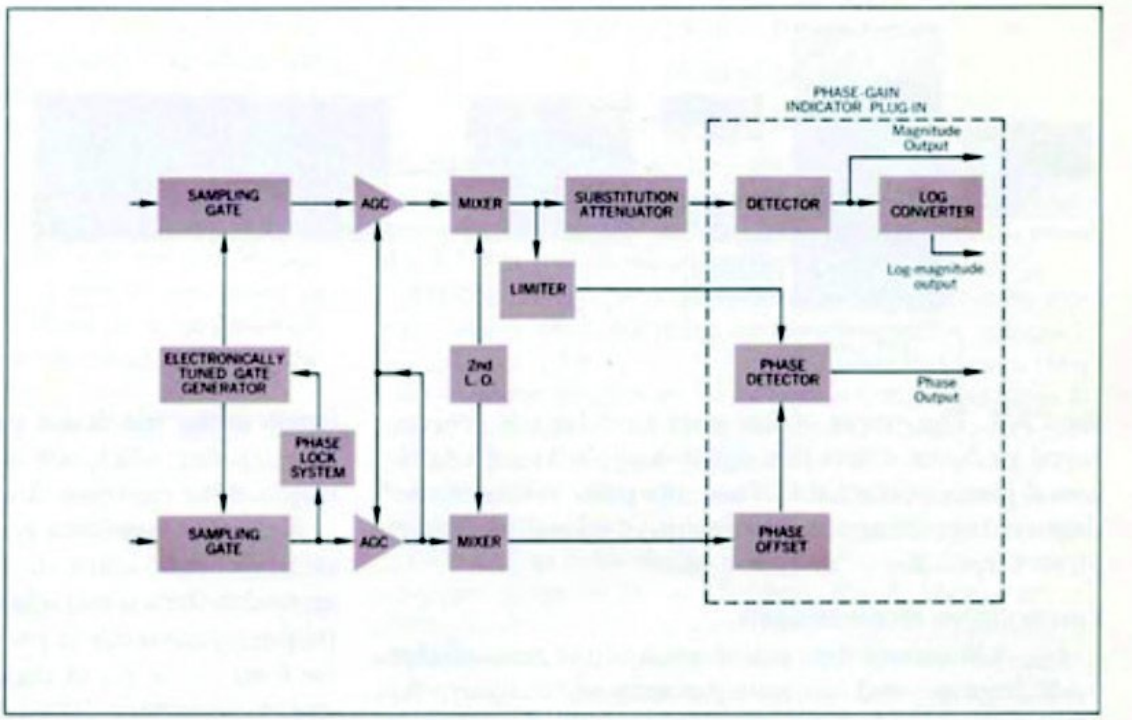


Fig. 4. *Basic system used in Analyzer to achieve frequency translation by a sampling technique.*

about 20 μs. The loop will remain locked for sweep rates as high as 220 GHz/sec (a rate corresponding to about 30 sweeps per second over the highest frequency band, 8 to 12.4 GHz).

The IF signals reconstructed from the sampler outputs are both 20-MHz signals, but since frequency conversion is a linear process, these signals have the same relative amplitudes and phases as the microwave reference and test signals. Thus gain and phase information are preserved, and all signal processing and measurements take place at a constant frequency.

Referring again to Fig. 4, the IF signals are first applied to a pair of matched AGC (automatic gain control) amplifiers. The AGC amplifiers perform two functions: they keep the signal level in the reference channel constant, and they vary the gain in the test channel so that the test signal level does not change when variations common to both channels occur. This action is equivalent to taking a ratio and removes the effects of power variations in the signal source, of frequency response characteristics common to both channels, and of similar common-mode variations.

Before the signals are sent to the display unit, a second frequency conversion from 20 MHz to 278 kHz is performed. To obtain the desired dB and degree quantities, the phase-gain indicator plug-in display unit (Fig. 4) contains a linear phase detector and an analog logarithmic converter which is accurate over a 60 dB range of test signal amplitudes. Ratio (in dB) and relative phase can be read on the meter of the display unit if desired, but the plug-in also provides calibrated dc-coupled voltages proportional to gain (as a linear ratio or in dB) and phase for display on the vertical channels of an oscilloscope or X-Y recorder. If the horizontal input to the oscilloscope or recorder is a voltage proportional to frequency, the complete amplitude and phase response of the test device can be displayed.

Polar Display Unit

The Polar Display Unit (Fig. 5) converts polar quantities of magnitude and phase into a form suitable for display on a CRT. This is accomplished by using two balanced-modulator phase detectors. The phase of the test channel is shifted 90° with respect to the reference channel before being applied to the balanced modulator. The output of one modulator is proportional to A sin θ. This signal is amplified and fed to the vertical plates of

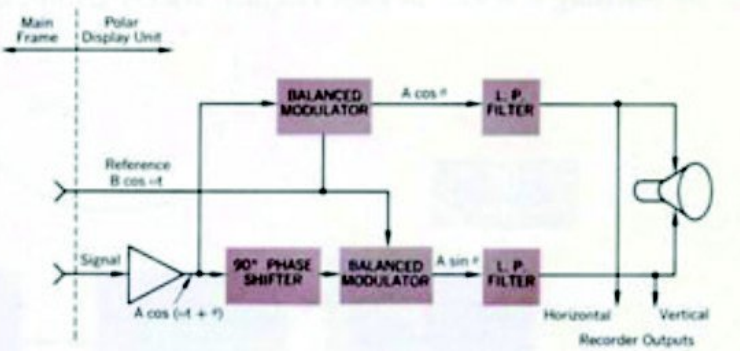


Fig. 5. *Block diagram of basic Polar Display Unit which converts polar magnitude and phase information to be presented on its self-contained CRT.*

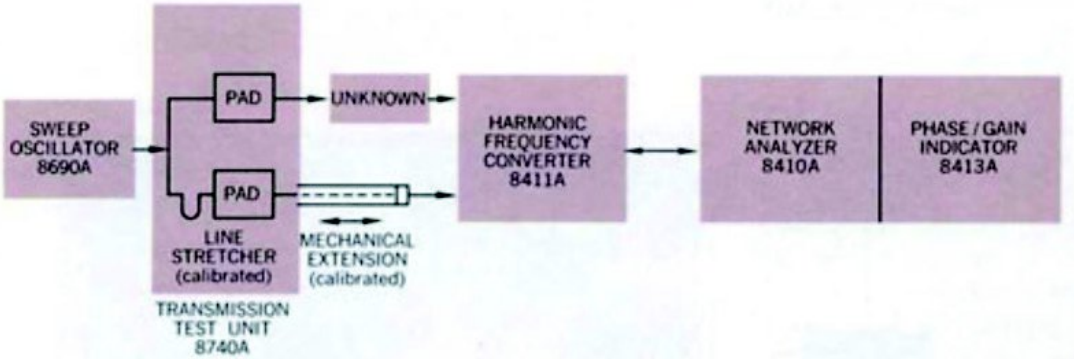


Fig. 6. Block diagram of transmission test with new Network Analyzer. S-parameters s_{12} and s_{21} can be measured thus.

the CRT. The output of the other modulator is proportional to A cos θ and this signal is applied to the horizontal plates of the CRT. Thus, the polar vector can be displayed in rectangular coordinates of an oscilloscope or an X-Y recorder.

Transmission Measurements

Fig. 6 illustrates the measurement of the transmission coefficients s_{21} and s_{12} with the network analyzer. As explained on p. 13, these parameters are the forward and reverse transmission gain of the network when the output and input ports, respectively, are terminated in the reference or characteristic impedances. Transmission measurements are used to determine bandwidth, gain, insertion loss, resonances, group delay, phase shift and distortion, etc. For these measurements a swept-frequency source provides an input to the transmission test unit, which consists of a power divider, a line stretcher and two fixed attenuators. The transmission test unit has two outputs, a reference channel and a test channel, which track each other closely in amplitude and phase from dc to 12.4 GHz. The device to be measured is inserted in the test channel, as shown in Fig. 6. Variations in the physical length of test devices can be compensated for by a mechanical extension of the reference channel of the test unit. Thus the magnitude and phase of the transmission coefficient is measured with respect to a length of precision air-line. Of course gain- and phase-difference measurements between similar devices can also be made by inserting a device in each channel. Excess electrical length in the test device can be compensated for by the line stretcher which acts as an extension to the electrical length of the reference channel.

Since the impedance levels in both reference and test channels are 50 ohms, the ratio of the voltage magnitudes applied to the test and reference channels of the harmonic frequency converter is proportional to the insertion gain (or loss), s_{12} or s_{21}, of the device with respect to the reference impedance 50 ohms. The phase between these voltages is likewise the insertion phase shift. When insertion parameters are being measured, the quantities of greatest interest are a logarithmic measure of gain (dB) and transfer phase shift. To obtain these quantities, the network analyzer is used with the phase-gain indicator plug-in.

Reflection Measurements

Complex reflection coefficient, admittance, and impedance measurements are made using the set-up shown in Fig. 7. In this case the signal from the swept-frequency source drives a reflection test unit consisting of a dual directional coupler and a line stretcher. Only two reflection test units are needed to cover the analyzer's entire frequency range — one for frequencies between 0.11 and 2.0 GHz, and one for frequencies from 2.0 to 12.4 GHz.

For reflection measurements, the polar display plug-in with its built-in internal-graticule (parallax-free) CRT is most convenient. A Smith chart overlay for this display converts reflection coefficients directly to impedance or

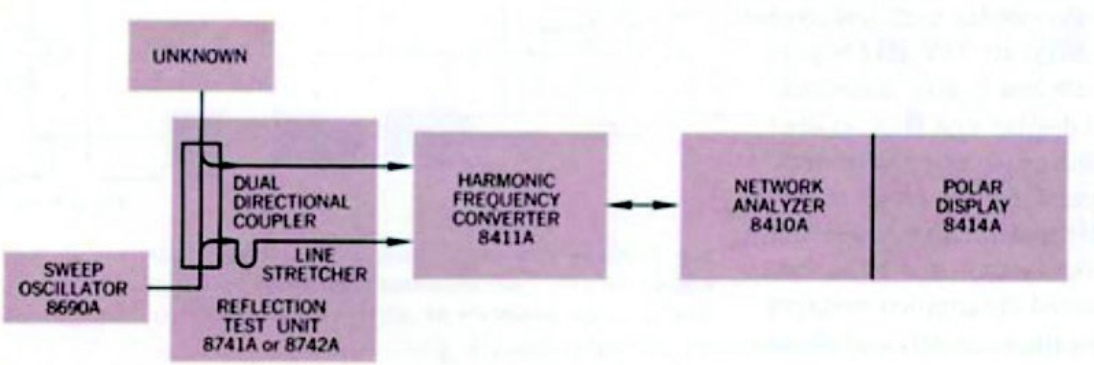


Fig. 7. Block diagram of reflection (impedance) test with new Network Analyzer.

Fig. 8. *Model 8740A Transmission Test Unit or Models 8741A and 8742A Reflection Test Units contain the calibrated line stretchers, attenuators, and directional couplers needed for network analysis.*

admittance. The line stretchers within the test units allow *the plane at which the measurement is made to be extended past the connector to the unknown device.* Thus the Smith Chart display can reveal the impedance or admittance within the test device as frequency is varied without the necessity of graphical manipulations of data plotted on a Smith chart. Seeing the impedance locus of a device over an octave-wide frequency range plotted on this display and watching it change as a tuning adjustment or some other condition is varied is truly an impressive experience for anyone who has ever had to use older methods.

Design considerations

In designing the new analyzer and in achieving some of its performance characteristics, several interesting circuit innovations were devised. Space limitations preclude a detailed treatment, but a summary of some of the salient innovations is given below.

a. A wide-band phase-lock loop was designed to enable the system to sweep rapidly. Maximum sweep rate, which is determined by the loop bandwidth, is about 220 GHz per second.

b. A voltage-controlled oscillator was devised to permit the harmonic frequency converter to tune over more than an octave in frequency (Fig. 9). With the varactors in Fig. 9 connected to the emitters, the voltage swings are small, permitting a low dc bias voltage to be used to get a large value of capacitance. Since the oscillator period is proportional to the varactor capacitance, a large tuning range results.

c. The fast voltage-step needed to obtain fast sampling in the harmonic frequency converter is initiated in a step-recovery diode that operates in a 25-ohm line. To obtain a step of adequate voltage to accommodate the external sampled signal, it is necessary to drive this diode with substantial current. The current is provided by the basic power amplifier shown in Fig. 10. The amplifier follows the local oscillator and consists of emitter followers in a binary tree configuration. Each of the four output transistors supplies nearly 200 mA peak-to-peak over the range from 60 to 150 MHz.

d. In the IF circuits of the signal and reference channels of the main part of the analyzer, AGC action is required but with small relative amplitude and phase change between channels. To achieve this, AGC amplifiers were devised which remove up to 20 dB of power variation while giving less than 1 dB of differential amplitude change and less than about 2° of differential phase change. AGC action is obtained from the current-dependent incremental impedance characteristic of a silicon diode.

e. Amplitude and phase change in the phase/gain in-

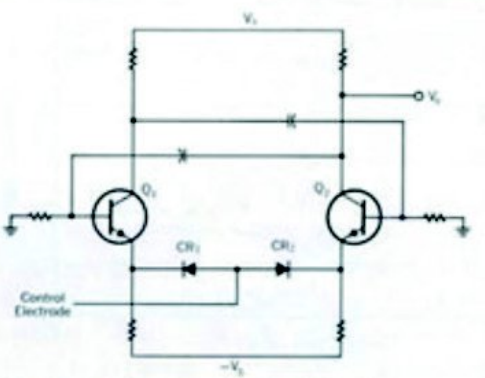


Fig. 9. *Emitter-coupled multivibrator is used for voltage-controlled local oscillator. Tuning range is 60–150 MHz.*

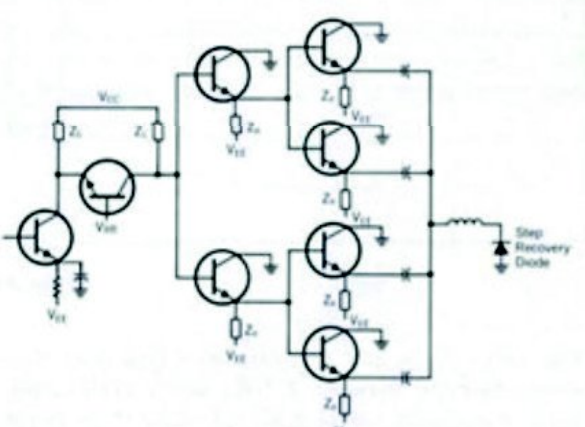


Fig. 10. *Wide-band power amplifier provides at least 0.75 amp p-p over frequency range of 60–150 MHz.*

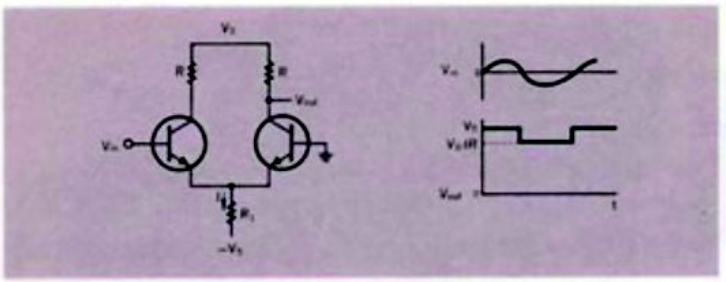
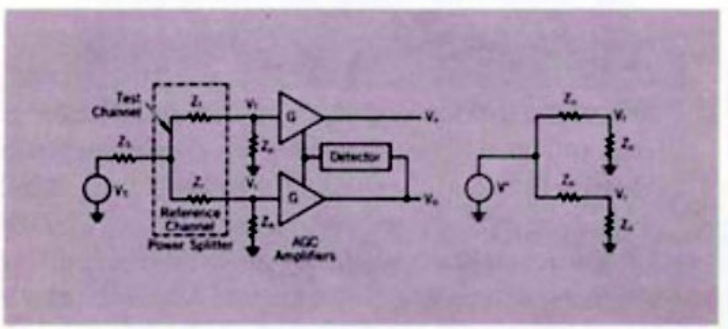
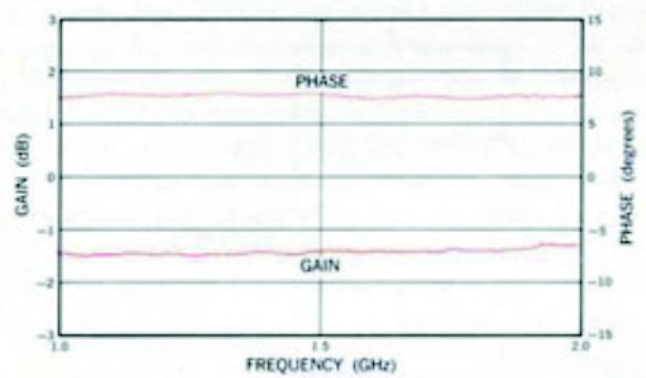


Fig. 11. *Limiting amplifier with two transistors switching total current I. Output voltage is dependent only on V_s and R.*

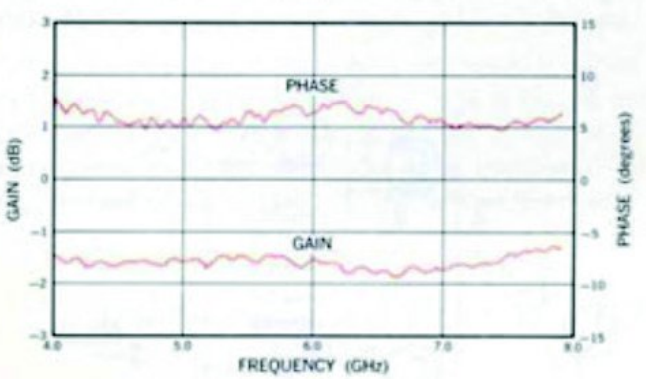


(a) *(b)*

Fig. 12(a). *Equivalent configuration of power divider and AGC amplifiers for calculating ratio.* 12(b). *Simplified equivalent with resultant zero-impedance source V′.*



(a)



(b)

Fig. 13(a). *Phase and gain responses typical of Network Analyzer between 1 GHz and 2 GHz: Analyzer is accurate within ±0.1 dB and 1.0° in swept measurements. Accuracy in single-frequency measurements is better.* (b). *Phase and gain responses typical of Network Analyzer between 4 GHz and 8 GHz.*

dicator unit were reduced by using a series of limiters of the type shown in Fig. 11. To prevent added delay when the amplifier starts to limit, the transistors are cut off but not allowed to saturate. A single limiter exhibits less than 1° of phase shift when passing from linear operation to limiting. Output voltage is dependent only on V_s and R.

f. A major engineering contribution occurred in the form of two wide-band directional couplers used in the reflection test units. The couplers have 30 to 40 dB of directivity over their frequency ranges of 0.1 to 2 GHz and 2 to 12.4 GHz. This represents a combination of performance characteristics heretofore unattainable.

g. Normally, a power divider operates with its three ports matched. In the transmission test unit a precision power divider was devised which operates with the source port matched but with the output ports mismatched. The ratio calculation performed by the AGC amplifiers (Fig. 12a) has the effect of making V′ a low-impedance source, so that the two channels do not interact with each other. If Z_t and Z_r in Fig. 12(b) are made equal to Z_o, standing waves are not present.

Performance

Typical measurement accuracies for the 1-to-2-GHz frequency range are shown in Fig. 13(a) which is a plot of the network analyzer's amplitude and phase responses over this range. Gain and phase measurements accurate within ±0.1 dB and ±1° appear reasonable for swept measurements. For single-frequency measurements, the accuracy is much better — comparable to that of standards-laboratory instruments.

Fig. 13(b) shows the amplitude and phase responses of the analyzer from 4 GHz to 8 GHz. The slightly-reduced calibration accuracy apparent in Fig. 13(b) can be attributed principally to the increased reflection coefficient of the harmonic frequency converter (wideband sampler) at higher frequencies.

Phase errors caused by changes in the amplitude of the signal in the test channel are shown in Fig. 14. Greatest accuracy in phase measurements is obtained for signal levels within ±20 dB of mid-range. In this range, phase ambiguities are less than ±1°.

Fig. 15 shows the gain and phase stability of the network analyzer. Over a period of six hours, total drift did not exceed 0.05 dB and 0.2° under normal room-temperature variations.

Gain and phase accuracies at low signal levels are limited by the signal-to-noise ratio at the output of the harmonic frequency converter. Noise in the test channel is below −80 dBm, which means that accurate measure-

ments can be made for test-channel amplitudes down to −70 dBm or less.

More typical measured data are presented in the s-parameter article (p. 13).

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Industrial Design:
Ned R. Kuypers.

We also wish to thank Microwave Division engineering manager Paul C. Ely, Jr. for his encouragement and helpful suggestions.

—Richard W. Anderson and Orthell T. Dennison

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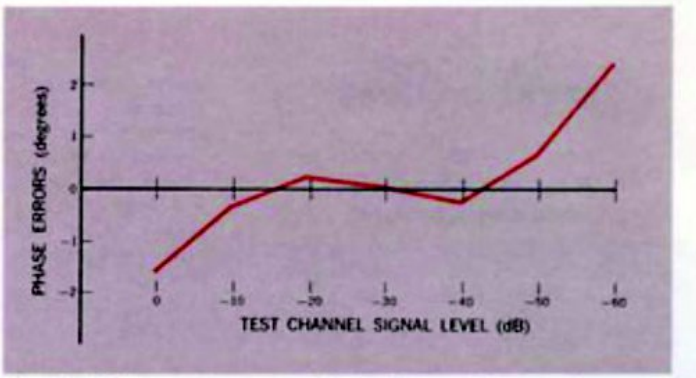


Fig. 14. *Phase errors caused by changes in amplitude of signal in test channel are typically very small. Ambiguity is less than ±1° for signals within ±20 dB of mid-range.*

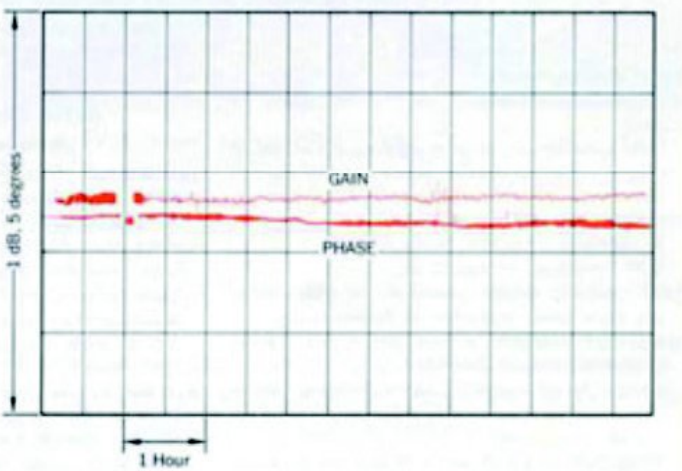


Fig. 15. *Typical gain and phase stability of Network Analyzer. Total drift under normal room-temperature variations over six-hour period was <0.05 dB and <0.2°.*

Richard W. Anderson

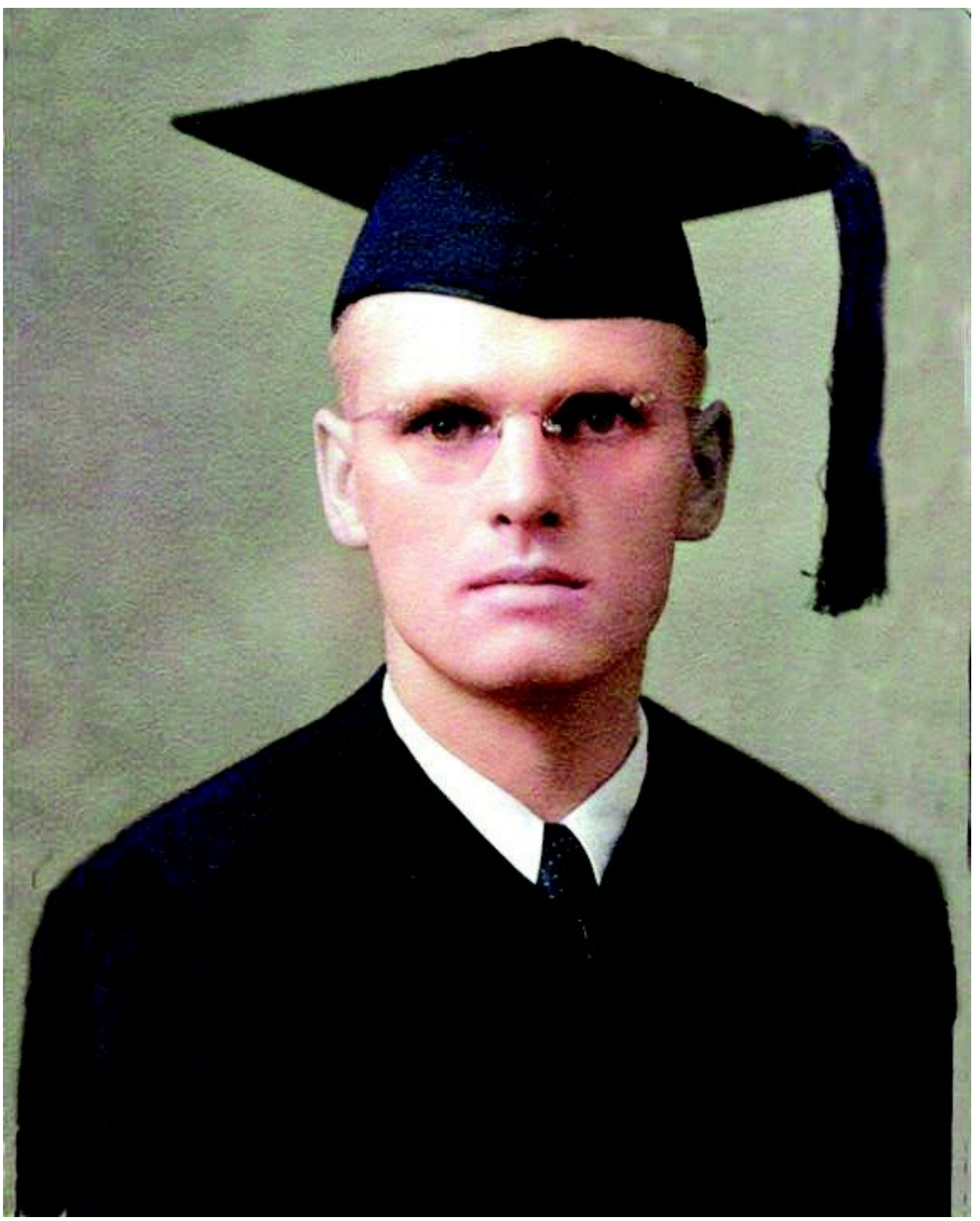
Dick Anderson joined the *–hp–* Microwave Division in 1959 after receiving his BSEE degree from Utah State University. He has contributed to the development of a variety of microwave instruments and devices, and he is now manager of the network analyzers section of the *–hp–* Microwave Laboratory. In 1963 he received his MS degree in electrical engineering from Stanford University on the *–hp–* Honors Cooperative Program.

Dick is active in the IEEE Group on Microwave Theory and Techniques. He holds several patents and has published a number of technical papers, his most recent being 'Sampler Based Instruments for Complex Signal and Network Analysis,' presented at WESCON 1966.

Orthell T. Dennison

Ted Dennison joined the *–hp–* Microwave Laboratory in 1960. He contributed to the design of the 415C and 415D SWR Meters, and directed the development of the 416B Ratio Meter and the later stages of the development of the 690-series Sweep Oscillators. Since 1963 he has been project leader of the 8410A Network Analyzer program.

Ted received his BSEE degree in 1960 from Utah State University and his MSEE degree in 1964 from the University of Santa Clara. At Santa Clara, he specialized in control systems and solid-state design. Ted is a member of IEEE, Sigma Tau, and Phi Kappa Phi.



Life Sketch of Norman Heber Anderson

I was born June 27, 1908. I was born on a Saturday. A man told my dad that because I was born on a Saturday, I would have to work hard all my life. I did work hard for many years. One year during the World War II I taught school and worked at the Army Supply Depot Saturdays and Sundays and seven days a week in the summer when there was no school.

When I was working at the Army Supply Depot on Second Street in Ogden, I worked very often four hours overtime. I would ride home on the Utah Idaho Central Electric Railroad. This railroad ran from Ogden, Utah to Preston, Idaho. The train ran through Brigham City on Fifth West.

I worked hard for many years. Now that I am eighty-three years old and have arthritis, I do very little. My wife Esther, bless her, does nearly everything that is done.

I was born in Redmond, Utah, a small town in Sevier County. We lived in an adobe brick house. We were poor. I have always been surprised that my mother would leave a nice city like Bergen, Norway to live in a desolate region like Redmond.

I remember nothing about my first three years of life. My parents told me that I refused to drink milk when I was a baby. They were worrying that I might not survive.

In 1911, my family moved to Brigham City. I remember just an incident. My brother, Clifford, was two years old. We were sitting on the floor of the buggy and my mother pointed and said, "That is the direction we are going in." I don't remember arriving in Brigham City. At first we lived on the east side of Brigham City in the First Ward. I don't know how long we lived there. We later moved to Fourth West and First South. We rented part of Laura Olsen's house. She was a widow with two boys.

My folks brought the north half of Mrs. Olsen's lot and built a house there. It was a square house with four rooms. There was no lawn. Instead there was a raspberry patch. There was not a bathroom. Over the years it was remodeled several times. That house is where I spent my boyhood years. I have many fond memories of this place.

My brother, Allan, was born in this house

June 25, 1912. Now I cannot be sure about this. Maybe Allan was born in Laura Olsen's house; I don't know. The house was built either in the summer of 1912 or the summer of 1913. I remember the men were laying the floor of the front porch. When the house was finished it was painted green.

I remember getting up one morning and my folks told me I had a baby sister. This sister, Florence was born October 20, 1913. Florence grew up to be a very beautiful girl. In 1930 she was chosen as Miss Utah. A year or so later she was chosen as "The Queen of the Rockies."

In 1914 I started school. I went to the Central School. My first grade teacher was named Miss Thorpe. She was called "little Miss Thorpe."

I still remember how nice I thought the school grounds were. There was a number of trees on the grounds.

In the second grade I attended the Lincoln School. Forest Street was the dividing line between the Central and the Lincoln School. All who lived south of Forest Street were supposed to go to the Central School. Those who lived north of Forest Street were supposed to go to the Lincoln School. However, the Central School was crowded and the Lincoln School was not crowded so they sent those of us who lived north of First South to the Lincoln School.

My second grade teacher was named Miss Hansen. Miss Hansen was very strict. In those days the students would line up on the sidewalk when the bell would ring. One day a boy in our class was acting up. Miss Hansen said that boy and all who were back of him would stay after school and march in the awkward squad. I was back of the boy who was acting up.

When we lined up to go into the building a teacher would play the piano and a student would beat a triangle and we would march into the building.

I spent about half my time in the Central School and about half my time in the Lincoln School.

When I was in the fifth grade in the Lincoln School, my teacher, Miss Zundell, said I was too poor a writer to go to the sixth grade. I was held back. When school had been going a week or two in my second year in the fifth grade the principal came into the room and said some of us could go to the Central School. We left the Lincoln School during the noon hour. When we arrived at the Central School it was after one o'clock. We were met back of the school by the principal, F. Joseph Law, a young man who was in his first or second year of teaching. I spoke up and said, "I don't want to be in that red headed teacher's room." Mr. Law answered me and said, "That is just where you are going." That is where I went. The red headed teacher was in her first or second year of teaching, also. That year was one of the most enjoyable years in all my school days. I loved that red headed teacher.

About Thanksgiving Day time, Mr. Law and Miss Jeppsen asked me if I wanted to go into the sixth grade. I was afraid to change. I liked the children in Miss Jeppsen's class. I liked the teacher so much that I decided to stay in the fifth grade. This was perhaps a mistake as I lost a year.

During the year we put on a play dealing with the Pilgrims and the Indians. It was a Thanksgiving play. I was Deacon ****. Roma Hansen was my wife. It was the only play I was ever in while I was going to school.

I was in Mr. Law's room in the sixth grade. I enjoyed that year very much.

I enjoyed playing soccer in school.

I did well in some subjects such as reading, history, and arithmetic. Art and music were not my favorite subjects. I remember in art we had crayons and we would make booklets. I would

start to make a cover with a border. I would set out to make the border a quarter inch wide. I could not stay within the boundaries so I would change to a half inch border then a three quarter inch boundary. I would end up with an inch border and it was not within the boundary. I enjoyed hearing the other kids sing but I did not join in.

As I was growing up I enjoyed Christmas more than anything. My parents were poor but they outdid themselves for us at Christmas. I remember we kids would get up during the night to see if Santa Claus had been there. When we saw the presents we would say, "Yes, he has been here."

When I would go outside on Christmas Eve it seemed there was magic in the air.

My parents sent us to church every Sunday and we always attended Sunday School, Primary and Religion Class. When I went to the Lincoln School, I had to hurry from the school to the meeting house so as not to be late for Religion Class on Wednesday afternoons.

When we were in Miss Jeppsen's class in school, she was also our Sunday School teacher. My mother worried about how Miss Jeppsen felt about Clifford and I wearing the same clothes to Sunday School that we wore to regular school.

Clifford and I were baptized March 30, 1918 by J.A. Fishburn. We were baptized in a building on First West between Forest Street and First West. It was known as the Tithing Office.

I was ordained a deacon November 8, 1920 by N.J. Valentine. When Axel Christensen, an old Danish man, would offer the invocation or benediction we would stuff our caps in our mouths to keep from giggling because he had a very strong Danish accent. We deacons would be sitting on the front bench so we could pass the sacrament.

We kids enjoyed playing cowboy. We bought pistols that would click when we pulled the trigger. A pistol cost twenty cents. We went to the picture show nearly every Saturday afternoon. We enjoyed the cowboy shows. I played I was Douglas Fairbanks, although he was not really a cowboy. Clifford was Tom Mix, another boy was William S. Hart, and so on.

Also on Saturday, they had what we called continued shows. The installments lasted thirty minutes and went on for about fifteen weeks. We would stay in the theater and see the show twice. Those shows were silent but we enjoyed them very much.

During the late winter and spring of 1921 when I was visiting Harold Christensen, a boy about my same age, I started reading the sports page of the Deseret News. I soon became a rabid baseball fan. I read about the Salt Lake City Bees who played in the Pacific Coast League. I persuaded my parents to subscribe for the Deseret News so I could follow the baseball games in the Pacific Coast League and also in the American League and the National League.

For a few years after that, I bought a Spaulding baseball guide and rule book. I also bought a Spaulding record book. I spent hours studying these baseball books. I figured out that there had never been a player I did not know something about. My favorite player was Tris Speaker, the center fielder for the Cleveland Indians. I considered Ty Cobb, who played in the outfield for the Detroit Tigers, the greatest player who ever lived.

We kids played baseball in the street. There was no asphalt in the street. We would start playing about 9:00 or 10:00 in the morning and play until dark. My Dad used to say that I became unhappy if a kid after playing for several hours in the July or August sun wanted to stop to get a drink of water.

When I became interested in anything

I go to the extreme. I don't become mildly interested in things.

We used to go down to the baseball park and see the Brigham Peaches play ball. Brigham City had professional baseball players in those days. I used to, along with the other kids, go to the outfield to try to catch the fly balls when the ball players took batting practice. My brother, Allan, was sitting in the grand stand when a man pointed to me and said, "That kid can catch them."

When I took gym as a freshman in high school at the end of the gym period Coach Ferguson would tell us to go out and run around the quarter mile track once. I soon found to my surprise that I could pass most of the boys in the class.

I was in a carpentry class where I was a complete failure. As my family knows, I have no skill in making or repairing things. Three boys came into the carpentry class and asked the teacher if I could be excused from the class. The class track meet was going on and these three boys needed a fourth boy to run on the freshman relay team. Mr. Pratt, the teacher, was glad to let me go. He often referred to me as the "Village Wit."

We went out to where the track meet was going on. It was raining and it was cold and they were about to stop the track meet and go in the building. Then they called for the quarter mile race which is 440 yards. I told the other boys I was going to enter the race because I was cold. There were five of us in the race. I was the only freshman in the group. I was lucky enough to finish in second place.

In my sophomore year, Coach Ferguson asked me to try out for the school track team. My first race for the high school was the City Creek run in Salt Lake City. The distance was about two and one half miles. There were about sixty five kids from Utah and southern Idaho entered in the race. I had never run that far before. I started too fast and at the halfway mark I was in second place. During the second half I was so tired I had to walk some of the way. I did not finish in the top twenty. I was not a real good runner. I got in the state track meet in my junior year in high school. I finished about twelfth in the state meet. My senior year I did not run because Doctor Pearse told me my heart could not take it.

When I was in high school, Leon and Leah were born. They were born on Friday the thirteenth of July, 1923. Leah died October the thirteenth 1924. Leon died December seventh 1924. We all felt very bad about Leah and Leon dying. My mother would talk about the twins to everybody who came to the house. This went on for years. Now she is with them again.

I did not spend all my time playing as a child. I remember my mother used to tell people, "My boys will be glad to pick your cherries."

The first job I remember was picking cherries in 1916 or 1917. It seemed that no matter how careful I was, I pulled the leaves off when I picked the cherries. When the lady came out of the house and told me to be careful I climbed down out of the tree and went home after she had gone back into the house.

I thinned beets for Oliver Ingram in 1918. In 1919 my brother, Clifford, and I thinned beets for Orvil Jensen. We made $3.55.

In 1920 we made our first real money. We worked for Judge Call, David (Whitey) Call's dad. We were paid $10.00 an acre for thinning the beets. We received 50 cents a row. The most I ever thinned was seven rows, which was $3.50. I earned $50.50 total.

As I was growing up most of my work was done for farmers, thinning and topping beets, picking cherries, peaches, tomatoes and beans.

That kind of work was hard for me as I

was always so slow. I have often said I was born with two left hands. I have no mechanical ability at all.

In 1928 I went to work on the section for Carl Nelson on the Union Pacific Railroad. I worked for Robert Lamont on the section during the summer of 1929 and 1930.

I liked that kind of work much better than working for farmers.

Shortly after being graduated from high school I received a letter from someone. In the letter was $20.00 in green backs. The letter said I would receive an equal amount each month if I would attend college. This was given to me because I had been injured in high school athletics. I stated earlier in this report that I quit running for Box Elder because Doctor Pearse said my heart could not take it.

I attended Weber Junior College that year and the money came every month.

Weber College is in Ogden and it made it possible for me to attend college while living at home. I rode in a bus to school. The bus was $.50 a day making it $90.00 for the year. My tuition, books, etc., cost $90.00 for the year. Just imagine one year of college for $180.00, including transportation.

It took me three years to complete two years of college. I received my graduation diploma in May 1930.

During the winter of 1929-1930 I became acquainted with Esther Watkins. I had been in a class in high school with her but I could not remember that I had ever seen her before. I could remember some of the other kids in the class. I must have been blind.

Esther's folks lived on West Forest Street in Brigham City. There was a pond right near the house. In the winter, the ice was cut and stored in the ice house. People did not have electric refrigerators in those days.

My folks had a refrigerator that was kept cold by putting a block of ice in it, after fifty pounds was put in the refrigerator at the time.

I would take a coaster wagon and go down to Watkins to get a block of ice. I would always hope that Esther would come outside. She usually did come out of the house. When I finally did get home with the ice about half the ice would be melted because it would be midnight or later. I still remember the first kiss I received. We were down by the old poultry plant on Eighth West and Forest Street.

I think of that often, I enjoyed that summer very much. Many of our dates were when I would walk Esther to church and then home again. We did attend the pageant in the Tabernacle at Temple Square when the church was a hundred years old.

During the summer of 1930, Bishop J. Carlos Sedenholm asked me to go on a mission for the church. My farewell was held the 26th of October 1930. Esther was in the hospital recovering from an appendix operation. I went to the mission home the next day.

I left Ogden on Union Pacific Railroad train, November 6, 1930. There was a big group of missionaries on the train. We spent one day seeing Niagara Falls. I was homesick and I was wishing Esther was there.

I arrived in France, November 20, 1930. We crossed the ocean in a ship named the George Washington. It took eight days to cross the ocean.

I spent a couple of days in the mission home and attended church in Paris on Sunday. I met my first companion at the meeting. He was Edward B. Kimball. His father was Edward B. Kimball who had been Tabernacle organist. At that time he was President of the German Mission. My companion was the announcer on the radio for the first Tabernacle Choir broadcast.

I went with Elder Kimball to the city of Limoges, France. While we were in Limoges,

a millionaire who was vacationing in Cannes, France sent Elder Kimball a letter asking him and his companion to come to Cannes and administer to his sick wife. We went and for once in my life I lived the life of a millionaire. The man paid for everything. We stayed in a big hotel. Our breakfast was brought to our room.

I was six months in Switzerland and two years in France. I did not feel that I accomplished much on my mission. Converts were few and far between in the French Mission. I had no baptisms. I had no companions that had any baptisms that I knew of. I saw two women baptized. They had been investigating the church for years.

After I was released from my mission in May 1933, I did some traveling. I went through Germany, visiting Berlin and other cities. I went from Germany to Denmark. I had a meal in Copenhagen. I was in Malmo, Sweden. That was one of the prettiest little cities I have ever seen.

In Norway, I spent a few hours in Bergen. Bergen is where my mother lived when she was in Norway.

In Trondheim, I visited a couple of days with Earl Hansen who was serving a mission in Norway.

After leaving Trondheim, I went to Volda in Norway. I spent a few days with my grandfather, my uncle Olaf and his family, and Mother's two half sisters were living with my grandfather. We still correspond with my cousin Kjellaug. I enjoyed my visit very much to Volda. None of my Norwegian relatives ever joined the church. They all treated me very well. The night before I left, one of my mother's half-sisters pressed my clothes for me.

In the past few years, cousins Kjellaug and Per have been to our home in Brigham City. Uncle Olaf's son-in-law Ottar Vegsund spent several days with us. Seiv, Kjellaug's granddaughter, was here once for Thanksgiving dinner. We marveled at how well they all speak English.

When I arrived home in June 1933, the Great Depression was on in full force. The first job I got when I came home was a job thinning beets.

Alf Olsen needed apricot pickers so I went to see him. He asked me if I had any experience picking apricots. I told him I had no experience picking apricots. He then said I could go over in the cherry orchard and pick cherries.

I had very little work for a few months. In March of 1934, I obtained a job on a railroad extra gang for the Union Pacific Railroad. Our job was to take out the old ties and put in new ones.

The boss was Roy Young. He was a great-grandson of Brigham Young. He referred to him as Old Brigham. He was twenty-nine years old and weighed about two hundred pounds. The gang consisted of twenty men. The first man hired was number one and the second man number two, and so on. The job lasted about four months and although jobs were hard to find, the last man hired was fifty-something. Four men of the first twenty hired lasted the four months. Roy Young hired and fired. For some reason he was good to me. He referred to me as the bishop. If he had not been good to me, I would not have lasted, as slow as I was. I worked on the gang three or four springs. Roy Young was not the boss much after the second year started. A Davey Daniels replaced him and he was a mild man.

In the fall of 1934, Bishop J. Carlos Sedenholm gave me the job of meeting house janitor so I could get married. The job paid twenty dollars a month.

Esther and I were married December 21,

1934 in the Logan Temple.

As I look back on it, I wonder how I dared to get married. The only job I had was the meeting house janitor job. I had no skills and very little ability. I wonder how Esther figured I could support her. She took a big risk when we were married. We had forty dollars when we married.

A friend said to me, "I guess you have as much right to starve a wife as anybody."

When spring came, I went back on the extra gang. When the gang disbanded, Esther, who was working at the Perry Cannery, got me a job there. We worked long days, sometimes eighteen or nineteen hours a day. Some nights I went to bed at 4:00 a.m. and got up at 5:00 a.m. We also had the meeting house to take care of. My Dad helped us at times.

Although we married with nothing we have always had a place to live and something to eat. The Lord blessed us and we have always been able to pay our bills.

We were getting nowhere when my brothers, Clifford and Allan, suggested that I go to school again and finish my college education. As you know I had attended two years at Weber Junior College. They both helped me with some money. Allan gave me four hundred dollars, which was a lot of money in those Depression days.

I enrolled at Utah State Agricultural College, in Logan, January 1937. We lived in the furnace room in the basement of a nice home near the college.

While I was in France, my sister, Jeanine, was born. She was born September 3, 1931. She spent a week or two with us in Logan. I was graduated in the spring of 1937. Esther was pregnant and she would be a mother on Mother's Day. Mother's Day is the second Sunday in May. Richard was born July 23, 1937.

He seemed like he did not want to come into the world. The ordeal in the Pearse Hospital took hours. I stood by Esther and I thought I was patting her arms but she said I was nervous and did not realize how hard I was hitting her. Dr. Pearse's wife said the doctor will save both your wife and the baby. I was frightened, I had no idea it was that serious. Finally, Dr. Pearse said he was going after the baby, by using instruments. Richard was born at 11:48 p.m.

Richard has been a joy for us. As a boy he did a good job keeping out of trouble. He has always been a hard worker. When Richard was six we could send him up town to buy groceries. Mrs. Thomas, co-owner of Skaggs grocery store, was astounded at how Richard brought string beans to the store, and then would buy groceries and take them home in a coaster wagon. He worked hard in Lamar Valentine's peach orchard. He started passing the Salt Lake Tribune when he was eleven years old. Richard did very well in school. I had him as a student when he was in the sixth grade. He did very well in college and he has done well working for Hewlett Packard where he is now one of their Vice-Presidents.

Ruth was born June 8, 1941. Kent was born May 21, 1943. When Ruth was born, we were happy to have a girl. Richard would tell people that he had a sister baby. We have tried to be good parents to our children. We loved them and did the best we could for them.

Like Richard, Ruth and Kent have been hard workers. Kent was a projectionist for the Roxy Theater. Ruth also worked at the Roxy Theater. Both Ruth and Kent had several jobs as they were growing up. Kent took over the passing of the Tribune when Richard quit the job.

I was never in the military service and neither was Richard. Kent spent a year in Vietnam where the fight was going on. Kent

also served a mission in the Spanish American Mission. He has mastered the Spanish language very well. He now teaches Spanish in a Los Angeles school. He is now a counselor in the bishopric.

Ruth is a hairdresser and she worked for several years at Job Corps, which was a difficult job.

When I was ready to hunt for a teaching position, I had attended the following institutions:

Weber College Associate of Science
Utah State Agricultural College Bachelor of Science
Utah State Agricultural College Master of Science

Schools where I taught, Grades taught:

Park Valley School Eighth, Ninth and Tenth
Lincoln School Fifth, Sixth Grade
Central School Sixth Grade
Box Elder Junior High School English and Foreign Languages

Beloved Daughter and Sister, Ruth Anderson

I was unable to find a job when I had been graduated by Utah State Agricultural College in 1938. I attended the University of Idaho in Moscow, Idaho. Richard was not quite a year old then.

In the fall of 1939, I obtained my first teaching job. I was principal in the school and I taught the eighth, ninth and tenth grades in one room. That was a rough year. I was glad when it was over. My second year of teaching was in Elwood and that was better.

My third year, I taught in the Lincoln School. I taught a total of twenty-nine years at the Lincoln School. I enjoyed teaching there. The last four or five were the hardest.

The Central School burned down in 1958. The fifth and sixth grades were sent to the Box Elder High School building which at that time was on Fourth East. Although the students were from Central and Lincoln schools it was called the Central School. I taught for two years in the Central School. I enjoyed teaching there. Richard was one of my students. I taught one year in the Box Elder Junior High School.

I retired from teaching in 1963.

I have served in many Church capacities. I taught Sunday School classes several times. I enjoyed the Gospel Doctrine class the most. I taught that class for four years. I enjoyed a class of about six boys who were about seventeen or eighteen years old. These boys were good students and well behaved.

Earl Hansen was president of the Mutual and he asked me to be his activity counselor. I accepted and I had a long miserable year. I was no more fit for that position than I would

have been if they asked me to be conductor of the ward choir. I served as a President for the Seventies Quorum. I was senior president most of the time. I was Stake Missionary for a while. I served as a High Counselor for a few years. After I was released from the High Council, I served as the High Priest Group Leader in our ward, the Fifth Ward.

When I was asked by President O. Dee Lund to be on the High Council, I told him we never went to the temple. He said that could be changed. He assigned our former bishop, Claudius Olsen, who was then a member of the High Council to get us going, and get us going he did.

Like anything I do, we, Esther and myself, went to the extreme. Many times we did seven endowments a day. We led the Council by a long ways. A couple of times we did eight endowments in the day. In just a few years I did more than one thousand five hundred endowments. Esther did over one thousand four hundred.

The last few years, because of physical reasons, I have been unable to go to the temple.

I have had my good days. I have had narrow escapes and I have been hurt in accidents while at work. I have had heart trouble, shingles, and I now have an itch I have had for three years. The itch is not as bad as it once was, but I still have to doctor it every night before I go to bed. The itch is always worse at night. I now need a walking stick to help me maintain my balance when I walk.

Esther and I have arthritis. We have been blessed in many ways. We are both in our eighties. Our combined ages of one hundred and sixty-five years make us the oldest couple in the Fifth Ward. I was lucky enough to get a wonderful wife. She does so much for me and I love her very much.

We attend church as much as is possible, although we miss some Sundays now. We have always paid a full tithing since we were children. We both have a testimony of Joseph Smith and the gospel. We pray night and morning. We appreciated and love our twelve grandchildren and our ten great-grandchildren.

As long as I can read and figure, my retirement will not be boring. Books, newspaper, radio and television keep me from boredom. Esther is my most prized possession. I ask the Lord to bless Esther, my children, my grandchildren and great-grandchildren.

I have things happen that I will always remember. When I came home from my mission in 1933, I had a sister, I had never seen. She was born while I was on my mission. It took a little while for my sister, Jeanine, to get used to me but after she did we got along fine.

Now, when I see a dog on a television commercial, I look at the dog and pay no attention to the commercial. When I was a teenager, my brother, Clifford, brought a dog home one day. The dog's name was Craig. We thought a lot of Craig.

After I was married, we had several dogs. We had Pal, Trimpy and maybe one or two more. None of them lived very long.

One day in about 1983 or 1984, Jeannine came over to our place followed by a little dog. The little dog was trembling and her paws were black. I think she had walked where there was tar.

We were standing on our driveway. Phyllis Worthington was there along with Jeannine, Esther and myself. We were discussing what was to happen to the dog. We think someone had put her out of an automobile and then drove off and left her. Phyllis Worthington said, "I will take the dog for Jimmy." Jimmy

was her son.

Phyllis took the dog. I said, "We don't want the dog." We had never had any luck with dogs.

Phyllis wanted to go to Arizona for a visit. She asked if we would take care of the dog. We agreed to take care of the dog. Kent was here when the dog came here that first day. He suggested she be called Peanuts and that became her name.

While Phyllis was in Arizona, Esther and I became very fond of Peanuts. She was at our place as much as she was at the home of Phyllis. We bought dog food for her. We bought her license each year.

She was attacked twice by another dog. We shared the veterinary bills with Phyllis. For years I would take a walk in the morning. I would attach a leash to Peanuts and she would accompany me. When she would see me coming from town she would always come running to meet me. She knew our car and when we would come home in it she would stand in the middle of the driveway. She knew we would not run over her.

When Phyllis would go to work at Thiokol early in the morning, she would fasten the leash to a table leg and I would go over a little later and get her and then she would stay with us until it was time to go to bed.

Many people thought Peanuts was our dog. One day Esther and I were going up to Earl Hanson's place. I was backing out of the garage, I could see Peanuts on the driveway. Esther had her move. A little while later we came home and when we went to drive in on the driveway, we could not see Peanuts. I told Esther she had better get out of the car and see where Peanuts was. I then drove on in the garage.

When I got out of the car, Esther was talking to Phyllis. Phyllis said Peanuts had just died. Peanuts died October 28, 1988.

I still miss the little dog very much. When I went walking alone I would think about Peanuts. I loved that little dog very much.

I know this is not a well organized life history but I want to mention a few things in closing.

My Mother and Dad had seven children. I was the first born, June 27, 1908; Clifford, June 15, 1909; Allan, June 25, 1912; Florence, October 20, 1913; Leon and Leah, July 13, 1923; Jeannine, September 3, 1931. Jeannine, the youngest, and myself, the oldest, are the only ones still alive on the eighteenth of April, 1992.

My parents were like the parents of Nephi in the Book of Mormon. They were goodly parents. They did their best for their children. I am grateful for many things. I am grateful that I was born in the Church. I am grateful that I have lived most of my life in Brigham City. There is no place on earth where I would rather live than in Brigham City.

I love my children, grandchildren, and great-grandchildren. Above all, I am thankful for my wife. She has been and is very good to me. I would be lost without her.

It is the desire of Esther and me that we can all be together in the next life.

Special thanks to David and Callie Johnson (Grandson) who have given of their time and talent to make the final copies of this history.

Life Sketch of Esther Watkins Anderson

WELLSVILLE, UT - Long time Brigham City resident, Esther Watkins Anderson, age 92, passed away peacefully at the Wellsville home of her oldest son on Thursday, October 25, 2001.

Esther was born April 9, 1909, in Brigham City, the daughter of John Hyrum and Lucy Clara Yates Watkins. She was born in the home of her grandfather, William Lampard Watkins, the same home where her father was born some forty years earlier. Shortly after Esther was born, her father was called to serve a mission to Great Britain.

Esther remembered that when her father returned from his mission he had a small moustache and that she refused to kiss him until he shaved it off. After her father returned from his mission, the family lived and operated a farm in Beaver Dam. Esther had many fond memories of Beaver Dam, especially the memory of being the only girl in her school class. The seven or eight boys in the class would push and shove each other for the privilege of sitting next to Esther.

When Esther was a young woman, the Watkins family sold the farm and moved to Brigham City where they operated an ice business on West Forest Street opposite Rees Pioneer Park. Esther remembered her father cutting ice on the pond and hauling the large blocks by horse team to the storage barn. Esther also remembered a shy young man by the name of Norman Anderson who came to buy ice for his parents. It seemed that Norman was always in trouble with his mother for staying so long that the ice was mostly melted by the time he got home.

On December 21, 1934, Esther was married in the Logan Temple to Norman Heber Anderson, the same shy young ice customer, but by then, a returned missionary, having served two and a half years in France. Norman and Esther made their home in Brigham City where Norman taught school and Esther focused on nurturing their three children. Richard W. Anderson now of Wellsville, Ruth A. Rasmussen of Roy, and Kent L. Anderson of Upland, California. Esther and Norman loved their children, grandchildren and great-grandchildren and

were always great examples of righteousness, industriousness, charity, frugality and patriotism.

Esther was always active in The Church of Jesus Christ of Latter-day Saints. She enjoyed doing temple work and loved reading the Book of Mormon. She had a special interest in blessing the lives of the less fortunate and usually sponsored at least one poor child in an underdeveloped country. She was an avid gardener. The yard about her home on 400 West was always neatly and tastefully garnished with many varieties of beautiful flowers. She had a great sense of humor that came through, even on the last day of her mortal life. She was an exceptional canner and a wonderful cook. Her cheesecake and floating island custards were favorites of four family generations.

Esther is preceded in death by her husband, five sisters, one brother, one granddaughter and two great-grandsons.

She is survived by a brother, Ray H. Watkins of Brigham City, her three children named above, 12 grandchildren and 16 great-grandchildren.

We will all miss her great example and wonderful sense of humor but we know she is very happy to be with Norman and other loved ones again.

Funeral services were on Tuesday, October 30, at the Brigham City Fifth Ward Chapel.

Interment in the Brigham City Cemetery.

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63 years and counting...