

Holly A. Cornell
His Early Life and Career
with
CH2M HILL - 1983

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INTRODUCTION

Holly Cornell was born in 1914 in Boise, Idaho. His father worked as a manufacturer's representative for the Kelly Clark Company, which produced canned goods and groceries. After the company went out of business during the Depression, the Cornell family relocated to Portland, Oregon. Later, when economic conditions improved his father rejoined Kelly Clark Company's office in Portland. Thus, Holly Cornell spent portions of his childhood in both Idaho and Oregon.

He recalled that his father enjoyed working with his hands and was very adept at building model ships. The younger Cornell took after him in this respect learning early how to construct models, airplanes, radios and other similar projects. These early interests coupled with an inclination for mathematics, were later to steer Holly Cornell toward a career that would allow him to develop these talents.

Another early quality that was to be manifested later in his professional life was his leadership ability. He was president of the student body in high school, and later in college was elected to numerous positions in student government. After graduating from high school in 1932, in the midst of the Depression, Cornell got a job as a messenger for the Bank of California, "...at what was at that time an excellent salary of sixty-five dollars a month."

After working two and one-half years and carefully saving his money, he made a career choice and set an academic goal: "I liked to build things and maybe being an engineer was the way to do it." He enrolled at Oregon State College in 1934; he was a serious student, older than the average freshman, who excelled in his studies. One facet of engineering particularly intrigued him, as he noted, "I thought I was going to build Bridges...they just seemed romantic."

On reflecting about his academic preparation, he recalled that there was one person who greatly influenced his career direction—an unusual engineering professor named Fred Merryfield. Merryfield was, "...a wild one... [He] had this tremendous enthusiasm. He was kind of a tough instructor but a very outgoing, outspoken, strong one; in a sense, he entertained you, he put on a show." Years later, this enthusiasm, strong individualism and mutual attraction caused three of his former students, including Holly Cornell, to come together in Corvallis, Oregon to launch a business.

In 1938 Cornell graduated from O.S.C. as a civil engineer. With the help of Merryfield, he was granted a graduate fellowship to continue his studies at Yale University. In December of that year [1938] he married his long-time girlfriend from O.S.C., Cleo Ritner. At Yale, Cornell encountered another engineering professor who greatly influenced him: "I think Hardy Cross was probably the best teacher I ever studied under." Cross was a philosopher as well as an engineer, and brought the humanities and engineering ideas together into his teaching. It was under the tutelage of Cross that Cornell's professional interests crystalized. He recalled, "...that's where I got the great love for engineering."

On completing graduate work at Yale University, he accepted a job with Standard Oil of California where he was, "...a lowly peon in the structural engineering department." Soon thereafter, in 1940, he enlisted for active duty in the U.S. Army Corps of Engineers; he served throughout World War II with distinction—receiving the Bronze Star—and was discharged in 1945 at the War's end. By October 1945, Cornell was back in Corvallis, which marked the beginning of what was to become CH2M HILL.

The primary focus of the interviews (February 10 and 22, 1982; April 5, 1982; and May 17, 1983) was the formative years of the firm—its weaknesses and strengths, and some of the events that shaped its course. He discussed at some length, the individual contributions of those who were instrumental in the company's development, that is, Howland, Hayes, Merryfield, Rice and Roderick. He remembered the group as a harmonious and complementary mix of talented persons:

We worked together well ... people with diverse backgrounds and different approaches ... we all had the recognition that we needed to do the thing that everybody could support, and felt some enthusiasm for going ahead. Nobody really had any concern about their own personal feelings or their ego or anything else.

This cohesiveness, team work, and support of mutual decisions beginning with the firm's infancy, was the primary source of strength and ultimately success, according to Cornell.

During these conversations he also discussed his own contributions, of which there were many. Some of these were the writing of the *Policies and Procedures Manual*; starting the Seattle CH2M HILL office; working with Archie Rice on the discipline or matrix system; serving as Director of Professional Services; the hiring of an in-house attorney; the introduction of computers in the firm; and, serving as President (1974 to 1978) and Chairman of the Board (1978 to 1980). With regard to the use of computers, he noted, "...the thing I contributed was getting us started in a specific, consistent, determined way early enough that we were able to get out ahead of most of the other people."

Cornell felt that he had one special ability that contributed to the success of the firm: I'm the one that's always looking for some way to improve the operation, or to solve the problems of engineering that we face." He stated that he also saw himself to be "a pretty good communicator and fair analyst." About the future of CH2M HILL, Cornell advocated continual experimentation and change. He believes:

...the companies that advance as compared to the ones that stay in the same rut and lose their market share are the ones that are always experimenting. Always trying something new. Aren't afraid to fail. Have at it, try it, if it doesn't work, throw it out, try something else.

Today the Cornell's live the winter months in Arizona and the rest of the year in Corvallis. Holly Cornell plays golf frequently and continues to act part time as consultant on projects for CH2M HILL.

[Editor's note: The following is a summary of Holly Cornell's original memoir. The summary focuses on key events and issues that impacted CH2M HILL's history as recalled by Holly.]

Memoir of Holly Cornell, founder of Cornell, Howland, Hayes, and Merryfield, May 17, 1983.

EARLY LIFE, EDUCATION, AND MILITARY CAREER



Holly Cornell

I know you were born in Boise April 5, 1914. Why did your family come to Portland and then go to Boise?

My father, Harvey Baeff Cornell, worked for a manufacturer's representative in the food business and they wanted to start an office in Boise so he moved over there in, I don't know, 1911 or 1912, I guess. So that's how I was born there.

Your father was employed with whom?

It was Kelly Clark Company, as I remember it. I don't know whether they are still in existence or not. They may be. They were manufacturers' representatives for canned goods and groceries and so forth. In those days, most of the canners and so forth didn't have salesmen, as such, and sales outlets and warehouses. They engaged these companies that were called manufacturers' representatives, who represented a lot of different manufacturers and they did the selling in the local areas. So when this office wanted to start an office in Boise, my father went over to start it.

Was your mother employed?

No.

And how many brothers and sisters did you have then?

A brother and a sister.

When you were young, what were some of your hobbies and major interests?

(chuckle) I remember making model airplanes; I guess that was one of them.

Gee, that would have been some of the earliest planes and war planes.

We used to make models of the World War I airplanes. They weren't the flying kind; they just looked like one. And sports, I guess. I was always trying to play baseball or football or something. I went to grade school in Boise. Then the Depression came in 1929 or 1930, and my father moved back to Portland and eventually went back to work for the same company, so I went to high school in Portland.

Why did he move back to Portland during the Depression? Why didn't he stay in Boise?

Well, for one thing, the Kelly Clark Company closed the Boise office so he didn't have a job. And at the time, I think, his health was a little bad; he had an intestinal problem—adhesions or something like that. And so they moved down to a little farm that my grandmother had out of Molalla, Oregon; and then finally we moved back into Portland, and he went to work there eventually for the same company, although not all the time.

And you moved back to Portland in 1929 or 1930, did you say?

Yeh. I graduated from Grant High School in January of 1932. I just discovered that the other day because they're having a fiftieth reunion.

So you like to build airplanes and you liked sports, then?

Oh, I think my boyhood was much like anybody else's. I didn't like to cut the lawn, and I enjoyed playing and horsing around and athletic games and making things with my hands. My dad used to build model ships and one thing or another. He was very good at that kind of thing, so maybe I just kind of copied him.

I remember one day my dad got mad at me because, I don't know where I got this idea, but anyway, it was in the early days of radio. I remember what it was. My mother sang in choirs and this kind of thing. She had an excellent contralto voice. And, back then I was reading Popular Mechanics or something and it told you how to build a crystal radio set. Somebody had started a radio store in Boise and I went down there with a list of what I needed and found out they had it. It took about ten or fifteen dollars. I went back to my dad's office and talked him into buying this stuff for me so I could put this thing together. Well, it took a while. He had to finally help me. We finally got it put together one evening when my mother was going to sing on the radio. And I can remember fiddling around with it. Those were the days when the crystal was, I guess, just something like the silicon chips they now have. But anyway, we had a little thing on a swivel with a little fine wire, and you moved it around on that crystal until you caught the radio signal. We were fooling around with that thing, and we finally got the radio station and here was my mother singing. We could just barely hear through the earphones, and I can remember my dad, who never swore in his life, saying, "Well, I'll be God damned."

(laughter) He was amazed that you two had done it?

Yeh.

I bet your dad was pleased that you went to college and went into something like engineering.

Yeh. My dad lived long enough to see me graduate, and I think it pleased him very much. He was real fascinated with me going to Yale. He died that fall that I went to Yale.

What would he have thought of you starting your own firm? Would that have been something that he'd support?

Yeh. I imagine. Dad was a pretty good bookkeeper. If we had really started this [before he died], I have thought we might have gotten him to come down and be our bookkeeper and office manager. He'd been managing offices and keeping books and doing all this stuff for years and that might have been a good way to go. But, of course, he was gone long before we ever started this.

Do you remember a time when you first considered becoming an engineer? Was it because of this tinkering with airplanes and radios?

No, I don't think I really decided to do that until after I graduated from high school in 1932. It was the Depression. My dad didn't have a job. I finally got a job as a messenger for the Bank of California at what was at that time an excellent salary of sixty-five dollars a month. I worked there for two and a half years because I didn't start school at Oregon State until the fall of 1934. So it was during that two year messenger period that I got to think about that I always would go to college as I was then able, on that sixty-five dollars a month, to pay twenty dollars at home and live on twenty dollars and save the rest of it. I did pretty well. You know, I don't remember now much about it but I didn't have any trouble saving the twenty-five dollars and making out on that. Still took out the girls and one thing or another. You know, seventy-five cents would be a big evening.

You graduated from high school in Portland and you worked as a bank messenger for two years, and in that time, you decided to go to OSC in engineering. Why didn't you pursue business, for example, since you were working in a bank or even continue working there?

I guess my mother kind of wanted me to be a lawyer. I didn't particularly like that, and I guess I finally decided that I liked to build things and maybe being an engineer was the way to do it. During the time that I was working as a messenger, I was trying to study up to be sure I could get into college and one thing or another, and I got to working on algebra and discovered I kind of liked the mathematics which I had always been fairly good at, and as a result, somewhere in that period of time, I decided I'd try engineering. I don't know who I talked to or how .. I can't remember now what particular thing triggered it.

I was going to ask, who was influential in this decision?

I don't really remember. It was kind of my own, I think. I suppose there was something I read somewhere, and the interest in the mathematical things, and then the building. I guess I thought I was going to build bridges when I started out in engineering.

And not airplanes or ships?

No, bridges. That's what I wanted to do. When I got that idea, I don't know; whether it was after I got to college or before, I can't say.

What fascinated you about building bridges?

(chuckles} I'm not sure I can tell you. They just seemed romantic. About that time they were building some of the Coast bridges, if you remember, down the Coast highway. There was a lot of publicity about that and it interested me. That's the only thing I can think of.

Just the way they were put together? · Or the idea of getting from one side to the other side over a piece of water?

Oh, some of those along the Coast were beautiful structures, and they were advanced and it interested me.

Did you do much designing of bridges in your time here?

We designed a lot. Not very much on bridges.

Were you involved in it? I know you've done designing, but have you personally been involved in designing bridges?

Two or three little ones. Never did the major kind of bridges that I guess I started out to work on. I had a chance to go to work for the Oregon State Highway Department when I got out of graduate school, but at that time I went to work in San Francisco for Standard Oil, I probably would have gotten into the bridge designing business if I had taken that state highway job offer.

Any regrets that you didn't get more involved in the design of bridges?

Oh, I suppose a little bit sometimes, but I was quite fascinated with the kind of design that we did here at CH2M so I didn't miss it much.

Were you always such an exceptional student? I saw your transcripts from OSC and you had excellent grades. Were you as good a student in high school?

I flunked English in high school. Oh, well. Nuts. (chuckle) And I did pretty well in algebra and geometry and those things. No, I don't think I was a very good student in high school. My last year, I finally realized that I'd better get some fairly decent grades if I wanted to get to college, so I did better I think the last year.

You still hoped that you could go to college in spite of the Depression? It wasn't so prohibitively expensive that you wouldn't be able to make it?

No, no. A lot of my friends in high school there were going to college, and they were doing it one way or another. You know, you could work your way through college. I saved enough in that two and a half years to be able to take care of myself for—well, I think I got pretty good jobs during the summer working for the highway department on a survey crew, so putting those together, I think I took care of myself for a little more than three years. The folks were a little better off by that time and they helped me for the last year.

Your father lost his job in the Depression and then later...

Things picked up and he went back to work for the original company.

That must have been tough for everybody.

Yeh. Well, my brother was living at home at that time and he was also working for the U.S. National Bank so the two of us managed to take care of things for the family until Dad got back. He had two or three jobs in the interim and finally ended up back with his original company.

In looking over your college record, I see that you were in a lot of leadership positions—treasurer of the freshman class and during your sophomore year you were president of that class and then almost president of the student body. Did you also have these leadership qualities and capabilities in high school and earlier? Did people seem to look up to you as being the leader?

I don't know. I was president of the student body at Grant High School. In the fall of 1931, was it? Yeh, it would have been. How that happened, I can't remember. I think I had taken public speaking, and somehow or another they had a public speaking contest and I had to give a speech to the whole student body that spring. Since I had changed schools and one thing or another, I was a half of a year behind, or a semester behind, I guess, is what they called it. So, when they were looking for candidates for student body for the fall of, would have been for 1931, I made this speech and I got nominated, and somehow that gave me enough exposure, as they call it today, to be elected. Well, so then, when I came to Oregon State there were a lot of Grant High School and Portland students down here so I guess my name was known to some extent.

You were chairman of the Blue Key and president of the Manager's Coop and a number of other positions.

Umm, hmm.

People just seemed to look to you as being the leader?

Either that or I didn't know how to say no. I don't know which. (chuckle)

Well. (laughter) I wonder what that special talent is that you possess?

Partly luck, partly being in the right place and, you know, getting your name known somehow. I imagine that if I hadn't gone to Oregon State, I wouldn't have known so many people or been known by many and probably never had done any of that or much of it.

But you must have enjoyed the positions, too. Is that right?

Oh, to some extent. It got a little weary because I was taking a full engineering course which, in those days, was eighteen or nineteen hours. I don't know how that compares to what today's is, or how they figure it today. And usually on the summer jobs I got, I'd have to leave two or three weeks before school was out in the spring, so I was always trying to make those things up.

Of course, the last term I was a senior, Jim Howland was involved in all this, too. He was the senior class president in the same class, if you remember. And the politics that was going on, and all these activities we'd gotten ourselves involved in were getting too much; and we both were writing

theses, which seniors did in those days. He and I moved; he lived in one fraternity and I lived in another, and the two of us found a room down on 11th Street or something at about Tyler. We rented it for the spring term and we disappeared down there, so we could concentrate and get our studying done, and finish our thesis, and all that stuff.

Your social life or your political life was getting in the way of your studies?

Yeh. (chuckle)

First, before we go into your time at OSC, why did you choose Oregon State College rather than some other place?

Well, I guess it was the engineering program. I knew a lot of people who had come to school down here. And, while I was working up there at the bank, they used to invite me down to fraternity functions and one thing or another, and it just always seemed like a logical place to go; and it was close and it was fairly inexpensive and I felt I could manage it.

And your goals were to go into civil engineering with the prospect of building bridges?

I guess so. I can't remember that it was that specific when I started engineering. I didn't know enough about what engineering was to be able to make that kind of a choice at that time.

Having been out of high school a couple of years you were probably more mature than most of the students, weren't you?

Yeh. That was one advantage; and probably why I was able to get fairly good grades in college, was because I'd had these two and a half years out. I was a little older. I felt it was real important. When I was a freshman, I was nominated for president of the freshman class and I declined. I refused to run; I said, "I don't have time to do that." I think I was treasurer, anyway; I don't remember how that happened. I really went to work that first year, and I think I got one B the first quarter. And, you know, once you've done that, it makes it a lot easier, because everybody automatically assumes now that you're a pretty good student and so they'll give you the break.

You mean the professors?

Sure.

(laughter) I never heard that.

Well, that's true.

Well, it must have been a closer knit group of professors back then?

Oh, sure. They knew everybody. You know, there were—I can't remember; at least in the civil engineering, there were only seventy or eighty of us as freshmen, so every professor knew all of us.

What did you think of the engineering school?

I liked it.

You realized by that time that engineering was the subject that you wanted to study? You had no regrets?

Yeh; and then, you know, I worked hard the first year, particularly, and managed to succeed, and you always like something where you think you can do pretty well. So, yeh, I liked it.

And I got to know the professors and got the chance to talk to them. A group of professors, particularly in civil engineering, were Fred Merryfield and Dr. Mockmore, Charlie, as we called him; Glen Holcomb, who is still living here in town, I think; and, I can't think of the structural engineering professor's name. They were interesting and things were informal and small enough, at that time that you could talk to them. They would go to the engineering society meetings and one thing or another and we could go with them. So, yeh, I enjoyed the engineering aspects of going to school very much.

I wasn't quite as happy with the political part of it. It began to get wearing and for some reason not as much fun as it had been; partly, I guess, because I carried a full engineering load, and then trying to do all these extracurricular activities got to be more than you could comfortably do.

I can imagine. How did the Depression affect the attitudes and the goals of other engineering students? Were they optimistic or pessimistic about jobs, or the economic situation, or did that seem to affect them?

I don't remember that we really talked about it too seriously. Most of the graduates were getting jobs of some kind—sometimes not in engineering, sometimes just on survey crews for the highway department. Quite a few of them took ROTC and, where they could, get a permanent commission in the Army. There was some kind of an act at that time that allowed the Army to give permanent commissions to ROTC graduates. But I guess, particularly in the early stages, we didn't worry very much about getting a job. I think most everybody got a job sooner or later.

Can you remember your first encounter with Fred Merryfield?

(pause) No. (chuckle) I think I had him as a professor when I was a sophomore. I don't believe he taught anything that I took as a freshman.

Now, was that in hydrology?

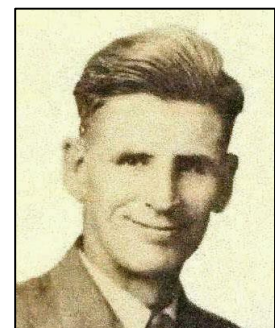
Hydraulics, I think. I don't remember what the first contact was.

You knew him as a sophomore.

Ummm, hummm.

What kind of a professor was he?

He was a wild one. Fascinating to me at least, as a younger guy, because he had this tremendous enthusiasm. He was kind of a tough instructor but a



Fred Merryfield

very outgoing, outspoken, strong one, in a sense, he entertained you; he put on a show.

I can remember once that he was working some hydraulic problem up on the board and ...the way that he'd do, he would ask somebody a question about, "All right, now what? What's next in this formula?" And sometimes if he didn't get the right answer, he'd turnabout and throw the chalk at the guy that missed it. But I remember one day, it was in a classroom there, and it was the spring and the windows were wide open, and somebody gave him some kind of outlandish answer, and he had an eraser in his hand and he said, "Oh, my God." And he threw it up in the air and the eraser went up, and at the same time he gave a big kick with his foot. He drop-kicked the eraser out the window. (laughter)

Oh, no! I bet everybody was surprised.

It brought down the house.

Oh, gee. So did that cause the students to be prepared when they came to class?

You bet. You know, there were only two ways you got along with Fred. You either were his fair-haired boy or he was your enemy. There was not very much in between.

Somebody mentioned that he considered you and another student to be the best students he had had all through his teaching career.

I don't remember that. He never told me that.

Apparently he told somebody else that. But you enjoyed his class?

Oh, yeh. Somehow we got acquainted—a group of us. I can't remember who they all were, but every once in a while, Friday nights or something, we used to go over to Fred Merryfield's and sit around and listen to Fred talk. You didn't talk **to** Fred very much; you **listened** to Fred talk. You could ask him a question or two and if that's what he wanted to talk about, he'd take off on it.

He had quite a few students that wanted to listen then?

I don't remember. I can't remember now how many of us used to do that. I used to and two or three others. Jim Howland, I think, went with us some. I enjoyed that. And then Glen Holcomb and Charlie Mockmore were good. They were different. They weren't as wild-eyed as Fred was but they also were interesting to work with and built your enthusiasm for engineering.

How did it come about that Fred singled you out and talked to you about starting a firm? Did those conversations start before you had graduated?

No, not really. When Jim Howland and I graduated, and Burke Hayes was in mechanical engineering—that was the Depression too, you know, and he, Burke, had come and gone; he had started a couple of years ahead of us but, as I remember it, he graduated the same time we did. The thing, I think,

that happened was that Fred and Charlie Mockmore convinced Jim Howland and I that we ought to take advanced degrees, and they went to work to try to help us find a way to do this. And Fred talked, on my behalf, to Hardy Cross at Yale, and somehow I got a fellowship along with a man named Grant Robley who was an instructor there at Oregon State at that time and who later became—(pause) I was going to say dean of engineering but that's not quite right—assistant dean at Sheffield Scientific School at Yale. And Jim Howland got a Tau Beta Pi fellowship. So Grant Robley and Jim Howland and I took a trip across the country in Grant's car and went back there together that summer.

One of you on the trip kept a little diary about the trip because I read it in the archives.

Yeh, there is one around. Jim Howland has it. I've got one, I think, somewhere. Some pictures and one thing or another. At the same time, Burke Hayes had some kind of a fellowship at Harvard. Jim Howland went to MIT and I went to Yale. We saw each other once or twice. I spent two years there and Jim got his master's degree in a year. Jim Howland and I ended up working for Standard Oil of California. I was in San Francisco and Jim was in El Segundo.

You're moving too fast. Just a second. You haven't graduated from college yet. (chuckle)

Oh, okay. Well, we graduated from college and got these fellowships and took a master's.

Why did Fred Merryfield and Professor Mockmore want you to get a master's degree?

They thought that was the right thing to do.

You followed their suggestions then?

Well, by that time I realized there were a lot I didn't know, and this Hardy Cross, Professor Cross, was very well known and Fred felt that he was probably—even though I was a structural engineer, and not sanitary or an environmentalist you now call it that Fred was—he thought I ought to get a master's degree and he and Charlie Mockmore went to work on Cross, and I got an offer as a part-time instructor at Yale, and Jim got the Tau Beta Pi fellowship. They just felt, I guess, that we were good enough students that we ought to go further; that we shouldn't just quit there and go to work somewhere.

I was looking at your transcript in the archives. You got three C's and all the rest A's and B's. The C's were in hydraulics, roads and pavements, and calculus. Do you remember that?

No, I don't. I don't know what happened that I did that in hydraulics. Roads and pavements I could never get very interested in. What was the other one?

Introduction to Calculus.

I think that was my freshman year and that year I got this job with the highway department. I needed it so I left school early in May I think, and I had to come back that summer and take the exam from the mathematics professor separately. I hadn't remembered that particularly.

How did you meet Jim Howland in college?

We were in the same class, taking the same courses.

You were just naturally attracted to each other as friends.

I don't know. Couldn't help it. There were only about twenty of us in class at a time.

Did you ever talk about setting up the firm with Howland before you graduated from OSC?

Not that I remember.

What I'm trying to have you talk about is how this idea of the firm got started and why you particular individuals came together—what qualities you possessed or whatever it was that caused you to come together.

It's too bad that you can't talk to Fred Merryfield because he's kind of the one that brings it up.

Well, he sounds like a real character. I really wish that I could have talked to him.

Well, you got to carry the story a little further I guess in order to solve that, or in order to answer that. After Burke and Jim and I got out of school or got through our undergraduate work at Oregon State, we went back there for the master's and Jim and I ended up working for Standard Oil of California—not in the same city and I don't think we had actually seen each other—and Burke went to work, I don't remember, either in Boston or for the consultant in Oklahoma.

He was in Boston first and then Oklahoma.

Jim Howland and I both had reserve commissions in the Engineer Corps of the Army. So come 1940, whatever, just before Pearl Harbor—I went on active duty a year before Pearl Harbor—things were getting kind of shaky in San Francisco at Standard Oil, and I wasn't sure I was going to have a job and I got this notice from the Army that they were going to call up the reserves and I think I went a little sooner than I would have had to, although they would have got me within six months or so. I don't remember just when Burke went into the Navy, maybe a little later, but Jim got called to duty about a year after I did. All three of us were in the service until late 1945 or early 1946. Somewhere in the process of coming back on leave and one thing or another, we would always go talk to Merryfield.

You'd come back to Oregon when you were on leave?

Yeh. I was married by then. My wife was living here and I had a son then—he was about two I guess—and they were living here in Corvallis. So every time

we'd come back or something, why, we'd come down to see Fred when he was here. You know, he was in the service for a while, too. I remember, I was back here twice, once in about the fall of 1944, just before I went to Germany, and then sometime in the middle of 1945. After I'd come back from Germany, I was on what they called POM leave because I was supposed to go to Japan; but they dropped the bomb while I was here and that never happened. We'd always go talk to Fred and, somewhere in this process, he got to talking to Jim and me about the possibility of going into the consulting business. I think Fred wanted to.

Why you two students? Why not somebody else?

I guess he thought, if he was going to team up with somebody, we'd be the best ones to do it with. That's all I know. We'd always been kind of his favorites for a period, for some reason or another.

Jim Howland also? Or just you?

Yeh. We had gone and gotten the master's degrees, you see. And Jim had taken soils, you now call it geotechnical engineering, in his graduate work, and I'd taken structural engineering, and Fred had a master's degree in sanitary engineering; so that made us a pretty good team. Then we got to thinking about Burke with whom we could have the mechanical/electrical capability.

How well did you know Burke Hayes in college?

Oh, not very well really, I guess. I knew Jim Howland a lot better.

So you never talked about the firm idea until you were in the military and came home on leave? It was never mentioned in conversations between you and Jim Howland at all?

Not that I remember. Well, after Fred brought up this idea late in the war, then Jim and I corresponded back and forth a little bit about it. I don't remember whether we got together before we got out of the Army to actually talk to each other about it. I think maybe we did once, but I can't remember.

When you went off to Yale, what were your goals at that time? Did you still want to build bridges? Was that still your dream?

Yeh. If I could have found the job that would pay enough, I would have stayed in New York.

Why?

Well, I liked New York. It was romantic in the big city and all of this, you know. And Hardy Cross said, "Oh, I can get you a job in New York if you want one, but it'll only pay you about \$130 a month and you've got; this offer." By that time, I had an offer from Standard in California at \$185. And he said, "I think you'd better go to California, and anyway you're not going to like New York," he said, "after a while."

Nice to visit but not to live in?

Of course, New York was a lot different, you know, forty years ago that it is now. It was the big city. And it was exciting and romantic and there were all these places to go and things to do and they were having the World's Fair at that time, one of those they had, I don't remember [which]. As a matter of fact, that year, my wife and I went to two world's fairs. We went to the New York World's Fair and the one at Treasure Island in San Francisco which must have been 1940, I guess.

Professor Hardy Cross was influential in your development at Yale University?

Ummm, hummm. Yeh. I'd never say this to Fred, but I think Hardy Cross was probably the best teacher I ever studied under. He was a fascinating kind of a guy, too. Little, short, rotund. He had a table at the front of the class and he'd lift his little pot belly like this and lay it on the table and stand there and lecture to you. (chuckle) It wasn't quite that bad but that's what it looked like. And he was much like Fred Merryfield. A little bit sarcastic. Spent a good part of the first two or three months convincing us that we didn't know half as much as we thought we did, and trying to get us to use our heads and not just the formulas. Little things like that give you some idea what his philosophy was. And, I guess, that's where I got the great love for engineering, and part of the reason I wanted to work in New York is that's where the big firms were doing the big bridges and the tall buildings and that stuff.

But he was convinced that Standard Oil would be better for your career?

He thought it was a better offer and he said, "I don't think you'll like it back here. I think you'd better go back West. That's what I'd do if I was doing it."

Well, I know you taught at Yale. Did teaching appeal to you?

Oh, I kind of enjoyed the teaching but I never had any interest in being a teacher in the sense of a career. I guess I've done a lot of teaching in a sense all my life, but I didn't want to be a professor. I wanted to be out there building them someplace.

Had you thought about starting your own firm at that time—not necessarily with Fred Merryfield? Had that crossed your mind before?

Not really.

You always assumed you'd work for somebody else then?

Well, I thought maybe I'd eventually be a part of some firm or something. I didn't know. I guess, at that stage in your life, you can't see all the possibilities; and consulting firms in those days were not very many. The fancy bridges were being done by the state highway departments. There were consulting firms that were doing the big bridges. Cross was a good friend of a man named Moisseiff [Leon S.] who was the foremost expert on suspension bridges at the time. He designed the Tacoma Narrows Bridge, and it's kind of my theory that that failure killed him.

Failure?

You haven't ever heard of the failure of the Tacoma Narrows Bridge?

Sorry.

It essentially blew down in about 1940. It's an old classic. The wind happened to be approaching at the right angle, and it was an advanced design and the deck stiffening was not sufficient, and it began to go (weave up and down and side to side) and then it finally [collapsed].

Was it the engineer's fault?

Well, yeh. They don't build them that way anymore. Well, I don't know whether he exactly took the responsibility but it wasn't long after that that he died. And the stories that I've heard, and this is just stories, were that he became so depressed and discouraged that probably he had a nervous breakdown and died.

Where was I? Oh, we were talking about the big bridges. There were several other firms that were doing that. But by that time I was married; and making a good living was pretty important, too, so we went back to San Francisco which we loved. Cleo and I lasted there about eight months and then I went into the Army.

How did you meet your wife? I understand she graduated from Oregon State also.

I met her [Cleo Ritner] here in school. We went together most of the time that I was in school.

What was she studying?

She has a degree in education and she taught. She graduated a year before I did. She taught typing and shorthand and so forth at Ontario. I don't know what they called it then.

Ontario, Oregon?

Yes. We were married the day before Christmas in 1938. I'd gotten to Yale that September. She helped put me through graduate school.

She put you through graduate school by doing what?

Or helped. I got pretty good pay back there. When we got back there, one of the instructors had died, or left, or something so we, Grant Robley, the other fellow that went back to Yale with me, and I essentially taught almost a full instructor's load in engineering mechanics—well, I wouldn't say full, but anyway they increased my salary and I got \$160 a month as I remember it.

And Cleo had a job. She worked for some guy who was a climatologist who was supposed to be one of the toughest in the school to work for and she got one hundred dollars a month. We had more money and were more prosperous (chuckle) in that two years at Yale than I think we were for the next twenty years. We didn't have much expenses; lived in an apartment; didn't have a car; did just fine.

And at that time, you always kept in contact with Jim Howland at MIT?

Yeh. Jim met Meisy, his wife, back there. I think she was going to Radcliffe was it?

I think so.

Or Vassar. I don't remember. Radcliffe, I think. They came down to visit Cleo and I a couple of weekends once or twice as I remember. And we kind of kept in touch there, but even then we weren't talking about this business. I don't think that had ever entered our heads.

You just assumed that you would go one way and he would go his own direction?

Yes.

But you didn't want to stay at Yale and so you took this job in California?

Well, I don't remember that I had any opportunity to stay at Yale, if I'd wanted to. Maybe, if I'd worked on it; but I didn't want to stay there and teach.

How did you like working for Standard Oil? Is that what you wanted?

Oh, I guess I didn't mind it; and it was kind of interesting, too. I'd just started out as a lowly peon in the structural engineering department and had a long ways to go. But it was a good experience because I remember I had to design and draw the detailed plans for a refinery supports for a bunch of fractionating columns which are tall, steel columns; and in that area, even then, you had to design them for earthquakes. I had to draw up the details and I was working for an old, tough, chief draftsman who only had a high school education, and he didn't think too much of these hotshot young guys with all this fancy education and their high theories; and, boy, he really turned the screws and put me through the ropes and insisted on the details being right; and made me redo it until I got it right. And that's probably where I learned how to check drawings.

But then, I remember I got this notice from the Army that they were going to call up people and you could go now or later. I talked to my boss, a man named John Renne who later was President of the American Society of Civil Engineers. He talked to the chief engineer and he said, "I can't assure you that there is going to be a job here this long. Things aren't looking very good and maybe you'd better take it." At that time, before Pearl Harbor, we were just called up for a year. We were supposed to get out by the end of the year. "Maybe you'd better take that and come back at the end of the year and see what it looks like." So I did. I took a commission of active duty in the Army. I probably could have avoided going for a while if I hadn't done it, although eventually I would have gone, I know. Jim did and so did everybody else who had a commission.

Eventually you went to Europe.

Ummm, hummm. Because of my teaching experience, I was lucky. Oh, they sent us to a refresher course or whatever you call it at Fort Belvoir, Virginia, and I was assigned to an engineering replacement training center at Fort Leonard Wood which was a brand new camp at that time. It was mostly mud and so forth. I was there for about a year, I guess, training recruits. I don't call that teaching. It wasn't. I was at first a platoon leader and eventually company commander. Our company was about 250 draftees. We had to make soldiers out of them. I was there at the time of Pearl Harbor; and shortly after that, I guess because of my teaching experience, I was transferred to Fort Benning, Georgia, which is an infantry post. I was the assistant engineer instructor; I guess you would call it, for the infantry offices they were training at the time. It was, you know, training draftees to be infantrymen. And that was a nice assignment. I was there for about three years.

You liked military life?

No. But, if you had to be in it, that was as nice a view as you could have. Eventually, I got a little itchy about that because all my friends were going over and fighting the war, and here I was just sitting around doing office sort of stuff.

What were you teaching exactly?

I was teaching engineering subjects to infantry personnel; and what it involved was how to build floating bridges, how to handle explosives, and just general instructions to the infantry personnel on engineering kinds of military work. We had a big demonstration that we put together there called attack of fortified positions. You know, that was the time that the French had a so-called Maginot Line, which was a whole permanent set of forts all along, to stop the Germans. It hadn't worked.

That must have been challenging to you.

Got very repetitious. I imagine that I've crossed the Chattahoochee River a hundred times building a bridge, you know; and we had an engineer company there with us, and they got so they could put that bridge together in their sleep. We'd put it on as a demonstration for the infantrymen to watch and then we'd get infantry to go across it.

I was an assistant to the regular Army officers who were engineering instructors at the infantry school. The second one left to take over what they called an engineer combat group, and through his connections at the Pentagon and Washington, D.C., he got me transferred in as his executive officer, and that unit went to Europe in the fall of 1944, I guess it was. We meandered around over there and chased Patton all across France and through Germany and stopped on VE Day, which was Victory in Europe Day, at Linz, Austria on the Blue Danube River. Came back, and our unit was to retrain and be a part of the task force that was going to land on the main Japanese island. At least that was our guess. Fortunately, with the bomb on

Hiroshima and the surrender of the Japanese, we never went. We never did it.

You earned a bronze star, didn't you?

Ummm, hummm. I don't know what for, really. I was no big hero. I didn't go out and rescue somebody under fire or anything.

Why do you think they gave it to you, then?

My boss got it for me, the same guy that asked for me, and got me transferred into his unit for managing the group while he went off and ...he was a great goer. He was an all-American football player, and a tremendously smart guy. At the time that he graduated, he had more swords or sabers or whatever they give you at West Point than anybody before him. And he liked to go off and be right up in front in the middle of things, you know, and so my job was to stay back there and keep everything going and try to keep up with him, and I guess that's what I got it [the bronze star] for. I was never under very serious battle conditions. Sure, we'd get shot at and bombed and shelled at times.

I know you must have been popular with your men because there's a letter in the archives that says, "To the best lieutenant colonel in the whole Army," and then it has all of your men's names under it.

Is that right? I don't remember that. Are you sure that was for me?

With your background, you must have been a key person?

I wouldn't say so. (chuckle) Well, you know, hell, it isn't all that fancy. You just got to keep at it and use your head and do what you need to. It was not highly technical engineering except the thing that those guys were doing on that rib. You don't want the war stories and all this do you?

Yes, it's very interesting. During this time you kept up a correspondence with Jim Howland and Fred Merryfield?

Not really. I'd see Fred when I got back from Germany.

After I got back from Germany and went back down to Camp Gruber, Oklahoma to get ready for the next move, I had talked to Fred about it [starting a consulting engineering firm] and so then I found out where Jim was and I guess I wrote to him or he wrote to me, I can't remember which. Jim had some of that correspondence around here the other day. And we began to talk about this a little bit.

There is some correspondence from that time period in the archives. Your goals hadn't changed then during the war years with all of these events that happened in your life? You still wanted to come back and build bridges?

I really didn't think I was much of an engineer yet. I'd only worked at it for about a year, and then I spent six years in the Army. I knew some guys who somehow didn't get in the Army. They were 4Fs or something, and now they had six years of intense engineering experience, and I figured I was just

getting farther and farther behind. I wanted to get the hell out of there and get going.

Well, you had some experience in the Army.

That wouldn't do you a hell of a lot of good when it came to doing what this company does—unfortunately (chuckle). In my resume, in the original, I tried to make it sound like it did but it really didn't.

Just in your telling it, it sounds like there was quite a bit of engineering involved especially with the bridge.

It was basically administration. It wasn't engineering.

THE PARTNERS COME TOGETHER

I can remember finding Fred Merryfield over underneath a truck carryall fixing something. He had what we now call a carryall with a laboratory in it. He was sampling the water up on the Willamette River, and he was saying, "They are going to clean up the Willamette River, and there is going to be an awful lot of work and we ought to get together and put together a company and do it."

Had he been doing consulting on the side already?

Yeh. He'd worked for years for the two big consultants in Oregon who were John Cunningham and Associates, and Stevens and Coon. He and Glen Holcomb and Charlie Mockmore did engineering for Camp Adair which was an Army training camp. They had a whole camp there at one time. They built that thing, I guess. And so he had worked for these consultants. He knew an awful lot more about the business than any of the rest of us did, surely, which wasn't too much really.

Did you ever consider going into business with your professor, Hardy Cross?

No. He was basically a teacher. That's what he did and what he wanted to do. He was getting pretty old at that time. You see, he started his teaching career in something like 1910, so, by 1945, he must have been close to the seventies.

I see.

I remember, I wrote a letter to him and told him what I was thinking about doing. I said Fred Merryfield and Charlie Mockmore say they'll help us, and he wrote back and said, "Well, if Fred and Charlie will help you, give it a try."

Did Fred Merryfield and Hardy Cross know each other personally?

I'm not sure that they ever met, but they had corresponded a lot and talked to each other over the telephone; over a period of years, several years, they had been in contact with each other because of students from here that went to either Illinois or Yale.

Quite a few students went back East?

Um-hmm.

I wonder how they got acquainted.

I think it was through that. I don't know that they actually ever met personally.

Was Charlie Mockmore involved in the infancy of the firm?

He was not actively engaged but he was awful helpful and helped us out a lot. I can remember, I suppose I'm getting ahead of the story again, but one of the first design jobs that we got was a water reservoir of concrete up at Forest Grove. And I can remember I was up there inspecting construction, and Charlie brought his senior engineering class up there one day, and we

put on a show for them pouring concrete and vibrating it and all that stuff. I guess I was the first one back, and I got discharged from Camp Gruborough, Oklahoma, sometime in, must have been in October of 1945. I came right back here because my wife and Steve, the first child, were here. And after I'd been here about a day or two, I made the mistake of going over to talk to Merryfield.

A mistake?

Because I came back [from talking to him] with a big roll of plans and bunch of stuff on jobs that he had. Because of what we had started to do, he had already taken on two or three assignments.

With the idea that you'd get together?

Yeh.

Well, had you said that you were going to come back to Corvallis and start the firm?

I guess so. I don't think it was that definite but Fred, being the way that he is, he got these opportunities to take on these jobs, and one of them was up at Crystal Springs Water District which is just outside of Hood River. Another was a reservoir for a little water district outside of Eugene. The first thing that I undertook was that reservoir for Eugene, and then I went through a preliminary design and estimated the cost and I went back to Fred and I said, "Hey, Fred, I don't think you're right. That reservoir is going to cost about five times what you said it was." Fred had made some mistake in arithmetic when he'd done it. (chuckle) So he and I had to go one night and tell the board the sad news about what it was going to cost. I don't remember that we worked for that organization anymore.

What appealed to you about starting your own firm and working with Fred Merryfield? Did his personality affect you one way or the other?

His enthusiasm had something to do with it. And by that time, you know, we had lost this time [during the war] or I thought I had. I wanted to get to doing some engineering and kind of recognized that the big companies were going to be slow and difficult to work up in, so we decided we'd give it a try. Fortunately, we didn't know enough about the business or anything else to know what kind of a thing we were undertaking. But with youth, enthusiasm and not knowing what you're doing really, we took off.

Fred didn't know either?

Not really. About all we had for capital to start out with was...you build up a certain amount of leaves in the service, you know, you've got two weeks' vacation a year or some damn thing, and so when we got out, when we were discharged from the Army, why we continued to get paid until all that leave was used up. And I think they gave you an extra thirty days on discharge or something if you'd been on active duty. So I was getting paid as a lieutenant colonel from that October when I got back until sometime in April of the next

year. Jim Howland had the same thing and I guess Burke did. That's really the only kind of capital or anything else we had.

When you left Yale, you chose a job in California because it would pay you twenty-five dollars more than a job in New York, even though you would have preferred to stay in New York. How did it happen that you were now willing to put yourself in a situation where there was a possibility that you wouldn't make anything?

Well, you know. We were young and full of confidence and it never occurred to us that we wouldn't be able to make it work.

What were you thinking would happen?

Oh, I can remember Jim and I saying at one time, "Gee, you know, if we just keep working at this, we'll get it to the point where we can make ten thousand dollars a year, and we'll be on easy street." Well, at that time, if we could have made ten thousand dollars a year, we would have been there. Remember, a dollar in 1946 would be about the same as ten dollars today. I remember that I finally got paid for the design work on the Forest Grove Reservoir I was talking to you about, and it was a check for thirty-four hundred dollars. That's the most money I'd seen in one chunk in my life. I was almost afraid that it wasn't real.

And they were satisfied with your job there?

Yeh. I guess we're still working for them. We went on from there, and Ralph designed a water treatment plant for them, and we rebuilt the pipeline, and then we later designed a sewage treatment plant, and we've worked for Forest Grove [since] and I guess still are.

So Fred Merryfield really got the jobs in the first place and you would work on them? And then Jim Howland came in January. Was Jim Howland responsible for Burke Hayes coming into the firm then?

Yeh, I guess Jim kind of thought that Burke would be a lot of help and so did Fred. Jim had been the one who had been corresponding with Burke mostly. There are some wires back and forth in that stuff that you've got that'll tell you that story. Burke finally showed up.

Did you have any doubts that there would be enough work for four engineers working full-time?

Yeh. I guess we did. (chuckle) We weren't very sophisticated, you see, in those days. We didn't know how much it took. We did everything. Finally, I think, about the middle of 1946, we hired a stenographer, which we called them in those days, but we did all the drafting and all the engineering calculations.

I can remember the first accounting system that we had was a big sheet—you know, one of those long accounting sheets—and down this side you had everybody's name and across the top you had each job that we were working on. And you'd take each guy's salary, and split it among those jobs

depending on how many hours he'd put in, so under each job, you had hours and dollars, and somewhere in there, you had expenses. You'd add that all up this way and across this way and once you got it all to check, then you knew how much to charge each client. Simple system. Exactly what we do now, except there are a thousand jobs and two thousand employees and it takes a computer to do that all.

Plus, in those days, you know, you didn't have anything like—well, you had tax withholding because I can remember once when I was acting as manager, I didn't have enough money to pay Uncle Sam his quarterly tax withholding, so I delayed it for two or three weeks. I had a little hard time sleeping in those days because every morning I'd wonder if, when I got to work, I'd find a padlock on the door and the IRS guy standing there saying, "I've closed you down because you haven't paid your taxes." But somehow, we slid by. (chuckle)

Gee. What contributions did you feel you could bring to this group yourself?

Well, I was going to be the structural engineer, you see; Jim Howland was going to be the soils and foundation expert; Burke was going to do the mechanical and electrical; and Fred was going to be the sanitary and hydraulics design. And that covered all the bases. We had the capability to do anything, we thought.

What happened?

We did it. I spent quite a bit of the time that first year over at the library [OSU library], digging out things that I didn't know about and finding and reading what I could to find out how to do it.

You were one step ahead?

Tried to be.

Tell me why you chose to come to Corvallis and start the firm here instead of someplace that would be more centrally located like Portland or a larger city?

Because Fred was here. He couldn't afford to quit teaching because he wouldn't have anything to live on. Anyway, this was the center of the Willamette Valley and our original market, we call it now, was going to be to clean up the Willamette River so this was as good a place as any to start, I guess. I was already here and my wife and child were here. Nobody else had any roots any place. We just started here, that's all.

And Fred Merryfield enjoyed teaching?

Ummm, hummm. Yeh. He taught for, gee, I don't know, clear up to almost 1970, I think, didn't he?

That's what I understand. It never crossed any of your minds that you would start this firm when you graduated back in 1938?

I think we got the idea of going on our own somewhere during the war when we got to thinking more, and got a little older, and got to recognizing that

maybe the big companies weren't all the solution. Jim and I both had offers to go back to work for Standard Oil after we got out of the Army, and we didn't do it. And Burke, I know, had two or three offers. I would guess that if we had stuck with them, we'd be pretty well up in Standard Oil by now.

I imagine. Who's idea was it to start the business? Was it Fred Merryfield's more than Jim Howland's?

It was essentially Fred's, in my recollection. Jim was kind of enthusiastic about it, and it sounded like a good thing to me.

Burke Hayes mentioned that he and Mr. Howland would talk about it as undergraduates. He never talked to you?

I don't ever remember.

You previously mentioned Professor Charles Mockmore, and that he was involved in some of the early projects. Was he interested in becoming part of the firm?

He was head of the department of civil engineering and didn't want to I guess. I don't remember.

Was it ever brought up?

Well, I never brought it up. I don't know whether Fred talked with him or not.

Do you think if Fred Merryfield had not pushed the idea with the four of you, you would have started the firm without him? Would you and Mr. Howland and Mr. Hayes have gotten together?

I rather doubt it. I think he was the spark that really got it moving and kind of convinced us that we could do it. I don't think the rest of us really knew enough about how it worked, unless Burke might have, to recognize the opportunity without Fred's urging and conviction that it was a good thing to do.

What were your expectations when you started in 1946? Were you just going to play it by ear and continue getting more and more projects, or did you have a vision of the large firm that you have today?

No, I think we started out with the idea that the four of us, with a little help in the drafting and maybe the clerical side of it, would just go on forever doing our engineering thing. I don't believe we really had any long range plans for growth or that sort of thing. We didn't really recognize how such an operation as we now have worked. And there weren't any firms as big as we now are at the time we started. There were a few in the Midwest and in the East that had maybe as many as fifty or a hundred employees but the firms that were the size of ours didn't really get started until about the 1960s or so.

Is that one of the reasons why Fred Merryfield thought it would be a success because there weren't many other firms in the Northwest?

There was a lot of work to be done and, yes, that was one of the reasons why, I think. We were fortunate in that when we started, the local established firms weren't able to handle all the work that needed to be done so we kind of took the work that they couldn't do in a sense.

There was enough work to go around, then?

At that time there seemed to be, yes.

Were there other professors who were starting their own consulting businesses or was Fred Merryfield unique?

There were a lot of professors who did individual consulting work. And there were professors in the other parts of the country that were also members or principals of the consulting engineering firms. There was nothing like that out here and there was a certain amount of objection, at least by the two established firms in Oregon, toward Fred being part of a consulting firm and also a professor on the public payroll.

How was that resolved?

It never really was. Well, Fred didn't teach full-time after we started the firm. I don't remember or know what the arrangements were. But he was on a part-time status at the university, and the university had always encouraged professors to work outside. They had never required that they limit their working to just teaching for the college.

Why was there a protest then?

Well, the established firms felt that that gave him an advantage as a professor, and they even accused us of using students in class to do the work and then charging clients for it.

Did he use students in class?

No. For a while there was a certain amount of complaint and bad feelings about it but after a while we established ourselves solidly enough and became large enough that they kind of gave up on the complaining bit because it was obvious we were independently operating. We had to be very careful about anything that we asked or tried to do through the college. At that time, the college had more equipment and this type of thing but, of course, they made that available to anybody. So we were very meticulous about making sure we paid the college whatever they charged for any equipment used or lab tests or this kind of thing that we had them do.

What kind of equipment are you talking about?

Anything from laboratory equipment, surveying equipment, stream measuring equipment, to traffic counters and all this sort of thing.

They let people outside of the university use it when it was available?

They would charge for it, yes. But this was part of how the university managed to finance that sort of thing was by charging a fee for its use when they weren't using it.

It wasn't legitimate then for students to work for you for a class project, for example?

No. We never did that, or allowed them to. We hired students sometimes on a part-time basis, and hired them in the summer. Several people that are still with the firm started out that way as part-time employees and we still do that to some extent. It's no longer very economical to do it that way. Today's students, at least, don't know enough about the practical ends of engineering to be of real help. If they're a good draftsman, or good with the computer or mathematics, they can be used now in some relatively routine kind of work. I guess we still hire college students on survey crews temporarily in the summer and this type of thing but primarily we do this summer work as a means of getting acquainted with the good students and helping us in recruiting them to come to work for us later.

Were students better trained in previous years?

Oh, right after the war, of course, there were a lot of older people going to college that had had some kind of experience before the war, or during the war, or something like this; that made it more possible, plus the fact that engineering projects in those days were not as complex and involved as they are now. We've come a long way in the technological advancement of almost everything we do.

And the students are not being trained for these new technological advances?

Yeh. And some of the students come to work for us know more about computers and some other specific theoretical things than we do. But it's quite a step from there to applying it to a specific work that needs to be done, or the practical application if it.

So what they're lacking is experience, then?

Ummm, hummm. But in those early days, there were people—Bill Watters, Carl Ryden, Ken Bielman and several others—who had actually worked on construction. You see, most of them had spent anywhere from three to five or six years during the war at some type of thing. Earl Reynolds, for example, had been in the Army but he had worked on what they called the Alcan Highway. So, there were a lot of people who had some considerable experience who were going to school at that time. This was a lot different than it is now.

CONTRIBUTIONS OF PRINCIPALS

I want to talk about the contributions of these founders. I'm going to start with Fred Merryfield. Can you remember him telling you how he happened to come to Corvallis? I understand there's an unusual story connected with that.



Fred Merryfield

I'm not sure that I can remember it completely. (pause) Why he came to the United States from England, I don't know. I'm sure he told us once, several times. But somehow he ended up getting off the train in Corvallis and going to school here. Maybe when you talk to Burke or Jim Howland, they can fill that in. My memory just won't bring it back to me now. He went to school here; and he worked for a couple of years for the railroad on the survey of the tunnel that goes through the Cascades—what do they call it? Willamette Pass—and then came back and went to teaching here, I think.

You know, Fred was a fighter pilot in World War I and he flew for the British—what do they call them? The Jennys—and had some kind of a crash; and there was a rumor for a long time, I know it was around when I went to school here with Fred as a teacher, that Fred had a silver plate in his head because of this crash, or crashes, that he had during the war. I finally asked him that one day and he said, "No, that's not true. I don't have any plate in my head." He said, "I may have some lack of brains but no plate."

(chuckle) He had a sense of humor, then?

Yeh.

Well, besides his enthusiasm for starting the firm and his contacts with clients, what contributions did he bring to the firm?

Well, of course the contacts and the knowledge of people and of prospective clients in the Northwest and in Oregon were major contributions. Plus Fred had a very good knowledge of sanitary engineering, water supply, waste treatment, and a wide background of experience in that kind of work which, in the early days, particularly before Ralph Roderick and Archie Rice arrived, helped to keep us straight; and he was able to guide us in where to go when we had a problem, to find a good answer, particularly technical.

I understand he was interested in cleaning up rivers in the 1930s. He was taking samples of the Willamette?

He had a project, I don't know exactly how it was financed but I think through the state, for sampling the water quality in the Willamette River, and he worked on that during the 1930s before the war started. And he was instrumental in developing the legislation which Oregon eventually passed which led to the initial steps in the cleanup of the Willamette River. And for a long time, he was on the Oregon Water Resources Board and at one time was chairman I think.

So he had the vision to know that this would be important then in the future—cleaning up the rivers? Because that was way before the environmental movement.

Oh, yes. I think you have to recognize that Oregon is probably and has always been at the head of the rest of the country in that phase of the environmental movement, and was cleaning up the Willamette River long before anybody heard of the term “environmentalism”. Fred made those stream measurements. He recognized that the river was sick and that things had to be done; and somewhere in the period from the mid-1930s through right after the war, Oregon did undertake to pass the legislation that required that communities treat their sewage, and that discharge of raw sewage into their streams was not to be done.

And this, of course, was one of the things that made it look to Fred like getting into the consulting business at that stage was a good move, because he could see all of this work that was coming up; and it turned out to be right. That’s the reason that the work for consultants was so much more than the established firms in the state could handle. That and the fact that for five or six years during the war, almost everybody’s municipal facilities—water supplies and streets and this type of thing—had been let go because there was no possibility to make any regular improvements or major maintenance and replacement until after the war was over. The materials and the labor and everything else were not available.

So part of the success of the firm is due to the fact that you were there at the right time?

The timing had a lot to do with it, I’m sure. And then we were able to get started right away, right after the war, which is the time when you needed to because there was a big need for a lot of things that had been let go during the war plus the stream pollution abatement program for which engineering skills were required.

Would Fred talk about pollution abatement in his classes?

Well, you see, I went to school in the mid-1930s. I don’t remember that he did, particularly in terms of the general environment. I’m sure that he talked about the fact that the streams were polluted because I know one of the projects we had to do for him when I went to school was to try to design a sewage treatment plant, which I did my best on but (laughter) looking back on it now, it was pretty sad I would have to say.

He was a man ahead of his time, obviously.

Yeh. Fred had vision and always did.

Did his place in the firm change over the years?

Yeh, as we grew and become larger and Fred gradually spent more time, he did a lot of things. He organized our technical library and set up an index which is still known as the Merryfield system. It’s an indexing system of

library-type information based on Roman numeral I, capital A, Arabic 1, lower case a, and then 1 in parenthesis, a in parenthesis, and so on.

Like an outline.

An outline type of numbering system. And he did that primarily for cataloging and indexing technical information for which the Dewey Decimal System, which we now use, didn't at that time seem to be very suitable. We could have used it then, I think. We don't essentially use it anymore, but it served well for quite a while.

He [also] helped in the development of design guides and this sort of thing and then, you'll have to ask Jim Howland just when this was, but along in the mid-1960s sometime, Fred became what we now call personnel director. And there was a time when he scheduled all of the work in the firm and assigned the people to it and so forth. That was at a time when we were maybe fifty or sixty people, not two thousand, so one man could do that. And he used to have a room in the office with charts all around it with everybody's name and all of the projects listed, and kept moving that around trying to meet the schedules and keep everybody busy, and then he did most of the interviewing and the hiring of new people.

How was he at selecting new people?

Fred had a tremendous ability to assess peoples' capabilities. It wasn't systematic or a systematized process. Fred just had a good feel for people and pretty generally he was right about the people that he hired, or that he recommended we hire, in terms of their capability. He's responsible for the fact that Ralph Roderick and Archie Rice joined us, which they did about a year after Jim and Burke and I started—a year or two, I can't remember just what the calendar was; and he's responsible for the fact that Bob Adams, Fred Harem, Sid Lasswell, Jim Poirot and a whole group of the key people that now are managing and running the organization joined us, I think.

He just had a knack of knowing who would be exceptional?

Ummm, humm.

I understand he talked quite a bit.

Yep. Fred enjoyed talking and was an excellent story teller.

Oh, can you give me an example of a story?

Well, he used to tell stories about his experience in the survey and the tunnel over the Cascades. And he had a series of his favorites which won't come back to me now, that some of us, after we heard them about the fourth time, you know, had a little trouble staying awake.

Oh, no. (chuckle)

But, the first time you heard those stories, they were really good, and Fred would illustrate them with gestures and very vivid word pictures. You know he had a deep and very powerful voice and a marvelous control of the

language so that he could make a very interesting and impressive story or presentation.

I wish you could remember a story.

Well, I may think of one pretty soon.

I learned earlier from you that he was considered to be quite a talker. Did that ever cause problems between him and any of you?

Well, I mentioned some about it when I said that after the time you'd heard the stories three or four times, they began to get a little boring. Sometimes he'd take over the conversation.

You weren't concerned that he would dominate conversation when working with clients, or be insensitive to their feelings?

Well, usually when we were meeting or talking to clients, Fred with his gift of language could make an excellent presentation, and so it didn't often cause that kind of problem. Fred was a strong character, and you either liked him very much or you disliked him quite a bit; so you had to be careful not to take Fred with you, when you had somebody that you might think was not on good terms with Fred.

Oh, his not being taken along didn't result in hard feelings between him and the others?

Oh, I think we knew Fred pretty well and we all recognized this; he couldn't do everything anyway so normally we would get him to help us where we felt it would fit.

He didn't try to dominate those Monday luncheons?

No, surprisingly, he was often very quiet on those, unless you happened to get into a subject in which he had strong feelings.

Like what?

Oh, personnel selection, and engineering excellence, I think is the term which should be used to describe it—believing in doing a good technical job regardless of how that fit with the fee or the profit picture.

So in his mind economics wasn't the prime motivation for doing the project?

No, and normally whenever it came to a matter of what we were going to get paid—fees—Fred would be very quiet while the rest of us had to work that out.

Why was that?

He had a reluctance to discuss any monetary matter with people who he considered to be his friends. Where that came from I don't know; it's partly related to a strong professional feeling that you should do the best job you can and let people pay you what they might, which obviously in running a business you couldn't do; and it was just hard for him to talk about money matters. Can't explain it any other way very well.

So he was uncomfortable about discussing prices and thought the client should decide how much the job was worth to them? Did he understand the practicality of running a business?

Well, not too well sometimes.

Did he let his opinions be known about that aspect of the business?

Well, he used to get upset sometimes when we got to what he felt to be too monetarily concerned. He felt we ought to be satisfied with whatever we could make, and that we shouldn't try to drive a hard bargain with a client.

Why did he want to go into the consulting engineering business in the first place? I mean that's usually a motivation.

It was not to make money. It was to do a good engineering job, an interesting engineering job, I think.

I didn't, I never talked to him obviously, but I understood that he didn't really participate in the projects directly. He taught at the college and handled personnel matters, but didn't so much get involved with projects, so it seems contradictory...

Well, that's right. It didn't work out that he could participate directly, although every once in a while he'd get involved in one or we would ask him to give us some help in working out a theory or a concept on the basis of which we'd do the detailed design. So he'd get involved in it from that standpoint.

And that was enough to satisfy him then, that that was his...

Well, I don't know if that was enough to satisfy him, probably wasn't completely, but this is just the way it worked. He was not available to be able to undertake these things, and he had a reluctance to take full charge of a project or something, partly because he didn't understand the financial part of the operation, and second, because Fred had a little problem, I think you would have to say, in actually fully completing something and wrapping it all up. He enjoyed the conceptual part of it, and the hard thinking that had to go in to develop the concept, but he sometimes lost interest when it got to the day-to-day effort that it took to complete the thing.

Didn't that affect his teaching? Isn't it part of engineering to see a project through from beginning to end?

Yeh, I don't think it did because Fred was one of the best when he would read a report turned in by a student and there would be marks all over it. He'd do that thoroughly. I think the problem was that he was so busy in teaching as we were getting started that he didn't have the time to do anything but kind of consult with us and meet with us to give his advice or thoughts. By the time it got to the point where he had stopped teaching and spent full time here, the process of engineering that we went through had become complex enough that he was reluctant to take the whole thing on.

Every once in a while he would do a report or a critique or something like that; that he would do completely.

I guess the reason that I am asking so many questions about him is that he's not here to make a contribution about himself and what part he played in the firm's history. If he liked to do engineering and that's why he set up a consulting engineering firm, why didn't he quit teaching? He would have been pretty much in the same situation that all the rest of you were—the three of you—no other job, a family, a wife.

Well, he was older for one thing. And I think it was partly he liked the financial security of the university position and the permanency of it. Until he was old enough to retire with a state pension, he continued to work about 90 percent at the university—90 percent time I think they called it.

It seems like he was a man of contradictions.

Well, to some extent he was. He had a very strong personality and enjoyed being the leader, or the prominent person in any activity.

Except in this firm.

Well he was pretty prominent in the firm, too, from that standpoint. We took care of the workings of it, but he was a strong figure in developing our image initially and in public relations types of things that we tried to do to get our name in front of the types of people who needed our services. He was, you know, national president of the American Water Works Association, and active in several of the engineering societies, and he enjoyed those types of things.

But apparently he was domineering and contradictory and seemingly insensitive. Yet you, Howland, Hayes, Roderick, and Rice all knew him pretty well, and were nevertheless willing to put up with the problems and inconsistencies?

(chuckles) Sometimes it would be pretty irritating and at times we had some pretty hot arguments, but I guess it goes back to the same concept we all had, and that was we had to hold the thing together, and somehow compromise, or work out, or solve a problem of difference between us, so we could keep on going. If we always let those things get in the way, we never could operate efficiently.

So many businesses, and so many partnerships do let such things get in the way.

Yeh, it's perhaps surprising that we kept the four or five, six of us kept together as well as we did. It was usually a willingness on the part of all of us to try to work out a mutually acceptable solution. Sometimes that didn't work with Fred, and once in a while we would have to say, "No, Fred, we're not going to do it that way". Generally if it had been discussed long enough he would accept that.

Who worked best with him?

Burke, probably. And Jim and I next, I guess. The reason that it might have been a little harder for Jim and I was because we were either managing, or president, or something, and had to make these decisions. Burke wasn't quite in that position so he didn't get into as many confrontations.

You mentioned that Fred was good at making presentations. Are there any presentations that stand out in your mind as being outstanding?

I can think of a couple of papers that he gave at American Water Works Association meetings and the American Society of Civil Engineers meetings that were well done. I don't specifically remember what they were now. And on presentations to clients, regarding our capability and this type of thing, he would do very well in introducing the general subject and discussing the broad scope or approach to be used; then we worked with him as a team and presented other parts of the thing. As I mentioned here before, he had a good voice, and a stage presence and a sense of the dramatic if you want to call it that that made his presentations quite effective, I thought.

So he gave the introduction and the rest of you filled in behind?

Sometimes.

Even though he wasn't involved in the particular project?

Well, this was usually in an effort to make a sales pitch to the client.

Oh, before you have the project?

To get hired. Seldom did he participate in the presentation of the results except on something where we needed his particular expertise, like an elaborate treatment process or something.

Do you know why he was thinking about starting the firm in the 1940s instead of much earlier? If he had this idea, why didn't he start it earlier?

Well, if you remember, the 1930s was the Great Depression.

Didn't he start teaching though in the 1920s?

Yeh. He was in the British Army, or British Air Force, when he was seventeen by lying about his age so that he was in his early twenties when he graduated from Oregon State. And then, somewhere in that stage, he got a master's degree from North Carolina in sanitary engineering. I don't know exactly when that was. Are you going to talk to Anne Merryfield?

No, I'm not. I wasn't planning to.

Yeh. Well, I'm sure that information is available on the old resumes and stuff.

What were some of the major problems in those early years?

Well, part of it was financial. That is, we were in, today, we would say that we were in a tight cash flow position. We didn't have enough operating capital. The only way we could meet the payroll was by getting paid for the work that we were doing, and there was a period of time in there when the partners didn't pay themselves. It was pretty tight at times. I can remember

once, I may have told you this before, it was my turn to be the business manager and we didn't have enough money to pay the quarterly payment to the IRS for the withholding, and for a couple of weeks there I didn't sleep very well because I was afraid every morning that I might come and find the door padlocked by the Internal Revenue Service. Fortunately, somebody paid us and we paid it up and never got caught.

But none of you ever lost heart or lost faith that you would make it?

(chuckle) No, maybe we just didn't know enough to realize how bad a situation we might have been in. We eventually arranged to get some help from the bank; I think the first loan was either for three or six thousand dollars from what then was the Benton County State Bank, which eventually became the First National and now First Interstate, and that was rather difficult because we didn't have any assets essentially to provide as a basis for the bank loaning us money. For a good many years, the four partners had to individually sign the notes, as well as the partnership, so that all of our assets, our homes, our cars, everything else was on the line as far as paying that debt was concerned.

Was that first loan for equipment, salaries?

No, just for operating capital so that we had enough money to pay the salaries at the end of the month even though we didn't get paid by the client until the middle of the month or maybe the next month. For a good many years that was one of the problems that we were constantly working on.

You had no problems in finding clients, then? You had plenty of projects to work on?

Well, we worked very diligently to develop business and to find clients and to get work to do.

Who was the best at finding clients?

Well, Fred was; Fred Merryfield was probably the best at finding them. And then from there, the rest of us took it over to develop the work and establish the fee and negotiate the contract.

Who did that? Was it equally shared depending on the project?

I did it. Jim Howland did it. And Burke.

Who was best at making presentations to the client?

Oh, Burke was excellent. And Archie was very good. Your approach or method of presentation would vary to some extent on the audience.

Did some of you work better with some particular types of audiences than others?

Yeh

Tell me, who worked better with who.

Well, let's see. I would say Archie worked best with audiences that were technically sophisticated, and therefore were interested in the technical aspects of the project. Jim Howland would do a better job with the type of people who were down-to-earth, practical, and economically inclined—that would watch costs carefully. Fred worked best with a large audience where an inspirational or an exciting type presentation was called for. Burke was a very smooth presenter. As long as he knew that the discussion, or the presentation, was about a subject that he was familiar with, he did an excellent job—he had a good presence (pause).

You left out two people.

Ralph had a kind of an old shoe approach. This will sound like a derogatory term but it's not meant that way. He worked best with the "old boy" type of person. Now who'd I leave out? Me? I don't... I guess I worked the best with client boards and groups who were a combination of businessmen and doers, or leaders in the community or the business or whatever it was we were working on. You know, when you go through it as long as all of us have, why, you make presentations to all types and mixtures of audiences, so it's a little hard to say exactly how that happened, but I think the way I've summarized it is pretty good.

One person said that you and Burke Hayes did better with a sophisticated audience like city people, whereas the other three, excluding Merryfield, did better with a smaller town audience.

Well in general, that's probably true. I don't think Archie is in that category. He got some of the biggest jobs, like the big sewage treatment plant in San Francisco, that was purely Archie's doing.

Was there one particular individual that provided more leadership than the others?

It was pretty much a kind of mutual thing. Fred provided the big picture thinking. Jim Howland, who you know was President and General Manager for... Maybe I'd better start back a minute. When we first started, of course, I was the first one back here so I was the General Manager. But we were also doing the technical engineering work so for a while we rotated that [the function of manager]. I'd take it for six months and then Jim would take it for six months. I can't remember how long that went on.

Just the two of you? Not Fred Merryfield or Burke Hayes?

No, Fred didn't have the time because of his teaching load and Burke, for some reason, didn't want to do it. At any rate, Jim and I rotated that thing and traded off every six months. After a while, they got to deciding that Jim was probably a better manager than I was, so he took it over and he managed it and was President after it became a corporation.

How was it that he was a better manager? What do you mean by that?

Oh, he paid more attention to details and was more energetic about it, I guess. And then every once in a while, one of us or the other would get heavily involved in a big project and couldn't spend the time on the business management end that we should, and that may have been why we stopped the rotation system. I don't know, except that we began to realize that there needed to be more consistency and a continual effort on that and that changing that responsibility every six months was really not a very wise way to do it so, just by mutual agreement, Jim gradually became the General Manager.

Under protest?

No. I think we all felt that that was the way that we ought to go and that he was the best at managing the thing at that stage, and so we just told him that's what he was going to have to do. In the early days, we used to have a partners meeting every Monday at noon, I think; and for a long time, we'd have a hamburger and a milkshake brought into the office. That's when those kinds of decisions were made.

One of his contributions then was his ability to manage the firm?

Ummm, hummm.

Was he able to find time to work on projects as well?

Yes, he did; quite a few, too, also in that period. And then, as the thing developed, we took the Northwest and we split it into territories. My territory was east of the Cascades from the Canadian border to central Oregon. Archie Rice's was west of the Cascades and south of Salem, and Ralph Roderick's was west of the Cascades and north of Salem which then included Portland and Seattle. And when we started that, I was spending a lot of time traveling to eastern Oregon and Washington, and so Jim Howland managed the operation and the business development and the project management in those

He oversaw...

The whole thing.

Does that mean then that each of you people had charge of the projects in those particular geographic areas?

Ummm, hummm. And the development of new projects and new work in those areas.

What if Archie Rice needed your skills in his area? Was there overlap?

I helped him. Burke's job at that time was to work on power and what they now call energy projects, and so he would help us all on his phase of the thing.

I'd like to talk about Burke Hayes and his contributions to the firm. What do you think he brought?

Well, of course, you recognize that Burke's education and background and experience had been in the mechanical and electrical work which Jim and Archie and Ralph and I were not trained for. Plus he brought a meticulous ability to analyze things and to develop technical solutions, and a knowledge of the electric power and mechanical electrical field that none of us had; and that was his major contribution.



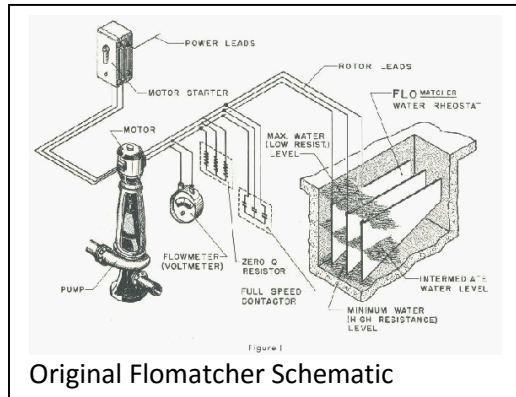
Burke Hayes

One of the reasons, I think, we were able to grow and develop as we did is because we had the capability to handle electrical and mechanical technical problems through Burke all in-house, whereas most of the other consultants were, for example, just civil engineers and, if they needed an electrical or mechanical expertise, they had to go out and find another consultant to help them with it. One of our strong points, we thought, and we used to use this in our promotional efforts, was that we could provide the whole thing in one place and from one source.

What do you think Hayes' greatest achievement was? The Flomatcher?

Oh, well, yeh. Prior to that, he was the one who convinced the Eugene Water and Electric Board that we could do the expansion of two of their power plants which were major projects for us in the early days. He was responsible for developing that business, and then the Flomatcher, and the technical

application of what at that time were advanced concepts of control and electrical/mechanical applications to the waste treatment, and the pumping stations, and the water supply operations that we were working on.



Original Flomatcher Schematic

He was innovative, then?

Umm, humm. Out of the need for variable speed pumping system for the sewer pumping stations that we were designing that had a large difference in the rate of flow, due to the

fact that in the summer when it didn't rain there was very little flow and in the winter when you'd have these big storms it was very high, came the development of the Flomatcher.

That must have been exciting?

Well, yes. And for a long time, we'd design the Flomatcher and have the contractor build them from drawings on the plans. Eventually we started the Flomatcher Company as a separate operation which Burke managed for a while and then Archie took over and we eventually sold it. I can't remember when that was, sometime in the 1960s.

Burke Hayes shied away from being the manager?

He managed projects but he didn't normally manage the firm. (pause)

Can you talk about his personality and how he fit with the others?

Burke had a pleasant, easy-going personality, and normally was not argumentative, particularly. Once in a while he'd get a particular thing that he felt strongly about and would make a strong argument for it; but he was generally willing to compromise, and did a lot to help us keep the group on a relatively even keel, and not get all split off over arguments.

How did he do that?

Just by calmness, and a careful analysis of the problem, and a willingness to listen to the other side.

He was in charge of the electrical aspects of the engineering. Can you talk about how that aspect was developed by him?

Well, I mentioned that he was responsible for getting us started in the electrical power work with the Eugene Water and Electric Board. He generally kept contact with most of the electrical utilities in Oregon, then later in the Northwest, and on beyond that nationwide. He was well respected in the electrical engineering field, is still well-known and looked up to by a lot of the electrical engineers, particularly around the Northwest. Burke could make an excellent, dignified, but practical impression. He was not as aggressive as, for instance, Archie or Ralph and perhaps I was but at the same time, he kind of stuck with things and carried them through pretty well.

You mean aggressive in getting projects?

Yes. And, you know, the pushing things through to completion. Burke made a real contribution. Some of us were discouraged at times because of his liking for experimental and investigative type engineering work, and sometimes he would wander off on one of those tracks rather than sticking with the project he was trying to finish. That, at times, would get a little frustrating; but at the same time we needed somebody with that kind of analytical ability who could kind of stand back and look at the whole picture, and come up with the suggestions or ideas or solutions that may have been needed.

Would that get the firm in trouble, his coming up with experimental engineering work?

No, I don't think it ever did. Burke was pretty sound and always did things after discussing them with the rest of us. I don't remember any times when we got in serious trouble.

I was referring to, CH2M HILL putting together a pamphlet proposing some bunkers along the coast, from an interview you did with a fellow named Hilton, and talking about proposing projects to the clients.

I think that's a pump storage project in Coos Bay.

You didn't name the project specifically.

I wouldn't say that really got us in trouble. Some of our competitors complained that we were doing free engineering because we put together the pamphlet and some pictures, and a description of this idea. In today's time nobody would even think about worrying about that thing, but at that time, our competition was sensitive to that kind of thing.

Who was the one that proposed some basketball machine?

Oh, (chuckle) well, that was Slats Gill. What he was looking for was a machine that would retrieve the basketball and give it back to the guy who was taking practice shots. I guess we built one once, or Slats did, and we were talking about the possibility of going into the development of this because Slats says, "well, hell, I can sell that to several hundred universities and all kinds of high schools."

Who did he sell it to in the firm?

I don't know, I guess it was probably Burke; but I think the reason for that was that Burke's responsibility at the time was what we had organized as a general services company which was taking these kinds of ideas. We spent some time looking at it, but I don't remember that being any particular matter of getting us in trouble. I'm not even sure that Burke didn't eventually say "look, that thing just doesn't have the market potential" we now call it, "that it should have" and it kind of petered out.

At one time, we used to depend on Burke to look at these kind of ideas that come in. (chuckle) Somebody was always coming in with an idea that could make them a fortune, you know. Even one guy used to come in and talk to one or the other of us about a perpetual motion machine he had invented, and he wanted us to build it. (chuckle) You know, people are always coming up with the thought that there is some way to make a machine that will keep running; you don't have to constantly turn. You know, you get close to it with some clocks, one thing or other. The energy requirements are low and you can wind the spring for a long time, but they still require energy.

You weren't convinced?

(chuckle) No. Hardly, but that's a far out example. But there were people who came in often with some kind of a machine to do something, and this person convinced one of us that it might have some merit, why we'd get Burke to dig into it. That was part of his responsibility as director of this company which we used at that time to develop new ideas. And then, you have probably learned, we did develop half a dozen of them. Some turned out better than others.

Why would people come to you, to CH2M?

Because we were engineers.

I know, but weren't you mostly requested to go out and consult on particular projects, not have people bring projects to you to react to them?

No. Sometimes people were looking for an engineer, I guess. I don't know how they would find us. Look it up in the phone book, or somebody would tell them to come see us. Even still we have people just walk in the door and want some help on something.

I understand that part, but I guess I don't understand...

(chuckles) Well, you know, people get an idea and they are always out looking for somebody to do two things: one, to work out the engineering or the details of it so it will work practically, and the other, to bankroll it. You know, a lot of the time they said, "Well I'll give you half the profits on this after the costs are paid if you will develop it for me." Well, (chuckles) in our position, particularly in the early days, we couldn't afford that, because we had to get paid for the hours we spent, and if we weren't receiving payment for most of the hours that we worked, we hadn't enough money to live on. So we tried to keep the charitable contributions as we used to say, to a minimum; but, in the process all of us have gotten involved in things that didn't pan out.

Was Burke responsible for bringing H. Zinder and Associates into the firm? I know you were involved, but weren't the electrical groups also involved?

Yes. They were primarily electrical consultants in the utility field. They did not design specific facilities, like a substation. They worked on the general aspects of electric power. Mostly hydropower. Back in the days when Eisenhower became president, he changed the Pacific Northwest public power operations from what up to that time had been a government financed 100 percent arrangement, to what in those days was called a partnership arrangement in which the government would put up part of the money and the individual utilities would put up the rest of it. As a result of that, [Zinder](#) became quite prominent in development of some of the big power plants on Columbia and the Snake River.

They were [also] affiliated with a Washington D.C. based group whose interests were somewhat different. They had an economist and they had some good electric rate and electric-power system study people, and I think the first approach, as far as Zinder was concerned, was made to Burke. Sol Schultz, who was running the Seattle operations for Zinder and was essentially the one who started that organization, spoke to Burke about it. I was in Seattle at the time, running the Seattle office, so I took over the negotiations from there, worked the deal out with Sol Schultz and Herschel Jones and Hal Mozer and (pause) two, three others. Sally Ruggles, for example, was their bookkeeper and secretary. She still works for the firm. She's the administrative manager for the San Francisco office.

So Zinder approached Burke Hayes about joining with this firm?

Yeh.

And then you carried through with the acquisition?

Yes.

Do you want to say anything else about Burke Hayes? Are you pretty satisfied with what we've got?

(Pause) Well, you know, he was for a long time on the Oregon Board of Engineering Examiners and made a good contribution there. That's a kind of ornery type of job and it doesn't pay anything, but I think the firm and Burke contributed a lot in that aspect of the things. I guess in a way I always wished that Burke had been more aggressive in respect to developing work and moving us into the major aspects of the power industry. But you kind of had to live with Burke as an individual—with his approach and admittedly he didn't have very much to sell there because we didn't have a strong power or electrical-oriented group at that time.

How could he have developed more work in the power industry?

Oh, in regular attendance at meetings of the various organizations that represent the power industry of the Public Power Association and the National Electric Board and the engineering societies, whole series of other things. Part of what we did in the water and waste field was developed through a consistent and aggressive attendance at all of the Water Works and Sewage Works and related organization functions, and taking part in the activities, being on committees, being the president of local sections, or something like this, all of which gave you an opportunity to meet potential clients and learn about possible projects and develop them. Burke did some of that, but he got a little discouraged with it because he said those things were closed shops and they are run by other people. Well, when we got Sol Schultz and Herschel Jones and Hal Mozer on board [from Zinder and Associates], they were already actively participating in those things, and continued to do so, and we've done better since.

Couldn't he have sent somebody else in his place, or do you feel that he was the only one that could have really make the contacts?

Well, I think he did send somebody else. I think Dick Nichols went to those things pretty religiously, but Dick was not the promoter type I guess is all you could say. And to some extent, I guess Burke is not.

I am sure all of you had short-comings that the others recognized. Was there anything like an open forum where you could give criticisms and suggestions to one another?

I'm not quite sure what you're getting at.

You said that you didn't feel that he was aggressive enough in acquiring more projects or clients in the electrical field. Was there an open situation in the firm, among the principals, so that you could feel comfortable in giving criticism or making suggestions to another? Did you have that kind of a relationship?

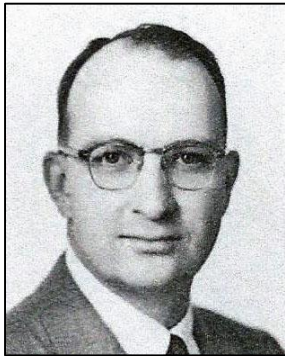
I think I talked to him about it and his answer was, "be that as it may, that thing is a closed shop, and I don't know how to get in there." He had a little

harder time than the rest of us. You see, about the time we started this, Fred Merryfield was the power in the water and wastewater field. He had been president and longtime secretary of the Pacific Northwest section of the American Water Works Association, and later on became national president. He was well known in the Sewage Works Association, and from that acquaintance would get Archie and I and Ralph to give papers, and get on the programs, and do all of this kind of stuff, which helped. Burke didn't have anybody to help him do that kind of thing, or give him the opportunity. So I don't know, maybe I was expecting too much. Probably was to some extent.

I'm just asking what kind relationship...

Yeh. We talked about it. And I would say, "Burke, you ought to go to the Pacific Northwest Public Power Association meeting." Well, he didn't so as much as I think he could have.

Can you talk some more about Jim Howland? Would you talk about what you felt to be his greatest achievements?



Jim Howland

Well, Jim had the responsibility primarily for soils and foundations and for highway work, what little we did in the early stages; and was instrumental in developing what later became or what is now the geotechnical discipline, because he took his master's work at MIT in that field, and so he could add that to our technical capability; and he also helped to develop the business and to control the costs and to manage the financing and, at that stage that we were in, that was a difficult thing because we had no resources to begin with and we had to watch everything very carefully.

It seems funny now, but we used to worry a great deal about costs which now we pay no attention to, but you had to do it in order to lift yourself by the bootstraps which is essentially what we did. And that I think was the real contribution Jim made, because he insisted that we had to operate within our income and that we had to keep the costs down. At our partners meetings we used to argue with him that we ought to raise the partners' salaries and he would insist that we couldn't afford it, and so we didn't. If we did have a year in which we made some profit, we tended to leave it in the business and not pay it to ourselves.

The others of you felt like you should get a salary raise?

He would try to show us, you know, that we needed the money to expand the business, and we'd have to wait until later for that [salary raise], and it was often a compromise. But all the same, Jim kept us straight and kept us from getting into too deep water financially, and I'm sure that that's one of the vital factors in us being able to develop and grow. Eventually it worked out fine but times were pretty hard for a while. But Jim stuck to his guns and he ought to get a lot of credit for doing it because it was real important.

This "no frills" attitude?

Ummm, hummm.

That was tough on the rest of you, though?

Oh, I don't know that it was **that** tough, you know. We were interested in what we were doing, and though we worried a lot about it, we enjoyed it. So we managed to make out; nobody starved to death.

During these partners meetings in the earlier years, did you discuss each project individually?

Quite often, and try to work out who was going to do it and what the solutions were, and sometimes we got into talking about the technical problems; and also, every week, we'd have a report from Jim on what the income was and what the costs were and what our bank balance was and all this sort of thing; and then we always spent time on what we called business development—what the new projects were and how to proceed to try to get this assignment or that one, and who could do it. So we worked together very well, I would say, for four, which later became six, people with diverse backgrounds and different approaches. By being able to communicate regularly, we got through the early stages of the development.

How were conflicts resolved during these meetings?

Oh, we just kept talking about them and working on them until we finally reached some kind of a solution that everybody would accept, reluctantly or not.

I'm sure you're all strong-willed independent people. Wasn't it difficult to resolve conflicts?

Yeh, except I think we all had the recognition that we needed to do the thing that everybody could support, and felt some enthusiasm for going ahead with, so that, as a result, nobody really had any concern about their own personal feelings or their ego or anything else. They just tried to keep working on the problem until we worked out a solution that was acceptable. And we managed by a consensus on the major decisions for a long time. You know, somebody who was opposed, if it looked like everybody else thought he was wrong, he'd eventually say, "Well, all right. If you guys think you're right, go ahead." And he would support it.

Nobody went stomping out and said, "I give up"?

No. That's probably where part of the strength of the company comes from, you know, was the fact that maybe all of the decisions weren't as good that way as if one man had made them but they held the whole thing together, and everybody supported the decision when it was made and understood why it had been made.

It doesn't sound like there were very many personality conflicts either?

Well, no, there weren't in the sense that we didn't jaw at each other. There were personality differences. I guess all of us were old enough by that time to recognize that personality conflicts had no place in the thing.

They shouldn't, but often they enter into it.

They do, but somehow we managed to keep that out of it. You know, Fred Merryfield was a driving individualist and he could be real difficult at times and Jim, as the manager, had his troubles with Fred, I'm sure. I know because I was in on some of them.

You had to appease him, you mean?

Yeh. Trying to appease him. Trying to convince him. Fred was always trying to get us to do more things than we were capable of doing at this stage. This resulted in conflicts, but we managed to resolve them and Fred eventually would agree. And one thing about Fred, he left the financial and the business management of the operation up to us, partly because, in the early stages, he wasn't available enough to be involved in detail anyway; but he left the financial and the business decisions up to us.

Up to the other five?

Yes.

I know that Archie Rice was the fifth partner, and came about the same time as Ralph Roderick. Can you remember your first encounter with Archie Rice—how that came about?

Well, Fred had said, "Look, Archie Rice is getting out of the Army, and he's the smartest guy I believe that I've ever taught in sanitary engineering." See, Jim was a straight civil with a soils special, and I was a structural engineer, and with Fred being busy most of the time at the college he thought we had to have a good sanitary engineer, and so he recommended that we hire Archie. You'd better talk to Archie and get this story straight, but he almost didn't come to work because of something like a ten or twenty dollar a month difference in salary between what he thought he ought to get and what Jim would offer him.



Archie Rice

Oh. (chuckle) Fred Merryfield had kept in contact with him when he was in the military?

I guess. I'm not sure about that.

You heard Fred Merryfield talk about this exceptional student and say, "We've got to have him."?

And by that time, Archie had been out of school for four or five years and had worked for the Oregon State Sanitary Authority before he went into the Army and then had been, I don't remember what they call it, but a sanitation

officer in the military. He worked on the water supply systems and sewer systems at the Army bases; I think his last assignment was in Savannah or Augusta, Georgia, somewhere.

How did you people feel about adding another person to your payroll?

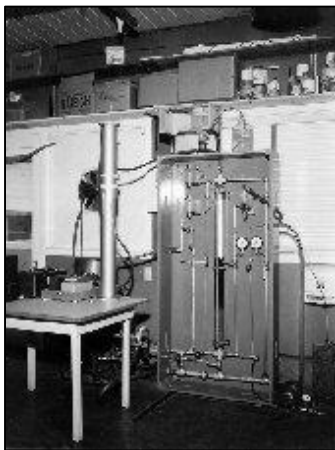
Well, I think at that time we had work to do and we needed some good help and here was somebody that seemed to fit. If we could afford to pay him, we were going to hire him, which we did fortunately.

Can you talk about his contributions then?

Archie's contribution was in the sanitary field; and Archie was a brilliant designer, and he could write very well and wrote excellent reports. He came along just about at the stage we began to get the jobs on the waste treatment along the Willamette River and also the additions to the water systems that had been neglected and so he managed the water supply and waste treatment projects and essentially designed them, and I'd do the structural and Burke would do the mechanical and electrical and Jim Howland would do the foundations. And as it gradually began to work out, Archie would mostly do the waste treatment plant studies and designs and Ralph Roderick would do the pipelines and the water treatment work, and I spent more of my time on business development and doing the structural design, and Jim managed it, and Burke did the electrical and mechanical and also the business development.

I understand that Archie Rice was very involved in Microfloc?

Yeh. This developed from a process that kind of, by necessity, was developed by Walt Conley and another man at the [Hanford] atomic plant in Richland, Washington. This was a high rate filtration system, and eventually we got to using the so-called dual or multimedia filter bed. At the time, we called it the General Services Company which eventually became Microfloc.



Original Microfloc Pilot Filter

The development that I think Archie probably contributed mostly to there was the development of a system using a pilot filter by which you could control the chemical dosage for water filtration—it eventually became the so-called Microfloc system. Along sometime in the mid or late-1960s, we sold it to Neptune Meter Company in exchange for Neptune Meter stock. We were having some difficulties in

engineering because people were accusing us of having a proprietary interest in the [Microfloc](#) system and therefore, you know, we weren't providing truly objective engineering decisions, plus the fact that we weren't really constituted as a manufacturing and equipment marketing organization; we were basically engineers. So it looked like it was better to split that off. For a while, we did operate separately, and then sold it to Neptune and split it off

as a separate equipment operation.

Was it a positive move?

Oh, I think so, yes. Then for five years, Archie managed Neptune Microfloc. He was not associated with CH2M at all, other than being on the Board of Directors and helping us out, he didn't work here at all for that five-year period. During that time, he got Walt Conley on the Microfloc payroll and built the business; and so, at the time that it was sold, it was a pretty good deal and six, eight, I don't know, primarily the six of us, did pretty well on that stock eventually.

The six original people?

Ummm, hummm.

I understand he's quite a character. I saw some photos in the archives of him dressed up as a woman?

Yeh. Archie is pretty outgoing and a lot of fun and he enjoys that type of thing. The picture you're talking about was a skit that he and some others put on at a section meeting of the American Water Works Association; he was an irate lady customer as I remember it. He and Jim used to be... He used to be Santa Claus and Jim Howland used to be Rudolph the Red Nosed Reindeer, and Jim would come in with a blinking light on his nose pulling a wagon in which Archie as Santa Claus would sit and he'd dole out the presents.

Oh, he would be sitting in it? (chuckles)

...well we couldn't hardly pull a sled. And Archie would be the Santa Claus and give out the presents with all kinds of, you know, funny gimmicks and cracks about people and stories about what they'd done. He did that for eight or ten years. He's kind of a ham, yes. Finally got tired of it. But he was always up to something. I can remember some of these stories. One of them is, I guess I was the manager at that time, anyhow, Archie and Ralph Roderick were at Pendleton running a pilot plant. Have you heard this story?

I don't think so.

Well, they were running a pilot plant up there at Pendleton on the waste from a pea cannery which is highly polluting. They were trying to figure out a way to handle it because we were working on the design of a treatment plant for Pendleton and so they had a bunch of tanks and pumps and one thing or another all put together there in Pendleton that they were trying to run. This is secondhand and if you're going to talk to Archie, maybe you'd better get the story straight from him. But, anyway, they had wires wandering all over and one thing or another, and somehow Ralph got caught in the middle of one of these basins about this deep in pea waste and Archie says, "Turn off the motor" and Ralph reached over to the switch box and of course, the

minute he hit it, he got a shock that knocked him over into the pea waste. And Archie died laughing.

(laughter) Good heavens.

And, let me think. I may have told you this. When Archie and Ralph were up there at Pendleton they used to play cribbage every night, and Ralph Roderick is an expert cribbage player. Finally, at the end of the month, Archie sent in his expense account and one of the entries on there was cribbage losses—twelve dollars or something like that. Knowing full well what had happened, Jim Howland, who was checking his expense sheet, put a big red circle around it and said, “Disallowed”. This just tickled Archie to death; he knew that’s what was going to happen. And he was always trying, and doing things like this, to make life fun and interesting; and he did. He contributed a lot to good nature and laughter in the operation.

He provided comic relief, I bet, in those partners meetings then.

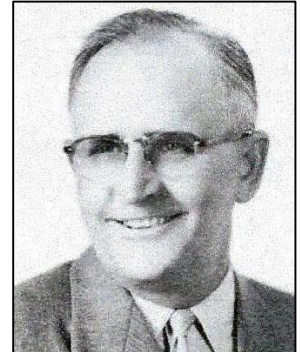
Yeh. Tremendous wit and always coming up with something.

I understand Ralph Roderick joined the firm about the same time as Archie Rice; they both came at the end of 1946. Can you remember your first encounter with Mr. Roderick?

Well, he and his wife showed up. They were living in a motel and they had a little spaniel, a small edition of—I can’t quite remember the breed—and they didn’t have any place to keep him. We were living over in a little house on Tyler Street just off Ninth and we had a fenced-in yard and we had a cocker, so we took care of Ralph’s dog. I don’t remember for how long, several weeks until they got settled.

And that’s the first you knew him?

That’s my first real memory. I’m not sure whether I talked to him when he came out the first time or not. I may have been off in Forest Grove or something. It’s hard to remember all the sequence of that without going back and digging it out. But at some stage in there we had just finished the job of building a reservoir for Forest Grove and decided that they needed a water treatment plant; and Ralph Roderick designed that, as I remember it, and I worked with him on that thing. I think that’s the first project we worked together on.



Ralph Roderick

Do you remember the discussion about hiring Roderick?

Not specifically. That was only 37 or 38 years ago.

I know, I have a hard time remembering what happened last week.

I’m sure I was in on it and I agreed with what they were proposing to do.

You don’t remember the specifics. I know that you offered the job to the fellow he came with, his brother-in-law, was it?

Yeh. Charlie Bayles.

Charlie Bayles and you didn't ask Charlie Bayles to be a partner?

No we didn't ask any of them to be a partner until after they had been here for a year or two.

But I think Archie Rice joined with the idea of becoming a partner.

Well, yes. I think maybe we had said something about we'd give him some kind of chance at having interest in the business. I think we probably said the same thing to Ralph. The only answer I could give you to that was that Charlie Bayles just was not a leader and a manager of people and operations.

And that's what you were looking for?

That's what you needed.

All of the ones that were partners had those qualities?

Yeh. We thought we did.

Can you talk about Roderick's contributions?

Well, he had worked for a consulting engineer and then for a city in Kansas before the war so Ralph probably had more experience on actual design and contract administration and all of that than any of us. So his contribution was to give us the experience and the background of how to handle the municipal work on the contract administration, and also a lot of practical capability on the actual design of the facilities that we were working on.

What do you think were his greatest achievements while he was working with the firm?

Well, my personal opinion is that Ralph's greatest achievement was in insisting that we go ahead with the design of the advanced waste treatment system at Tahoe. I think, if it hadn't been for Ralph, that we'd all have got cold feet, but he insisted that you could do it. We were going to apply the Microfloc system of filtration to the thing, and he got Russ Culp out here to go to work for us. He just pushed that thing and insisted that we do it. I think that if it hadn't been for him we probably never would have done it and that was one of the things that really got us started on a nationwide reputation, because that was the most advanced system there was for a long time.

The rest of you didn't think you could do the project or supply the system needed at Lake Tahoe?

Well, that was getting pretty advanced. It was out of my field; I didn't have much to do with it. But I know that some of the other people that were working with Ralph, the sanitary engineers and so forth, were afraid of it and weren't sure that it would work. And Ralph insisted that, "Yeh, we could make it work," and so we went ahead with it. But there is no question in my mind, that's [Ralph's biggest contribution](#).

Now Ralph managed this office for a long time too, you know. And he and Della Hickey [head secretary], they wouldn't do it that way now, but he and Della Hickey just on their own decided that, by golly, they were going to put the specifications on what, at that time, was a new advance which is the IBM Magnetic Tape Selectric Typewriter (MTST) and we had the earliest computerized, if you want to call it that, specifications system of almost anybody I know. He went ahead and did that just because he thought it would work, and they made it work and it worked well for a long time.



Della Hickey Matthews

So he was a man ahead of his time also? He was a motivator?

Yeh, you bet. Ralph was a motivator. Ralph was not afraid to try something and he worked hard at it. He saw ahead to what was coming and he tried to get us to move in that direction. Ralph is very conservative in his personal life and all this kind of stuff, but in engineering he looked ahead.

What motivated you four partners to ask Archie Rice and Ralph Roderick to become partners? Did you not feel like you were sharing more of the pie than you wanted to?

They were working just as hard as we were and contributing just as much and getting just as little out of it. So we figured, in order to make it worth their while to stay, we ought to give them a piece of the action.

All four of you agreed to ask them to be partners?

Yes. I don't remember that it was any kind of a difficult decision. I don't know. It took two or three years before they became full partners and I don't remember now all the details of it but there was no question what they were equal partners in terms of responsibility and one thing or another. I can remember saying to Archie once, "Well, hell, if you're going to do as much work as the rest of us and contribute, then you might as well join us and accept some of the liability." (laughter)

It was very significant though, adding these two as partners?

Yeh. Kind of from that came the general philosophy that people that contribute ought to also participate in the ownership and the benefits, if any. Because, eventually, before we incorporated, there were twelve partners, I think, wasn't there?

Yes, there were. Can you talk some more about Ralph Roderick?

I mentioned about these things that he did when he used to be manager of the Corvallis office. At that time he and Della set up the specification system. He was constantly working on new ideas, or trying to get us into new fields.

New fields?

Well, new applications within the sanitary engineering field I guess you would say. He worked hard, he worked well with people.

What about his contact with the Hill organization?

Yes, I guess that that is something that was important. You have to remember that at the time that was going on, I was deep in operations in Seattle. We actually merged with the Hill organization in 1971, was it?

Yes.

Well, I was in Seattle till 1971, so Ralph had worked, and Jim too, I guess, and Archie, with the Hill organization and I had not had very much direct experience with them; so I am not really familiar with the developments that went on there.

Didn't he make the initial contact with the Hill organization in the fifties?

I think so, yes. I think their first contact, as I remember it, I'm talking kind of about hearsay; but I think their first contact was a problem they were having with the City of Redding with a pump station that cost too much when it was designed by somebody else, and somehow Ralph got to talking to Clair Hill about the possibility of using a Flomatcher type application; and eventually we did design it for them. I think that's the way it started. I don't know. Does Ralph confirm that, or did you ask him?

As I remember from Rice the first CH2M contact was when Rice bumped into another fellow he knew in Brookings. This fellow worked for Clair Hill. Clair Hill was there and that was the first initial contact. I don't remember if they had any business dealings with him then, though.

I don't know about that. I guess I said in here before, he [Ralph Roderick] was quite conservative in his private affairs, but in the engineering side of the business, was aggressive and forward-looking and innovative, and wasn't afraid to try something new.

PERSONAL PHILOSOPHY, MANAGEMENT STYLE, AND INTERESTS

Personal Philosophy

How about the others of you?

Oh, we were various shades of conservative, I guess. *Would you say you're one of the more liberal minded of the six partners?*

I suppose so. I have never talked to any of them about their basic personal beliefs. That may be one of the things that helped us all manage to keep together, because we figured each individuals personal life was his own and it was none of our business what he wanted to do with it, or how he wanted to think, or what beliefs he had, so long as it didn't get so outlandish or too radical that it hurt the image of the company.

I guess I assume that you are all very close friends and that discussion of personal beliefs would naturally enter into your relationship?

I would not say that we are close friends from the standpoint of discussing with each other our personal life, or our personal problems, or something like that.

So if you had personal problems, you wouldn't look for support from these other original partners? You might rather take your problems to someone else?

Yeh. I guess so. I don't know. I don't know what kind of problem that would be. If something was related to the financial aspect of the firm, or my relation with it or something, I wouldn't be afraid to go talk to them about it. Maybe the other guys have talked back and forth to each other about these things, but I always respected the other guy's privacy in his personal life and beliefs, and they respected that in me, near as I can tell.

I might tend to be more liberal about some things than they are, but that's partly talk and not all real, you know. But your personal beliefs have just never been a matter of concern by any of us that I know of. I know I get a little irritated with Jim Howland sometimes because of his emphasis on character and—can't think of some of the words he used to express it. My tendency is to feel that yes, you got to be honest and you got to be trustworthy, but we aren't hiring people to be models of somebody's idea of a good character. We're hiring people to get a job done, and if they can get the job done, and their personal lives don't otherwise interfere with it, why, let them go.

Have you seen the Little Red Book, or what he now calls the revised edition?

Oh, Chairman Jim Speaks?

Yes

What do you think about this book?

Well, on the face of it I don't disagree with anything that is in there, but you can see the kind of approach is somewhat like "father knows best," which is not my style. I tend to try not to tell people what they ought to do or anything else, but expect them to produce.

What do you think he expects from books like that?

That that will help people be better members of the organization, I guess.

But he's looking beyond the organization, you're saying?

To some extent, I think. Yeh. You can't help but put your own personal attitudes in there. And that's all right.

Over the years, how have you—not you personally, but all of you, dealt with Jim Howland's feeling about this? Do the others agree with his approach?

Some don't disagree very much. Sometimes I've said, "Hey, it's none of our business what somebody thinks or believes. What's he doing that's wrong"? Or, "How does that make him a worse contributor to the firm's interest"? Sometimes I've talked him out of some of that. It is strong. And Jim is pretty open-minded. He doesn't try to insist on his ideas being followed in every way. So, from that standpoint, it's never been a real problem, I don't think. This varies, you know. You can go make a survey of the firm and you'll find that probably, surely half of them, maybe a lot more than that, like Jim's approach.

One thing that was mentioned by several of the others, the people I've spoken with at great length, and that is Jim Howland's attitude towards perks and (pause)—I don't know how to put it...

Ostentation and...

Yeh, that seems to be very important. How do you feel about this attitude of his?

I agree with Jim on the perk thing. I don't think that the top guy ought to have a bar in his private office, drive a Cadillac, and get free vacations on the company airplane, and use it to go to the Rose Bowl and these kind of things. I think that, simply from his position, he more or less has to have some additional things. If he wants a private secretary, he ought to have one. He should have a better office than most of them, and there is a certain amount of things you have to do to give the right image to the clients, but I don't believe in all these fancy perks that a lot of the top administrators tend to get. And some of it I get a little irritated with.

I regularly get fancy engraved invitations from the American Management Association indicating that I have been selected to be a member of—I can't remember what they call it. They have a group of top business people that they take into this thing; and they periodically have 2-week retreats, or something like that, in some resort they have got fixed up in Florida, or one up in Maine, which is just an ego trip for all of those guys; they sit around

and brag to each other about how well they are doing. I don't have much use for that kind of thing.

But the problem is that you have been successful. You and the others.

All right, but if I am successful I want to be recognized for my success not for how ostentatious I can look.

So you agree with that part of his philosophy?

Oh, yeh.

One comment was about his view of private secretaries.

Yeh, I agree with it.

That you shouldn't have private secretaries?

Well, in the sense that your girl Friday whose main job is to get your coffee, and pay your personal bills, keep your appointments and see that your tie is straight; otherwise sit there and manicure her nails until you holler.

Oh, boy. Is that what executive secretaries do?

Well, that is what some of them do. I guess the thing that cured me was that I was trying to get a job from a company and I was talking to some people. They had an engineering office in an open space building and they had partitioned it off. All around the outside of this big open space there were private offices. There must have been thirty or forty of them. Out in front of each one was a secretary with a typing desk and a typewriter, and all the times I spent going in there I didn't see a tenth of those secretaries doing anything but sitting there ready to answer the boss's telephone. Or at least that is my impression, I'm sure that's not completely right but...

Gosh, apart from its being boring; how uneconomical.

I believe a guy ought to have the services he needs to have to do his job efficiently; that he shouldn't have to do a lot of detail work that can be shifted to someone of lower salary who is perfectly capable of doing it. I don't have any objection to that. I have objection to the concept of the girl Friday, and this is what a lot of the people think that a private secretary is. It is a poor use of resources, people, and everything else. There are a lot better ways to do it, and you find that nowadays the progressively organized companies provide an administrative group which services a group of executives. This gives them the ability not only to tradeoff when somebody's gone, but to specialize in the kind of things they handle; and it supports the individual a lot better than one person being an errand person who carries the bosses' stuff to somebody else to have it done. Everybody won't agree with me on that, either.

Management Style

That leads into another question, that of management styles. I'd like you to compare your management style with Jim Howland's, with Harlan Moyer's and Archie Rice's too. Can you make some comments about that?

Yeh. I think I tend to be a more permissive manager than either Archie or Harlan. And I might appear to be more permissive than Jim Howland, but I don't really think I am. By permissive management, I mean trying to give somebody a responsibility and then leaving them alone to get that accomplished, rather than to tell them how to do it, or be very emphatic about the method they use or how they go about it.

And this goes along with your philosophy of "smarter than a dog"?

Um humm.

How would you apply this philosophy of permissiveness?

Well, I try to make sure they understand what their responsibilities are; to make the definition of their job and their responsibilities clear, and see that they understand it. And if I did it all right, I'd ask them to develop their goals of what they're going to try to accomplish in the position they've been given, and then review that with them periodically to see what kind of progress they're making. And the theory: if the progress is poor and I can't see an improvement, then I better change the person.

How does that compare to Jim Howland's approach, then?

Well, Jim's a little more directive about the things that he feels are important. However it is hard for me to answer because he doesn't talk to me as an employee. He talks to me kind of as an equal. So I'm not sure just how he operates, but I've observed that he tends to be a little—all I can say is dogmatic, not exactly demanding, more specific on what should be done. When you get right down to it, Jim isn't half as tough as he sometimes comes across, because normally Jim doesn't really make a major move without a consensus. Now Harlan doesn't do it that way. And neither does Archie. They'll figure out what they think is right and they'll go ahead and drive it through.

So how is that working in this firm? Or how did it work in the case of Archie?

Worked pretty well, I guess. Archie tends to get more accomplished than all the rest of us do. But there are some people that have trouble working with him.

So why didn't he take over then after Jim Howland? Why wasn't he considered the intermediary between Harlan Moyer and Jim Howland?

Oh, well, there was no intermediary between Harlan Moyer and Jim Howland.

Didn't you come in as interim President after Jim? And that was so that Harlan Moyer could finish up in Redding?

Where'd you get that? You're a cycle out.

I thought that there were six choices that the firm was considering for President. And ...

That's when I was President.

Right. Okay. That's true. But I thought—you better set me straight.

At the time that Jim decided he was not going to be President anymore, the Board of Directors sat down and tried to figure out whom to make president. And, the possibilities at that time were Poirot, Wierson, Moyer, Rice, Reynolds, probably Adams (pause) and Suhr also probably, and finally me. When the Board of Directors set out to make this decision they threw me out because I was a candidate.

Threw you out of the Board?

The Board meeting. But as I understood it, and I think this is reasonably correct, they didn't feel that any of the other candidates could quite move into that job immediately—that they needed more seasoning or something else. They couldn't really agree, but they decided that I would be harmless enough that they could put me in as President for a sort of interim period...

Oh come on, what's that mean? (chuckles)

(chuckles) Well, I think they were looking at acceptance, and the problems that they might have with a bunch of people untried and a job as big as that.

Why didn't Jim Howland just stay until someone definite was chosen then?

Well, I don't know exactly. I think he felt he'd been President long enough, and I think that both Archie and I, who had talked to him about this, felt the same thing.

That he had been in long enough?

That he had been in long enough, that it was hard on him, and that we needed some new ideas and some new approaches in the management of the company. To some extent due to the fact that he'd grown up from the beginning in a relatively small organization, it was hard for him to adjust his approach to what had now become a multithreaded monster. And I don't know whether—I don't know just why Jim decided to—I think Jim had that same kind of concern.

So it needed—there was a feeling the firm needed a new approach?

Well and they thought that making me President would provide a good transition and give us time enough to make a better analysis of what to do about the next President.

Why did they choose you, now? Why do you think besides that you would be the least harmful?

Well, they thought that I would have acceptance from the firm in general, that I had the experience and background, and was old enough and so forth that I could manage the thing better than anybody they had on the list that I named for you.

Did you enjoy that position? Would you have wanted to continue in it?

I'd never particularly gone out to be President. I got my kicks out of being one of the guys that started the thing, and my name was on the door, and I didn't feel I had to have the title and so on. Well, yeah, I accepted it because I wanted to see that the firm proceeded—went ahead in the direction I considered it ought to go. And I tried to do that. Didn't get a lot of it done at the time I was president. So then, I don't remember what I said, but I said I was not going to be President for three or four years or something like that. Then I began to do some thinking and talked to some of our management consultants, including a friend in Seattle who helped us on the long range planning. Do you remember what his name was?

Oh... I've heard that name, but I don't know it off the top of my head. This was just in the last few years—in the seventies you're talking about?

Yeh. Seventy-three or something four? And we set up a group. First we got a couple of people that were, you might say, outside committee members. One was John Gray, who was president of, among other things, I'll think of the name in a minute. The other one was a lawyer from Seattle who had been in the business of hiring engineers and watching them work for a long time. With those two, plus three or four others, I selected at random from the firm people who I didn't consider, or would themselves consider, or would we consider, as being candidates for President. We first set up the criteria for the Chairman of the Board and the President and kind of separated their duties, partly on the basis of what I thought I wanted to do because they all assumed I was going to be Chairman of the Board.

... when we got that done, we discharged that committee, and set up a selection committee also made of people who were not candidates for President, and went through an interview and grading process; had the candidates go talk to an industrial psychologist to get his view on the thing and went through it quite logically and thoroughly; and came up with the selection of Harlan for president with the concept being that the President would be the internal manager, and the Chairman of the Board would be the outside man who was responsible for public relations and the firm's image and the relations with the government, and this type of thing. And so I became Chairman for a couple of years, I guess; and when I retired and was no longer a stockholder, Earl was made Chairman and I was Vice-chairman for a year to make a transition.

Did Harlan Moyer turn out as expected? I mean did he meet your expectations?

He met mine. Yeh.

Has he carried on the tradition that you original four, and then six, started with?

Well, what tradition do you mean?

Well, the importance of the client, the one-to-one relationships, integrity of the firm, and other philosophies—really what Jim Howland encouraged all those year he was President?

Well, I guess so, I guess in the best way he can. And you know that philosophy you're talking about is difficult, if not impossible, to follow when you've got eighteen hundred to two thousand people. Jim worked harder at it than I have, or did. Harlan works awful hard at it, in that he's around this and all the offices of the company all the time. He spends more time on the road than either Jim or I ever did. But it's tougher in terms of decisions. He's able to affect the reorganizations and reassignments of people and compositions faster and better than we did, because he's not so concerned about the consensus, and when he's once convinced he knows what ought to be done, he goes ahead and does it.

So what was his reception, then, from the employees that have been with the firm under Howland?

I suppose that this bothers some of them. Nobody has ever come to me, and I have never heard anybody say anything about what Harlan has done in a complaining way.

You mentioned in another interview that you did with someone else, the biggest problem today are one, maintaining the quality with the size and diversity and the spread of operations; and two, motivation of the people—the firm is so large that you sort of have lost or tended to lose a one-to-one contact between people in the organization. What do you do about solving that problem? Or what's Harlan Moyer doing about that? Or is there anything that can be done?

Well, the way I can see that you can do that—particularly with the one-to-one or at least the evidence of personal concern for the individual—and the way I always do it, is to do it the way we're doing it now, which is kind of by accident. You've got really fifteen or twenty groups of people in regional offices with a regional manager who is supposed to take care of the one-to-one personal care and feeding of employees. There's no way that the top brass can do it. You know you can have rallies and pep talks like the—what's this group of people that sells the cosmetics?

Amway? Mary Kay Cosmetics?

I don't know what they do, but they have big rallies and give prizes and do all that kind of stuff. So I think you've got to depend on good managers to carry on that so-called tradition. They're the ones that have got to motivate the people. Try to work out for them how they can progress in the company if that's what their desire is, and also try to be close enough to watch the quality of the work.

Are you doing anything to encourage these ideas? I understand that Mr. Howland goes around to each of the offices that requests him and talks about the philosophy and history of the firm. Are you doing that, not necessarily in the same way, but anything similar?

When I'm at a regional office, if there's any kind of a meeting or get together I'm usually invited to come, and then they start asking me questions. I don't dwell very much on the history and background like Jim does. One of the

things I'm trying to do is quality control, or quality assurance we call it now. That's what this report I'm making

The audit?

Oh, we don't call it an audit. We call it a performance and procedure review.

Is it for the whole firm?

Well, this one we did for this office. But there is a team put together that makes this kind of a review of every office every two or three years. It's not always the same team. This is the first time I've done it.

Who chooses these teams?

Joe Worth does, whose job is (chuckles) I don't know what it is. His job is Director of Professional Practice which involves developing programs to review and improve the quality of your work, the procedures that are followed in executing the projects, and to work on the problems that result from errors, mistakes, omissions, whatever—try to find out what causes them, try to correct them and so forth. So he is essentially responsible for quality control.

So are you going to continue being on one of these teams?

I probably will be from time to time. I agreed that I'd try to work out what we're going to call a quality assurance manual combining all of these procedures, and try to develop a normal process that will ensure the quality. Then I get specific assignments on this type of thing. I'm the chairman of a review board that's responsible for the quality of the design of the deep tunnel system for Milwaukee. It's going to cost them some \$750 million dollars I guess when it's done. That's a for-the-duration kind of assignment, which is the duration of the project.

How does your schedule of going to Arizona and playing golf and relaxing fit into this assignment?

Well, I can get to Milwaukee as easy from Arizona as I can from here probably. I'm only an hour and a quarter from Denver if I got to go meet with Harlan or somebody like that. More and more as the firm grows, the Corvallis office is not the center gravity of activities.

I think you mentioned that it's been a problem having the headquarters located here. You're working then when you go to Arizona?

Part of the time, yeh. I guess I've averaged working, at least on the basis of a time sheet I fill out about half the time for the last year and a half.

Is that the level at which you want to continue working then? About half-time?

Yes, as long as I can contribute and stay healthy enough to do it. I get a little bored doing nothing, or just playing golf all day.

Interests

Do you have other activities you enjoy besides golf?

Not really. I don't have a farm like Archie does. I don't have a place over in the mountains like Burke does. I've got kind of a hobby of earthquakes, but I arrived at that from the engineering association.

I remember something in the archives about that. What do you do with this interest?

Oh, I belong to the Earthquake Engineering Research Association. I'm on a couple of committees, both the American Society of Civil Engineers, American Water Works Association, and work on the development of procedures and methods to design facilities to withstand earthquakes.

Did you go to California, then, and look at the structures down in Coalinga?

Coalinga? No, we were coming back from Arizona and we went within five miles of that town on I-5 two days before that earthquake happened. Like Cleo said, "It's a good thing it didn't happen when we went by there, or we might not be home yet!"

(laughter)

I'd be over there looking into it. I'm on a list of people that can be asked to go and look at the effects of earthquakes for instance, that are set up by the Engineering Research Institute. I haven't gone on any yet.

Do you do research on your own? Or is it just in connection with the activities of these associations?

In a sense. One of the things—I'm on the committee now to write what they call design notes for the life line facilities subject to earthquake, life line meaning almost infrastructure—water, sewer, highways, communication, power, whatever.

Why is earthquakes a particular interest? I'm surprised it's not bridges, stemming from your earlier interest.

Because when I studied structures at Yale, I got to working with the analysis of structures that were subject to lateral force as against just dead weight. One of the lateral forces you have to design structures to withstand is the force of an earthquake. Also wind, but the earthquake forces are so much greater.

... if you remember I started my career after graduate school, in San Francisco. John Rinne, who we mentioned, was chairman of the committee of the San Francisco section of the Engineering Society which developed the advanced approach to the design of buildings for earthquake. That development is still the basis that a lot of earthquake design is made. San Francisco is probably the most advanced in the world in earthquake design with the possible exception of Tokyo. So I enjoy this. Sure, it's kinda like a bus driver's vacation, but I go to these committees and we work on these things. It's interesting, fascinating, sometimes challenging. Like I say, I'm chairman of a section and my job is to write the part about design of water and sewer facilities for resistance to earthquake.

You're not involved in any associations building bridges?

Sure, yeh. There are lots of them. No, just haven't got into that.

So your time's pretty much taken with research and then your half-time position with the firm.

Well it could be the next three or four weeks I'm going to be working full-time. But when I get this job done and the review of this tunnel done, then I'll go spend part of my time working on this quality assurance manual and play golf the rest of the time, I guess.

More on Philosophy and Management Styles

Earlier when we were talking about Hardy Cross, you mentioned that Fred liked to discuss philosophy? Philosophy about what? I assumed you were talking about philosophy of life, and yet you said you didn't discuss personal beliefs with any of the principals. Maybe I made the wrong assumption?

Oh, in a sense I guess that's what it was. It was probably related to the profession that we were all in. (pause) Fred was a great one to discuss the basic concepts of politics, not the details of who you ought to vote for: British philosophy of government versus that in the United States; the concepts of preservation of the environment and the degradation or overusing resources; the ideas about what people needed to be not happy but fulfilled. He would enjoy giving forth on those things. And he had some good ideas. But I think that's the type of thing I'm talking about in philosophy. Not just personal beliefs. Fred never discussed personal beliefs to speak of. I can never remember talking to him about it.

But I thought that you partners didn't discuss your personal beliefs that are the impression I got, yet I hear you saying...

And now I'm saying the other thing? (chuckles) Well, it was never about personal beliefs. And it was not about a personal application of any philosophy. It was about a general concept of philosophy.

Did he bring that up in his classes, then when he was a teacher, or was this just between you and him?

Oh, once in a while he brought it up in classes when he got rambling. Gee, I can't remember at this stage. But I think probably he did some.

What would he have thought of the environmental movement and the environmentalists? Would he have been in accord with them?

He was probably the first environmentalist in Oregon.

I know that Tom McCall gets the credit for cleaning the Willamette, but apparently Fred Merryfield had a tremendous amount of input.

Well, yeh, but I wouldn't be surprise if Fred didn't put part of the idea in his head. He was a friend of Tom McCall's. And they knew each other. Fred was a Democrat, too. And Fred was one of the first appointees to the Oregon Water Resources Board, and did make the initial study on the pollution of the

Willamette River, and helped set up the criteria from which the original law was passed back before World War II or about the time of World War II.

Where did this interest come from? Most people weren't thinking of cleaning up the environment and even considering that the resources might be endless.

For the first part, Fred was a sanitary engineer: he worked on treatment of wastes and when you get into that you immediately start to look at what the discharge of the waste is going to do to the stream it's going into; from which he developed the concept of available oxygen in the stream and it's natural ability to purify it, or absorb or do something with wastes that came to it; plus the damage that was being done to the fishing—to the salmon runs that were coming up the rivers; plus somewhere he got the state to appropriate some money to make the initial survey. I suppose that's where it comes from. I think it probably started from a professional concern or interest in the problem of stream pollution. He was way ahead of his time.

It sounds like he was. Can you describe a scenario of all six of you on a Monday afternoon? Depict each person's personality and how they reacted in the meeting?

Well, Jim always had an agenda and we would start down the agenda. As I remember it, the first item on it was new business, proposals and so forth. And we'd run down the list of who was supposed to see who and who was responsible for doing what about those things. And Fred Merryfield would get started on how he knew so and so, or such and such and that this was the way, maybe, to approach it and finally somebody would say, "All right." Or Jim would say, "That's in your territory so you organize the approach and see if you can get that job."

Then we'd have a financial report in which Archie and I would complain about how we were starving to death and we ought to be making more money. (chuckle) And Jim would say, "Well, damn you guys. If you'd get a better fee and do the jobs more economically, we could make enough money to pay better." And Ralph used to say, "Well, let's don't pay out the money. Let's keep it in the firm. There isn't a better investment that you could make if you've got any money than in CH2M."

And Burke generally was kind of quiet and would kind of wait until everybody had argued back and forth and then would often suggest a solution or a way to work it out. And we would go at that for a while. And then we'd have a report on the major projects that we were working on, where we stood and what kind of help we needed. And that was about it.

Who dominated? Jim Howland was the chairman?

Yeh, but he had a little trouble dominating I would say. (chuckle) I don't know that anybody did unless Fred did if he got off on a particular thing that, at the time, he thought important or was bothering him. But sometimes, we'd just shut Fred up and go on with our own business.

So everybody knew about every project?

Oh, yeh. And, of course, you know, as that gradually grew and we got bigger and got to doing more and more, why [it would] worry some of us that, "Boy, we're getting too big. We haven't got the close, family kind of relation that we had, and how are we going to manage to do a good job and keep everything going and everybody motivated when we get so spread out and so large that everybody doesn't know exactly about everything that's going on and everybody doesn't even know everybody else?"

How did you resolve that problem?

I don't know that we have completely. But we still try to operate in relatively controllable groups. Instead of having two thousand people here, we get two thousand people spread in regional operations all over the country. The largest isn't over about two hundred or a little more, and each one of those offices tries to operate as a well-unified group where people know each other and so forth.

So you sort of kept that family flavor?

Tried to. We're losing it; it's not what it used to be and that's one of the things we had to sacrifice when we grew to the size we are, but we still make an awful lot of effort people-wise to keep people informed of what is going on and give them a chance to contribute and to ask questions. I don't remember just where it says this, but in the Policies and Procedures Manual we operate with an open door policy and we say, anybody can talk to anybody else no matter what his position, and we generally try to follow that. It gets kind of wearing at times but generally we try to do that. It seems to work.

You know, last weekend they had the annual stockholders meeting in Portland. On Monday morning they have a four-hour session on what goes on at CH2M and they cover all the offices and all the disciplines; each one gets about ten or fifteen minutes. It's an astounding thing when you get that whole story of how much we're involved in and how many things we're going. This is kind of an outgrowth of that [open door policy] thing and everybody seems to like it because it gives them a feel for what's going on that there's no other way to get.

All the project managers came to Portland in that period?

All the key employees, as we call them, which, you know, covers most of the major project managers. This is really organized by Sid and Gene Suhr, and they run it very hard-headedly. Gene stands up there with a baseball bat and if you go ten seconds over your time, he hits you with it. (laughter)
Theoretically.

I hope it's rubber.

ACCOMPLISHMENTS, EDUCATION OF ENGINEERS, AND THE MOVE TO SEATTLE

Accomplishments

You mentioned the Policies and Procedures Manual, and I understand that you put that together. Would you consider that one of your major contributions?

Oh, I suppose. You see, I left here in August of 1970 and went to Seattle to start the Seattle office.

1960, I thought you left.

1960, excuse me. And Archie, at that time, or right after that, went to work for Microfloc for five years, and then he came back and Jim made him executive vice-president. We never knew quite what that meant, but Archie, being the way he is, didn't have any trouble with what he thought it meant and proceeded to do it.

But anyway, he and Jim, along about 1968 I guess it was, came to me one day and said, "We need somebody to take a year off and take a look at the whole firm and the organization and figure out where we're going to go and develop a program," or what we now call a long range plan. I don't remember what we called it then. And they wanted me to do it. So I turned over the management of the Seattle office to Jim Poirot, and I took on this job; and the results of that first year's efforts were what I called an Engineering Production Study which developed the concept of where we were going to go, and what things were going to look like, and how we were going to do it, and what we needed to do about things like the computer and personnel and the organization and all of this. One of the things that I came up with in that was that we had to have a policies and procedures manual; we were now too big to be able to transmit all of this stuff by monthly or weekly partners' meetings. So my first assignment after I got the report done was to write the *Policies and Procedures Manual*.

Why did they choose you to develop this program?

Well, I don't know. Just thought maybe I'd like to do it, I guess, or thought I could do it, maybe.

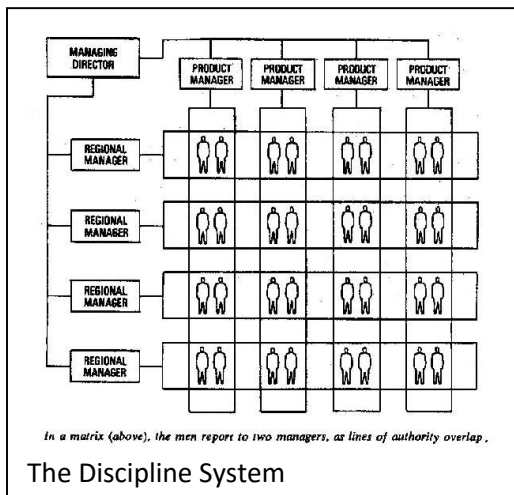
Well, they must have thought that. But for what reasons? Were you an exceptional communicator or an analyst? Manager?

I'm a pretty good communicator and fair analyst. I'm not a smart analyst as Archie is and a lot of others we've got. I think maybe they thought that if I did, and I came up with these ideas, that I could sell it and it would get accepted.

So you're considered a good salesman then?

(chuckle) Maybe so. It was fun. I enjoyed doing that work, that job. And, oh, that got us started in a whole series of things that we're still working on: management training and development, the centralized specifications system, the information systems that we use, the development and continuation of advanced technical effort. And I do think probably that study did have quite an influence on what we've done since because we've generally followed, one way or another, most of the things that were developed there. Haven't all taken the same shape as they looked like they would at that time, in 1970, but generally we've followed the general concepts that came out of that [study].

The one thing that study didn't do was work out a solution to the problem which we faced, which was with regional offices working in regions. There was a tendency for each region to try to build the capability so that they could handle any kind of project that came up which is not a very economical thing because it means that you are duplicating staff in all these places, and the results of the Engineering Production study recommended the organization of what I called, in that thing, a major projects division. We started the work on that, and Archie got to working with it, and it was Archie who eventually came



up with the concept of the discipline system [the forerunner of the matrix system]. He worked with me on it and talked me into holding a conference once with all the regional managers and the directors and everybody in Seattle to discuss this so-called, what he called, the discipline system, and at that meeting we decided we'd go ahead with it, which we did. We officially put it into effect just after we merged with Clair Hill which would be 1971, wouldn't it?

What was the reception from these managers? How did they regard this new

system?

(chuckles) As I remember it, we presented an approach to the organization of the company which would utilize this system and presented it on the basis that it was impossible to organize every regional office so that it had full expertise in every field that we worked on. We had to have some way to do this; and here was the proposal that we were going to follow, and what did we think about it. We discussed the idea; spent a whole day at least, or maybe it was longer than that. Archie and I had kind of organized it, and I guess to some extent predetermined what the decision was we wanted to come out of it. All I can really remember is at the end of it, I said, "Well, there's the program. If nobody really objects, we're going to go ahead and do it." And nobody really objected, so we did. (chuckles)

Were they just stunned or was it a consensus?

time; that's why there is so much travel because the guys that are expert on this, that, or the other thing, are in demand all over the company.

And Jim Howland saw it as a positive move, also? He was president?

Oh, I think he did after Archie and I kind of browbeat him into it (chuckles). Archie primarily. I don't remember if I said in here or not but in making the engineering production study I had come up with some kind of a similar need and the production study kind of defined the need. I had not seen the thing Archie eventually came up with, but I had put in a separate group, which I called the Major Projects, which was supposed to undertake the major projects and provide the expertise, discipline, and one thing or another to the other people. I hadn't thought of the so-called matrix. It was not a very common term at that time. Where Archie ran into it, I don't know; I think he came up with the idea and then he went around looking for some name he could tie to it for support for doing it, and he found this stuff on the so-called matrix organization.

Didn't Archie ask you to come down from Seattle to help convince the others of the need for the matrix system?

Well, after we had decided to do that, then it became necessary for somebody to run the so-called discipline side of the matrix, since Jim was running the regional side. I guess Jim wanted me to do it, and Archie finally convinced me I couldn't do it without moving down here where he and Jim and I could be together; Archie was then executive vice president or something like that. So I did.

You didn't particularly want to move down did you?

No, we liked Seattle.

Have you ever thought about moving back there?

Oh, yes, we have. But the difficulty is we sold our house on the water, on Vashon Island, so we lost the place to go back to.

You could always buy another one.

(chuckles). Well, maybe. Those kind of places are awfully expensive now. We should have kept it. Even if we were just selling it now, we'd get several times what we sold it for.

You can say that about most real estate now.

Yeh.

Does the phrase you coined, "smarter than the dog" have something to do with your management philosophy?

(chuckle) Well, that phrase comes from my father-in-law. It was my father-in-law's expression. Essentially he used to say, you know, if you are going to train a dog, you've got to be smarter than he is so you can talk him into doing what he needs to. I used it to apply to the concept that you've got to understand better than the individual you're trying to motivate or direct or

convince—you've got to understand as well as he does how he thinks and where he's coming from in order to influence him to do what you think needs to be done.

This goes for clients too, I imagine.

Yep.

How have you applied that philosophy?

(pause) Well, I try to figure out a way so that what I think needs to be done is also something that the individual who needs to do it wants to do which is the way you train a dog. You don't hit him on the head. You convince him with praise or with reward or something to do what you want him to do. And this, I think, is the way you have to work with people. You have to try to work out a way so that his goals and the company's goals fit and then he wants to do what the company needs to have done, which means that sometimes you adjust even the company's goals in order to make them fit the individual so that he can now accomplish what needs to be done with some satisfaction that it is meeting his own needs.

Is that difficult to do when working with a large organization?

Well, sure because that kind of a concept you apply on a more or less one-on-one basis except that the general concept of our operation, which is to try to give the people who contribute a piece of the action, is an application of this same concept. You know, if a good engineer wants to be in a sense a participant and an owner and a contributor to the organization he's working with, then you need to give him some voice in what's going on, and some piece of the action, and some way where his rewards have some relation to his contribution.

Is this where the Key Employees come in?

I guess so. The Key Employees really are what used to be the partners. And the first Key Employees were the twelve partners at the time. I can't remember where the Key Employee term came from. But it was a way in which we could give them ownership of the company, and it would designate partners without calling them that; because you can't have partners in a corporation, you can only have owners, stockholders.

Education of Engineers

This brings up another question. You lent me the book Engineers in Ivory Towers by Hardy Cross.

Yeh.

I looked at it. It was very interesting. In places, it was difficult for me to understand what he was saying since I'm not an engineer, but he obviously was a very thoughtful, astute person. He talked about the place of engineers in society. I would like you to say something about your philosophy with regard to the place of engineers in society and how they fit in?

(pause) Well, currently, there is a lot of discussion about the fact that engineers don't participate in public and community affairs the way they should, and they don't use their knowledge to help make the decisions on things that have technical ramifications, because they tend to be retiring and prefer to stay working with their slide rule or their computer and their project.

That's certainly a stereotype.

And they're oriented to a specific task. They're doers; they're not politicians, most of them, so that they have difficulty trying to influence people, particularly the general public, and they have distaste for the kind of conflict that, in the political world, is a way of life.

I guess my philosophy is, yes, engineers should participate in public and community affairs. But I think we have to remember that engineers, despite the stereotype, are all shades of personality, and for some, this type of thing are really not possible. They just don't have the kind of a nature that can make it possible for them to succeed in trying to influence or help on decisions which are involved in the public sector, and [to deal with] the notoriety and the publicity that comes with it.

At the same time, those whose personalities and interests and capabilities fit that kind of thing, should do it. I do not believe that decisions of a major nature should be made strictly by a technician, including an engineer, because they tend to have a tunnel vision that prevents them from seeing all the sides of a question. Therefore, I think an engineer should participate, but the major kinds of decisions that involve a decision about a technical matter ought to have some people with other backgrounds and other interests to counterbalance the engineer's tendency to seek the perfect solution from a technical standpoint that may not be the perfect solution from the standpoint of benefit to the people or benefit to humanity or benefit to the community.

After reading Hardy Cross' book, he seemed like the ideal engineer, combining the humanities with the technical field—a real renaissance man.

Yeh, of course, you have to attribute this partly to his background. He started out, didn't he teach literature or English?

So he brought a little of the humanities into engineering, then?

Oh yeh.

That's unusual for an engineer?

Ummm, humnun. So he was always more of a general philosopher than most strictly engineering professors. Fred Merryfield was a little like that too. Fred was a great reader and liked to discuss philosophies and so forth. But that's the best I can state my philosophy on that.

Do you think engineers should have more exposure to philosophy and liberal arts?

That's another current argument: how much the liberal arts types of things should an engineer have? I know that when I was in college we had some requirements: we had to take some social science. I took a course in sociology which, at the time, I considered a waste of time; I'm not sure that it really was. And also I'm sure that the course I took, which was Introductory to Sociology, wasn't organized to fit the needs of somebody like an engineer; it was organized and taught on the old concept at that time, on liberal arts type of approach, so that it didn't accomplish what it could have. But, properly done, I think it's important that things like sociology and philosophy and some languages and literature should somewhere become a part of an engineer's background. I doubt, with today's highly-complex, immense technical society, that you can give an engineer a four or five-year course and still provide all these others things that are necessary. Somehow, you've got to get it some other way, either by getting him started so that he reads and he digs that out himself, or that he takes it up later in some other kind of continuing education.

Do you encourage this development in the firm? I know that you give your employees an opportunity to join Toastmasters.

Ummm, hummm.

Do you encourage people to take other courses?

Well, we'll pay the course costs for anyone who wants to take a course in a field which improves his capability to perform his job in the company. We feel that, basically, it's an individual's responsibility to provide his own basic education. We don't normally, as a policy, pay a person to obtain a master's degree for instance. There are ways that it can be done by selected courses all of which benefit his capabilities with the firm, which eventually may end up providing him with a master's degree, but we think, as a professional, he's got a responsibility to come with the training necessary to be a professional.

We aren't in the business of making professionals: we are in the business of hiring, motivating, developing, and using professionals to provide professional service. So, we do those kinds of things. We encourage people and will give them time off and encouragement and, at times, financial help to participate in community affairs and other things, and we encourage them to work with the national societies and this type of thing. We don't, as a basic policy, specifically at least, direct or have any program for the training, education, or development of knowledge other than the technical part of it. We don't discourage it.

In hiring a professional, do you look for ones that have had a lot of experience and a well-rounded background?

Try. We try not to get, well, I guess you might call it technical drones. We try to get somebody who has also indicated some capability to work with people, to manage, organize and understand how things get done, and to find, therefore, somebody who not only can do the technical end of it but can also

work with the people that we have to work with. One of my favorite statements is, "I don't care how beautiful a technical answer you've got, if you can't convince the client that it's the right thing to do, nothing is going to happen." So you've got to be able to work with him and to express, explain, sell, if you want, the concept that you think he ought to follow. If you can't do that, then the fine technical work that you do may be wasted.

Move to Seattle

Why did you volunteer to start that office in Seattle? Isn't that correct, that you volunteered to go or were you pressured to go?

No, I think it was, in part, my idea. It looked to me like we had pretty well saturated the market in Oregon at that time and that we were going to have difficulty selling our services to a larger city like Seattle if we were located in a little place like Corvallis, Oregon. I had been kind of covering the eastern Oregon and Washington territory. I kind of felt that maybe a move would be something new and different and it would, I guess, help us to grow. I'm not sure that everybody else was that anxious to go. By that time, we'd already started an office in Boise so it looked like something like this was a logical move.

What did the others think?

Well, there was some question about whether we needed to grow or not, or whether we couldn't do perfectly well remaining at the size we were and just going ahead that way. I had the concern, you know, that we were going to get all the work done and then there might not be enough work. We needed to broaden our market and our acquaintances and our reputation.

The goal of some of the partners was to stay at the same level of growth and you wanted to expand?

Ummm, hummm. I think there was some of that. Although I don't think anybody ever put it into quite that many words, I think sometimes the question was raised, "Well, do we need to get any bigger? Size isn't necessarily good."

Why did you see growth as positive, then?

Well, because, in order to do the kind of interesting advanced projects that I was interested in, and I think several of the others were interested in, I felt that we had to have a broader market—a wider range of possible clients so that we had a chance to do some of these more interesting projects.

What made you think that you could succeed in Seattle where there obviously was a great deal of competition compared to Corvallis where there probably wasn't as much?

There certainly was more competition but there was also more work to be done, particularly operating out of Oregon. Once you took care of the Willamette River and a few of the larger cities in eastern Oregon, there wasn't much else to do and we were not very successful in working in

Portland because of coming from a little community down the road. So, from my experience in working in eastern Washington and one thing or another, I thought that even though the competition may have been tougher, there was a possibility of more work there than there was just remaining here.

Was it a challenge to you to go up there?

Yes, it was.

How did the people propose to stay at the status quo if the jobs, projects, were running out?

Well, that hasn't actually happened yet, I guess. Opinions can differ. None of us were able to see very far ahead at that time, as we can now. It just struck me that that's the way it was going to be. And also, I thought that we needed to be located in a major city if we were going to do the advanced kind of projects.

Who were the ones that wanted to remain at the status quo and not expand?

Well, I think, Jim Howland was less enthused about it than some of the rest of us. I don't remember about Burke. I don't think he had a strong feeling either way. I think both Archie and Ralph, at that time, were kind of in favor of it.

You were a success in Seattle?

It took a while. We had some work to carry us over; some things that we were already doing in Pasco and Kennewick and Richland, Washington, and Yakima and Pendleton and Wenatchee—these are all east of the mountains—and Centralia, I guess, which is south of Seattle. So we had some work to keep us so it wasn't completely an empty shop, and we worked on those jobs and just kept at it. It took about five years before the office was, I think, really paying for itself.

Would you consider that one of the major challenges in your time with the firm?

Oh, I suppose, yeh. It was a busy time, an interesting time. And frankly, I like Seattle better than Corvallis. I enjoyed living there. It was a different atmosphere.

Could you have stayed up there?

Oh, I suppose I could have. See, along, when I was in Seattle we started an office in Portland and worked out the merger with Clair Hill and Associates, so that by about 1971, when I moved back from Seattle, we had become a major firm. I don't remember what the total employees were, but four or five hundred by then, which meant that it took a lot more time from a management standpoint to keep everything going; and the integrating with Clair Hill and Associates group needed some careful handling; Archie and Jim, primarily, were trying to manage that and needed some more help; and then we got the so-called discipline system installed, and I was supposed to be in charge of the discipline operations. It just didn't look like handling it out of

Seattle was going to work very well. The way we operate now, with the kind of travel and communications we have, we wouldn't necessarily have to do that [operate it out of Corvallis]. At that time, I thought you did.

Have you considered moving back to Seattle after you retire?

Oh, haven't seriously considered it. We had a house on Vashon Island up there, a nice one on the water, but we sold it when we left. If Cleo and I had kept the house, we might consider moving back there.

Oh. That's a beautiful area. By the way, this is probably a naïve question, but, your firm is in Bellevue, isn't it? It's not in Seattle. Is there a reason why it's not in Seattle?

(Chuckle). Well, we started out in Seattle. We had an office in downtown Seattle in the Logan Building at (pause) can't remember; it's a block from the Olympic Hotel; and we were there until 1969 or 1970. We needed more space; we couldn't find it there in that building; it was difficult all around Seattle; that was before they had started to build most of those big office buildings down there. And at that time, I was no longer managing the Seattle office; I was doing what was called the engineering production study. Jim Poirot couldn't find any other solution, and a canvas of the employees indicated that they would all like to live in Bellevue, and so eventually we found this space over there which is more economical.

Some of us were concerned, including me, that when you moved out of the big city and couldn't say you came from Seattle that people would not recognize you as a major operation, and that big City of Seattle wouldn't want to hire us because we weren't operating within the city limits. I would say that in general, that that concern didn't pan out to be that important. We might have lost a little, and we still call it the Seattle office even though its address is Bellevue. We do that a lot. The Denver office is not really in Denver; it's in Littleton, but the post office box address is Denver. (Chuckle)

What were some of the most difficult times for you and the firm as you look back on the last thirty-six years?

(chuckle) Oh, the two or three times when the workload fell off, and we had to let people go, and we were having trouble making ends meet.

When did that happen? Are you referring to your financial difficulties when you first commenced operating?

No. It seemed to me there were about three times when we had to reduce the staff. One of them was in 1975/1976, and there was at least one other time in the sixties somewhere. I can't remember when it was now but we were off and going. Jim Howland could tell you better than I can.

Do you consider those the most difficult times for you personally?

I think particularly the 1975 one because I was President at that time. That was a difficult one. There were individual ones with particular projects, or people, or something like that which you handled as they came [but we had

an occasional real problem like] the times when we were having trouble finding enough work to do, or had an overall problem, not the normal run of the mill type of things that you worked on from day-to-day; so that's why I guess I consider those about as difficult as any of the times that we had.

Were there times when you just wanted to give up and just say, "It's too much work and I don't want to do it anymore. I want a change of career or direction"?

Oh, I don't personally remember any time when I got quite that bad. Sure, you got discouraged at times. But, you know, you always had, at least in this organization, other people to talk to. If you really were discouraged, you'd go sit down and talk it over. I'd go and talk to Archie or to Jim—somebody. And we'd hassle it out and kind of get each other back on the track again. So I never really considered quitting or giving it all up. By the time it came about time for me to retire, which was in 1979 I guess or 1980, I think I was getting a little tired of working at it that hard for that long.

What were some of the highlights, the high points, in your career here?

(pause) Well, moving to Seattle and opening that office had to be a high point, I guess, and the reorganization to install the so-called discipline concept.

You saw that as a positive move then?

Ummm, humm. Yes.

Were all the other partners in agreement with going to that system?

After we worked them over for a while, yeh. Oh, I think, [the times] when we were successful in obtaining some of the major projects were probably high points. If you ask me now to go back and name what those were, I'd have a hard time doing it.

Take your time.

One was a big water supply project for the City of Richland, Washington.

Why was that project a high point, particularly more than others?

It was a big treatment plant, larger than others and fairly comprehensive, one that we worked all the way through from the beginning study phase clear into completion of construction and operation. I suppose another one was the major project we had for the external facilities for the Boeing 747 plant there north of Seattle. And the Foothills water supply project for Denver was a major one.

Are you saying major in size or complexity? Are they highlights because you...

In that case, both.

Was the fact you were being recognized on a large scale—nationally-exciting?

Well, probably, although I didn't have, or wasn't as directly connected with this. Of course winning that award for the Tahoe advanced waste treatment

plant was a highlight. And so also was the project for the Occoquan advanced waste treatment plant near Washington, D.C. I don't remember, but at the time it was close to one of the biggest we'd ever done. And then—of course, I didn't have very much directly to do with this either—was the Milwaukee project which we're still working on. Some of the littler projects that didn't make much of a splash to anybody else were kind of milestones, I guess, to some of us because of what they represented. We got the job early in—I can't remember if it was in the late 1940s or the real early 1950s—to design the water treatment plant on the Willamette River here for the city of Corvallis which was a major step as far as our advance into sophisticated treatment work was concerned. (pause) Those are the highlights that kind of come to my mind right now.

How did you like being President? Was that a highlight for you?

Oh, it had its satisfactions and, you know, you got recognition from it and it was interesting and exciting. It was hard work. I had been so close to the management of the firm and the direction, too, I guess, for so long that it wasn't a major shift as far as I was concerned. It took some reorganization and some assigning of duties different than before, but it didn't require a great deal of reorientation as far as my approach or my attitude was concerned.

Why did they choose you as the President over others?

Archie didn't want to do it; he said that was not for him. Burke, I guess you'll have to say, was more inclined toward the technical and the design analytical direction. Ralph Roderick, I think, had retired or was retiring. Fred Merryfield was not, at that time, a possibility, we didn't think. And Clair had his hands full getting Redding shifted to Harlan Moyer who was taking over as manager. And unless you went to one of the younger group, on which nobody could really kind of come to a consensus, why, I was about the only one left.

So, you're saying it was because you were the only one and not because of your style of administration?

Yeh, yeh. I think they felt that I could pull the thing together and get everybody working together without having a big bunch of internal warfare, because I had the time and the stature and everybody knew me well enough that I could get the thing across without hullabaloo; and I guess that's probably true.

Someone described you as charismatic and a democratic leader.

(chuckle) I wouldn't say that's necessarily true. Democratic or autocratic?

Actually, democratic.

Well, I guess that's right. I'm not an autocrat. I try to get people to do things because they think that's the right solution and they're in favor of it, rather than just telling them to do it. I try to give people a chance to use their own

initiative and figure out their own ways of going about getting something done within the limits of what we've set out goals or our objectives that we're trying to meet, and therefore give people a chance to use their own initiative and to try to back them up in accomplishing this.

It doesn't always work. Sometimes it's hard to sit there and watch somebody do something a different way than you would do it, particularly if it turns out that it doesn't work very well that way. But, I think you've got to have the patience to let people use their own judgment or initiative, or you're going to have an enthusiastic, driving, interested and motivated organization.

How does that style compare to, say, Jim Howland's?

Oh. Similar, I think. Jim was a little more autocratic on some things and I guess you'd have to say less so on others. I don't think either one of us ever could be considered as directive-type managers. We both believed in giving people their heads. If you talk to Jim, you might ask him about his favorite saying in managing this outfit. It's not like the typical pyramid where the manager sits here and all the lines of authority go down this way. It's more like a man on the ground in a fairly high wind with about forty gas-filled balloons on long strings, and you're sitting here trying to get them all into some kind of order.

You mean because of the independence and the strong will of all the others?

The drive that all these people have on their own.

That must be very difficult to manage.

Well, yeh. That's, you know, where it takes the patience, and the understanding that everybody's not going to do everything quite the way you will and sometimes they'll take off and get you involved in things that you really didn't want to get involved in at all, so you kind of have to watch and keep your eyes open to see what's happening.

Do you think the other partners would have been capable of holding on to these balloons?

Yeh, I think so. I think it was always a matter of getting everybody pulled together and, you know, the other partners did a lot of management. Ralph Roderick managed the Corvallis office at a time when it was practically the only major office we had. And Burke managed the electrical and mechanical work for a long time. Archie, actually, was president of what is now known as Microfloc, and he managed that; built it from practically nothing to a good-sized organization.

Did he have a democratic way of administering too?

Not so much.

What do you feel personally were a few of your greatest achievements working with the firm?

Oh, I don't know. I suppose the move to Seattle and building the Seattle operation into what it eventually became has to be one achievement that I'm pleased about. And I suppose that I was satisfied with the job I did as President: getting the organization in to the mode in which it now operates.

What aspect of engineering and being part of CH2M HILL did you enjoy the most?

Oh, I guess I enjoyed most the technical design work, the project or technical project work that I did. I would like to continue to do that to some extent.

Are you going to continue that even after retirement?

Well, yeh. I'm chairman of what we call the Advisory Board for the Foothills Project in Denver which is not exactly technical design work but it is, nevertheless, the management, direction and construction operation of that whole project. I've been involved in finalizing of the contracts and one thing or another in Trinidad, and I work on the committee that's developing design guidelines for designing water, wastewater, and similar facilities against earthquakes. So, from those kinds of things, I'm going to keep dabbling some, I hope.

If you could start the firm all over again, what would you do differently?

(chuckle) Well, I'd like to think I probably might not start it in Corvallis, but that's where Fred Merryfield was, and there might have been no other way to do it.

You mean start it in a larger city or more centrally located?

Yeh.

What has been the disadvantage of being in Corvallis?

Well, you say, what was the disadvantage? The location, after the organization had grown some, of course. You know, we got our start by coming from a small town and working for small towns, and it might not have been so easy if you'd started in Portland. Although, I think probably we could have done it. In the initial status working out of Corvallis had some advantages until you got to the point where you were covering three or four stages instead of one, and then it ceased to be that way.

I don't know what else I might have done differently. I suppose, looking back on it now, I might have tried to build a stronger mechanical and electrical group than we did initially. Eventually we got there but I think we might have put more emphasis on that to begin with. But [the emphasis you put depends upon the] kind of function of the jobs that you have to do and what it takes to get them done. I don't know what else I'd have really done differently. Looking back on it, there probably are dozens of decisions that weren't very good moves, yet, sooner or later, they all eventually worked out. I think some of our office expansions that we undertook were not really very wise.

The one to Alaska and the one to, oh, let's see, some of the expansions of Florida were not probably the best decisions.

The merger?

Oh, I think the merger was all right. The merger with Black, Crow & Eidsness is a mixed bag in a sense. It took us a long time to get it squared around to where it was working properly and not a drain on the rest of the organization. But, if we hadn't done that, I don't think we would have ever had the growth and the stature nationwide that we have today. So, who knows?

How did you feel about women professionals being employed with the firm? Did you have any reluctance hiring women?

Well, I don't recognize that I had any reluctance, and I think I've tried to support it. You know, there are all shades of professionals, from women engineers to women accountants and administrative managers and all those kinds of things. I suppose that there was some question in my mind originally. I've watched some of the girls that have come in as engineers, and I have been particularly involved with the women that have worked in the administrative and those kinds of positions, and I think it should be supported.

Is anything being done about that or can anything be done?

Yeh. We keep trying to work on it and, of course, the whole problem of discrimination—sex and race and color too—is involved. We've got Willie Loud and one of his duties is to work on that problem, and we're trying to get it corrected. It's a slow process because you don't change a person's attitude, particularly the older ones, just by writing a directive or giving them a lecture. You have to try to develop an atmosphere that will allow these people a chance to demonstrate what they can do, and then let them, the minorities, women or whatever, prove or show that they can perform and produce. When you do that, you generally get acceptance, I think. I don't think we're highly successful in that direction.

Even with the younger engineers?

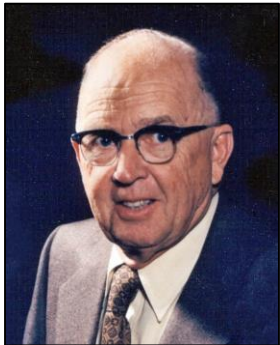
I think they're better off because they're younger.

But you personally haven't had any problem?

Yeh, I don't think I have. I don't personally have problems accepting them. I have had problems getting people, women particularly, who I feel are capable to take more responsibility. Now that problem is getting them accepted by others.

CLAIR A. HILL AND ASSOCIATES, AND CONTRIBUTIONS OF CORNELL

We've talked about the contributions of all the original partners but we haven't spoken about Clair Hill. Can you talk about him and his contributions to the firm?



Clair Hill

Well, of course, Clair started out in this business in Redding about the same time, I think, that we started out here in Corvallis. Or maybe even a little ahead of that.

He started in the late 1930s and then went to war, came back and started again.

So that, you know, he kind of went along parallel with us, although, I think a lot of his work initially was in surveying and mapping, whereas ours was in the design area, particularly in the water and wastewater field.

Clair did a real job in building that organization up to whatever it was at the time that we merged. I think we kind of saw things eye-to-eye in terms of how to manage it, although Clair didn't run his organization with the free and democratic approach that we used. It was pretty much a one-man show until he began to realize that, unless he set up some kind of a system where the ownership could be transferred, it was going to be hard for him to realize anything out of it. At that time we got to working together and he got to following some of our concepts on ownership and eventually we put the two firms together.



The early Clair A. Hill and Associates

I have never been really close to Clair in terms of working day-to-day with him because at the time I took over as President, Clair had turned the management of the Redding operations over to Harlan. Of course, Clair was on the Board of Directors for several years and I was working with him at that time. I think Clair's contribution was in terms of being able to spot opportunities and not being afraid to try to take advantage of them. And sometimes, in hindsight, those were mistakes, but also sometimes they were real good moves.

I think it was kind of Clair's instigation, along with Roderick, that we started the San Francisco office. That was even before the merger. We had a common office there with Clair Hill and Associates. And he started the Alaska operation before the merger. So, Clair had the ability to recognize good people and to get them on board, and probably less concern about what the other parts of the organization would think about his decisions. This was

partly because he didn't have major partners he had to answer to, like we did, so for that reason, I think he operated much more efficiently in the earlier stages than we did.

Much more efficiently?

He didn't fuss around about the decisions—he just made them.

It would be a lot easier, wouldn't it?

Yeh. He developed a fine reputation in California. Knew an awful lot of people and still is a great benefit to us because of that. Constantly on the go and I think he still is.

Were there those that wanted to remain at the same level of growth and not expand at the time the merger was being discussed?

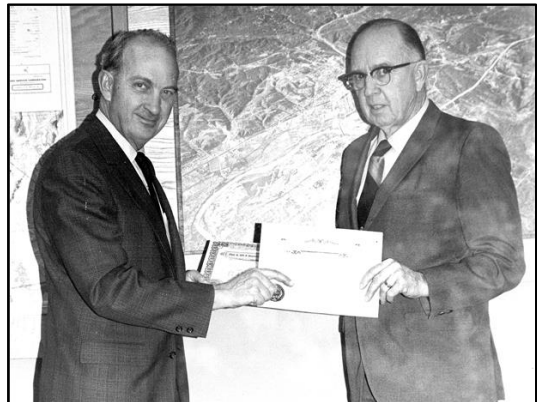
Yeh. Some of the people in Redding didn't want to do it, and they never were very happy with it. I guess most of us up here kind of thought it was a good idea by that time.

Because you were expanding into California?

Umm Hmm.

Would you like to say anything else about Clair Hill's contribution?

Well, yeh. I guess Clair was considerably responsible for the merger. He felt it was highly desirable, and could see that the two organizations could put together and accomplish quite a bit in California and he was probably going to have trouble doing it himself. So I think you have to give him credit for keeping at the merger, trying to work with Jim Howland. The two of them really ended up working it out, overcoming obstacles and finally getting it put together.



Jim Howland and Clair Hill exchanging stock.

I wonder what would have happened if he hadn't merged with CH2M?

I don't know. At the time, you know, we were doing a lot of things together. We could have kept right on going that way, working joint ventures and one thing or another. That's probably what would have happened.

But just speculating, what would have happened when he retired from his firm?

Well, he would have probably turned it over to the group of Harlan. Jack Jensen and Alan Hill and half a dozen others that were working and were part of the organization then. He had started to do that before we merged, you see.

Contributions of Cornell

I want to ask this now. We've discussed the contributions I think of everybody—Howland, Hayes, Merryfield, Rice, and Roderick and Hill. I'd like you to talk about your own contributions some more, one very significant contribution being the bringing of computers into the firm.

Well, the computer is a result, basically, of the engineering production study that I developed, a part of which was to try to look ahead and see where the profession was going, and try to work out what steps CH2M, which it was at that time, ought to be taking to stay up with the advances in the profession. The more you got into that, the more obvious it became that the use of computers was going to be a coming thing.

So in this study you discovered or you surmised, that computers were something that the firm should acquire?

Yeh. The third step, which is what to do about how to do the things we should be doing, it seemed obvious to me that a computer was one of the things that we were going to have to get cracking on.

What do the others think of that?

Oh, they agreed with it in principle, but it was awful hard to get them to do it. We first signed up with General Electric, who had a big computer somewhere that you could use with a telephone line to an old telex machine. Remember how they used to—oh, you may have never seen one—they used to send telegrams by typing the information into a machine which sent some kind of electronic signals to the receiving end, and it would be typed back again. No different than our current electronic system, just very elementary.

... we found a couple of guys in Seattle that were interested in that and we started to use it. A couple of years later we bought the first computer of our own which was an IBM 1130, I think the number was—by today's standards, this [the 1130] wouldn't even come close to being a microcomputer—and set it up down here, and put somebody in charge of it, then tried to get people to use it—and ran into a lot of reasons why they shouldn't. "I could do it by hand faster", or "I don't like to do it because I don't know what's happening", or "Working out by hand's better". I guess it took us five years before we really got the full utilization out of the computer. And then all of a sudden it took off.

Wasn't there some resistance from the other principals? Because of experience like Clair Hill's, who I guess had a terrible experience with computers?

Well, he tried to go into the business of providing computer service.

Was it because of the initial outlay of capital there was some resistance?

Our people you mean? No, they didn't know quite how to use it; it was change, and they resisted it. We put Ken VanDusen in charge of it. He was

an aggressive type who made people mad half the time, but also pushed hard to do everything we could by computer; and he was pretty quick and knew the sewer and water business well enough so he could make the applications to that field. So we finally got it underway.

Do you consider that to be one of your more significant achievements?

Oh, I guess so. Except that the—I guess the thing I contributed was getting us started in a specific, consistent, determined way early enough that we were able to get out ahead of most of the other people. It would have happened eventually, we couldn't have prevented it.

If you hadn't done the study, though, you wouldn't have realized its importance and, or CH2M wouldn't have gotten involved with computers until everybody else did?

Well, I don't think we would have gotten started in it as rapidly as we did.

Somebody said, one of the other people I talked with, this was his quote, "If Holly is the brains of CH2M, why then Jim is the soul of CH2M."

(chuckles). That's interesting.

Why would that person say that?

I guess that must be the way it appears to them. I don't consider myself the brains of CH2M. I really consider Archie is. But be that as it may, Jim was the one who shows the most concern about people and individuals and their welfare. And I guess they'd say what they did about me because I'm the one that's always looking for some way to improve the operation, or to solve the problems of engineering that we face.

Why do you say Archie should be characterized as the brains of CH2M?

Because he's smarter than I am. Half the ideas that I put together and developed I got from him or we got from each other, by fighting and arguing and brainstorming and so forth.

Do you feel, then, that you were more comfortable with Archie than with the other principals?

I guess so.

What other contributions do you think you've made to the firm's development?

Well, I guess the initial development of the business in eastern Washington and Oregon, which eventually lead to the development of the Seattle office. The Seattle office development I think, was a major contribution. We went up there and started from nothing and in ten years built it to something bigger than Corvallis was at the time we left Corvallis. The engineering production study, and the development of the concepts of the organization, and the methods that resulted from that. You can find most of the things we're doing today in there somewhere if you want to look hard enough; they aren't by the same names and they don't fit in the organization in exactly the same way, but most of them are there. And the *Policy and Procedure Manual*,

which was initially my effort, and the computer, and the reorganization of the firm to mesh in the regional and the discipline system—not the idea, but the implementing of it. And the developments of the organization in terms of the Board of Directors, and the Chairman of the Board, and the President, and their different responsibilities. Can't think of anything else.

Would you consider yourself charismatic?

Some, when I'm cranked up to be. I mean, when I'm excited or fascinated or interested or somehow intrigued, motivated.

So people look to you as a leader, then?

I guess so.

Do you think more so than the others?

I don't know. Never thought about that. I don't think they look at me as more of a leader than they do Jim, I think they look at me to lead them in different ways than Jim does.

What do you mean by that—you mean style-wise, or different directions? Different changes?

Well, I think it goes back to the same thing that somebody said a while ago. Jim will lead them in the direction of having a compatible, motivated, energetic, well-knit group of people. My tendency is to lead them into accomplishing great things technically or otherwise.

Several others I talked to saw you as a stabilizing influence.

Yeh, (chuckles) I think that's right. I have at times been able to settle down violent disagreements by trying to be kind of cool about it and keep people off the ceiling, and to keep their heads straight. Try not to let people get carried away with things until they've thought them out. Yeh, I guess I have been a stabilizing influence.

I was told that you were responsible for having an attorney on the staff—a in-house attorney. Could you comment on that?

Okay. Yeh. At one time, in the early days, when the tendency to sue people, particularly professionals, wasn't near as bad as it has become, or as prevalent as it has become—I won't say it necessarily is bad—and, I guess as a part of the engineering production study, I discovered that you could buy, or get insurance to insure yourself against the damages due to errors and omissions as it was called, in the plans or engineering that we did. And as a part of that, we—the consulting engineer group—finally organized our own—well, I arranged for us to get this kind of insurance. It started out one hundred thousand dollars maximum limit, I think. But in the process of that, the insurance company came up with a program to train the people in what they call loss prevention, which is what you have to do to minimize the losses from errors, omissions, and mistakes. When you get right down to it, loss prevention is nothing more than doing the job right the way that book says.

There's a five-foot shelf of books we have written that will tell you how to do that, which we've developed here. And in the process of that, I got to working with insurance people on this liability and claim system, and initially made a study which Len Weber helped me with. Len was a lawyer—an engineer too, but had gotten a law degree in Texas or Oklahoma where he worked on the oil well fields or something. So he helped me with this program and we developed a loss prevention program, and as a result, Len just kind of naturally gravitated into the legal end of the engineering business. He had been working on highways and other things, but obviously was more interested in the legal aspects of it, and since he was already working for us, why we gradually worked him into handling most of the legal stuff. And I guess really it was more accident than deliberate calculation. As soon as we had a lawyer, why, then we began to give him things like a partnership agreement, or the corporate papers and the contracts and all of this kind of stuff. But I guess I did start it, yeah, from that standpoint. More by the process of solving the problem than in the deliberate thought to go out and get the legal staff.

But it turned out that an attorney is very necessary, then?

Yeh. One way or the other, and it's a full-time job.

I'm sure it is. Also you were responsible for getting a representative in Washington, D.C.?

No, I don't really think I can take credit for that. I made a couple of studies for that when I was Chairman of the Board, and I couldn't satisfy myself that we could afford it, or rather that it would be cost-effective, part of the reason being, I didn't know who to get. My concern was that we'd hire a retired colonel or we'd get applications from those kind of people; you know, ex-army, navy, public, Federal employees who had got up to fairly high status and were now retired, they would want to be our Washington D.C. representative. I've watched some of them and all they did was go to cocktail parties and take their favorite potential "client" to lunch. I didn't think they were accomplishing anything.

... after Earl became chairman he got to looking at this thing some more and discussing it. It so happens that he mentioned this to Dick Corrigan, the man who is our Washington D.C. representative, who had that position with the American Consulting Engineers Council—nationwide for all of the consulting engineering firms. Earl discovered that Dick Corrigan might be interested in going to work for us. He was kind of tired of working for a group that had no consistent or very good management. Not very good potential; he was as far as he could go. So Earl hired him.

So it wasn't your idea?

Well, it was an idea that I'd been kicking around, I never could figure out a way to make it work to my own satisfaction. And if I'd still been President and discovered this about Dick, I'm sure I would've done it then.

Has it been a positive move, to hire this representative?

Well, I think it has been, yeah. And when it comes now to things like the Superfund project and these others, I'm sure we needed that badly.

Anything else about your contributions?

Don't think of anything more.

THE PLACE OF HISTORY, THE ROLE OF A SPOUSE, AND THE ENGINEER IN SOCIETY

The Place in History

What are the major strengths of your firm today?

Its technical capability; its broadly-based organization which gives it the ability to apply the technical knowledge wherever it's needed; its stability because of primarily, I guess, its ownership policy. The turnover is very low, at least in terms of technical people; I can't say that for the clerical types.

To what do you attribute the low turnover rate in your firm?

Well, a lot of them stay because they own part of it; and a lot of them stay because they recognize that they have an opportunity to own part of it, to get a piece of the action; and I think [because of the] general management's attitude that allows people to go ahead and, within the limits of the objective that they're trying to accomplish, to use their own initiative to get the job done.

How does that compare with the way other firms of this type are run?

We are much more open, much less dictatorial. People have a lot more freedom to go and do whatever they want to when they want to. They don't have to get permission for a lot of things that a lot of firms are very sticky about.

And that hasn't been taken advantage of over the years by your people?

Oh, at times, I guess. Not normally, I don't think. Sure, sometimes you get burned but also you get an awful lot of loyalty and good, honest effort as a result of it.

So, you've got some fine individuals that work for the firm?

U:mmm, hummm, yeh.

Perhaps others don't?

Well, you know, the guy that isn't willing to have that kind of an attitude, to really put out, probably isn't going to last very long. Nobody will want him on their team and the first thing you know you can't find things for him to do. And we've got people like that.

Can you talk about some of the weaknesses in the firm?

Well, I suppose some of the weaknesses are that we probably are much less efficient than we ought to be because of this tendency to allow people to use their own initiative. As a result, we don't do as well as we should on the routine kinds of things that ought to be done by some kind of standard procedure, the same every place and therefore mass produced with the computers or something else.

I don't know whether you've heard anybody complain but we finally instigated this system of expense accounting that is a chore, but it is probably the way ninety percent of businesses do it. From the word go we had never really been very methodical about that; we just paid people whatever expenses they put down. Of course, when we started to get audited by the IRS and the defense and the government agencies, boy, we had to put this system in, but there has been a terrible lot of complaints and everybody still doesn't like it. You know, if you worked for IBM or if you worked for one of the other big consulting engineers firms or you worked for almost any big company, you probably would have started right out doing expense accounts the way we are doing them right now; but some of us around here haven't had to make it out that way for thirty or forty years and we don't like change.

So [there are a] whole series of things that I think we probably don't do very efficiently because of that [tendency to allow people to use their own initiative.] We have a very high overhead relative to other firms in our business and this is partly because of that factor of being fairly generous about allowing the people to take their heads; and also because we do have a large number of regional offices each one of which requires its own management and accounting, and this kind of group is bound to be less efficient than if you had all two thousand in one building, one accounting system and one of everything. This becomes difficult because it means we have to charge higher fees than other people because our overhead is higher.

But you do better work?

We think we do, particularly in terms of individual attention that you can give to the work.

So clients are attracted to you because of that individual attention and because of your reputation?

I think so.

Where do you see the firm heading in the future?

(chuckle)

More expansion?

Well, only in terms of the fact that today's projects are becoming so large and so complex that it takes a major organization to complete, for example, the famous Milwaukee project or [the one we may] eventually do in Biloxi in Mississippi. Those kind of things are what causes us to expand in the project delivery management area.

Whether we will grow, you know, as rapidly as we have in the past in terms of people, I don't know. I think we will continue to increase in terms of staff size but probably not at the rate we have over the past ten or fifteen years. Because, you know, an expansion of five percent a year now means you are adding one hundred people whereas five percent when you only had a

hundred in the first place was only five, so that now you just don't grow that fast.

And I think that the trend is going to be toward the program management approach which, to some extent, is going to change the complexion of the type of people that we have and the type of work that we do.

But it looks to me that in general that's probably the way it's going to go because somehow it just isn't the simple operation that it was when we started thirty-five years ago. If somebody says, "I need a pipeline from here to here, how big should it be?" And we told him and he said, "All right, let's go. How much would it cost?" To get the financing worked up right, you would size the reservoir, for example on the basis probably of about how big a one you could get on the site and be reasonably economical. Nowadays you don't do it that way. You've got to go through environmental impact studies and God knows what else before you can even get started.

What about other fields of work? You are getting into the energy field and food production. Any other?

Yeh. Those are all natural outgrowth of the kind of work we are doing. And, as you know, we've got this OMI-operations management organization—which is going to take on the job of contract operation of treatment facilities, and those types of things, so we will probably go in that direction. Just technical complexity of the facilities that we now design is so far ahead of where it was thirty years ago that you just have to continually expand and adjust your staff and your capabilities to meet today's highly advanced, complex requirements.

Are you entering more into the private sector?

Yeh. I think we have tapped it pretty well. We are doing a lot of those kinds of things for private companies. Oh, I think that the public works types of projects will still be a major part of our operation.

Do you think the employees of today and the future can carry on the quality and personal touch that you original partners nurtured?

Well, I hope so. The tendency, of course, as you grow is to lose that individual pride and so forth. But one of the reasons I think we may be able to keep it is that we keep the organization into manageable groups in regional offices and so forth, where they can become a close enough knit organization so that they know something about what's going on and can feel a part of it whereas, if you took all of those people and put them in one great big building, most of them wouldn't feel like they've got any share in what's happening. So if you are going to maintain that kind of an attitude it's going to have to be as a result of the kind of an organization we're running. Whether that will carry on and to what extent and for how far, I guess remains to be seen. You can see it now. If you get on one of the big projects, like the Milwaukee one where there are a couple of hundred people all working on the design of this facility, it's pretty hard to understand where the

little piece that you're working on fits in the total. So, you know, the guy needs the chance also to go out and work on the small project where there are only two or three others assigned as well as on the great big ones.

How can historical information about the firm's past be useful today?

Oh, I suppose it would just keep us from making the same mistakes again. I hope that's what it might do.

Then, how can you say that you don't think anybody will read this, or that it will be useful?

If you handed me that, I'll put it in my briefcase and say, "that's gonna be interesting, I'll go read it. But it might still be there a year later. Not read. (chuckles)

Are you saying that you think that reaction would be typical of people, or engineers, or CH2M employees, or what?

Oh, I think it's fairly true in general about the engineering employees in CH2M who are busy; they don't even have the time to keep up with their technical field.

Yeh, but when you're gone, don't you think the people in charge will want to know why a particular policy has put in motion and what the people were like that started it and why did they do the things they did—what was their thinking?

I don't know, is there such a thing for IBM?

Well, I don't know about IBM exactly, but it's getting more common among businesses.

Yeh, I've read about it. I've noticed that a lot of people are doing this. Yeh, in some ways, it would probably be helpful. I hadn't really thought about the reasons for what this could do. I suppose it's important or desirable to set down the reasons why that's done. I got a book over there somewhere. Jim wants me to review. Yeh. It's called *The Board of Director's Handbook*, and it talks about a lot of the reasons why we're doing certain things and about certain policies and stuff, and it goes into some of the background.

Do you want to say anything about the place of history in the firm? Present and future?

Well, yeh. I think history's important, but the thing I object to is that, "Well, we've always done it that way; why change?" I was reading an article somewhere just recently which says that the really well-run companies—the companies that advance as compared to the ones that stay in the same rut and lose their market share—are the ones that are always experimenting. Always trying something new. Aren't afraid to fail. Have at it, try it, if it doesn't work, throw it out, try something else. So, the attitude I object to is, "Well that's the way we've always done it and it's always worked, so why

change?" I think that's wrong. I think you're going to end up in the grave when you do that.

The Role of the Spouse

Something I want to add before we get through. Shall I do that now? It's about my wife's contribution to what I've done. I don't think I've covered it very well in there, but Cleo helped put me through graduate school. We were married while we were back East, and she used to type my thesis at night and work for somebody else during the day. When we first started the business here—she typed the first half a dozen reports, I think we made. I think she used to type those damn things in ten carbons. You've heard the famous story about the first office was in the bedroom of the little house we were renting over on Tyler Street, and I'd built a drafting table that let down from the wall, and when I was using the drafting table you couldn't get into the bed. But she typed the first few reports that we put out on a little L.C. Smith portable typewriter and made thirteen copies. That was before the days of electric typewriters.

She typed thirteen copies?

Ummm hmmm. She did a lot of those kinds of things in the early days that I don't think this [interview] necessarily reflects. She's been that kind of support, and a lot of help, and somebody to discuss things with, for a long time. And so she made quite a contribution to whatever we've done—I've done—CH2M, too.

Did the other wives participate quite as much as she did?

Well, I don't think that's right. They participated in different ways.

But I mean directly for the firm?

Meisy Howland has always been a real help to Jim—going places and helping particularly with people and the firm parties and so forth. And, of course, Cleo for a long time went with me to the Water Works meetings and that kind of stuff. And all of those things are important.

I have wondered how you juggled a busy firm life that took you away from home so much with a social life and a personal life, and seemingly did well at all of these activities?

I didn't do very well in the social life and the personal life in some ways. I neglected my family to some extent. I haven't had a widely active social life. We do a certain amount, but it's not very much, partly because I'm gone or undependable. I have probably given more priority to the firm and my profession than I should have, considering the family's interest. Although I have two grown children and they seem to get along fine; I don't know whether more time or attention to them would make any difference or not.

But if you had an opportunity to do it over again, and know what you know now, you would have probably spent more time with your family?

I think so, probably. [It is a] question of how you are constituted. Engineers to some extent are kind of one track minded and, at least for my part, if I have got a real problem with the business or engineering that I have got to solve, it's hard for me to leave that alone and go do something else. Not everybody is that way.

Would you discuss problems from the firm with your wife then? Is that what you mean?

To some extent. After she gets bored with them why I stop doing that, as much. Then after a while a problem sounds like they are all the same, and I guess they are really.

You are saying that your wife was a support to you through the years?

Yeh.

A wife of a principal has to be pretty understanding.

Yeh. Yeh, there have been articles about that and apparently a lot of the wives of top executives, a lot topper than I am, have had difficult problems because of single mindedness, that they consider neglect, and that is probably what it is.

Knowing the national statistics on divorce, it's surprising that out of six individual, and Clair Hill, none of you have been divorced.

Yeh. If we were from the current generation, yours for example, that might not be true. We were raised with the fact that a marriage was for life and that's the way you did it, and we have somehow adjusted to whatever the difficulties were.

That says a lot for the wives.

It was not easy for them. They sure had problems I can bet, lonesome times, and a lot of neglect.

Well, I can imagine it would be difficult to leave something that you started, nurtured and watch come to fruition?

Yeh, but you have got to be awful careful about sitting around there and trying to wet nurse the thing after you've left and aren't really involved in it, or the first thing you know you'll take away the incentive for the guys [whose] job is to make it work now.

Well, you are aware of that so you will be careful.

Try to be.

You said that the expansion into Florida was probably not the best of decisions. Maybe you could make a comment about that before we end here.

Is that all I said? As a result of their purchase by Hercules, Black, Crowe and Eidness was not in as good financial shape as we had thought at the time we made the merger. For example, we got badly hurt by a coastal boundary survey that they had contracted for and even though Hercules paid a part of

the loss on the project, it went on for a long time, we lost a lot of money on it. That was about at the time the recession, and the real estate collapse and one thing and another had hit Florida and so there wasn't a market for services that the organization had been built for, so we have had a long series of expensive losses by that organization or group until just lately.

So it hasn't panned out?

It's hard to tell now because it's integrated with the rest of the whole organization, and a lot of the work we are doing might not have been possible if it hadn't been for having the strong eastern representative. So I don't know that you can say that it hadn't panned out. It has been a costly investment, and it's going to take it a while before it pays out completely.

You also said the expansion into Alaska was not a positive move.

We had the same kind of troubles trying to make Alaska profitable. I'm not familiar with how it has developed in the last few years but I think it's probably doing better now, or I hope it is. Once you're in a position like that it's probably a mistake to close it out. Alaska is a growing community and if you can weather the rough spots you're in a position to take advantage of what, for our kind of services, is a growing operation; and that's what we live on is growth and development. So I guess, yeah I think we could have done it with a lot less loss than we have but, that's all over the dam now.

The Engineer in Society

Along that same line, talking about growth and development, can you discuss the engineers' responsibility for the public's interest? Do they have a responsibility? In situations where it's a question of engineering feasibility versus the public interest, what is CH2M's policy?

I think the engineer has a very definite responsibility to the public, and I don't believe that he should make any engineering decisions that are going to be detrimental to the public's interest. You can look at that in a lot of different ways. There has been a lot of discussion in the engineering... literature and there are some people who are working on engineering ethics as such, and are looking at things like—what's it called—whistle blowing by engineers in an organization who disagree with what the management [says], or [with] an engineering decision, and have either gone to the press or gone to the societies or something else to complain about this.

The failure of the doors on the DC-10 is an example, if you want to, you can go back and read quite a bit of literature on that thing, in which some of the engineers involved in that design felt it was wrong and finally said so; and there were some failures as a result of that door coming open which caused some airplane crashes. There have been quite a few other instances. I don't pass judgement on those but I hope that our people recognize that no matter what the client says or their boss says, if they are convinced that some things are going to be a serious detriment to the public, they ought to say so.

You have been talking about cases where physical safety was involved, but what about the engineer's responsibility in cases where the detrimental effects are not so obvious, as in land-use planning, the building of dams, the environmental impacts and so on—when it's a case of the environmentalist versus the engineer. Maybe it's evident especially in the foreign, say for instance down in Latin American if a client wants you to build something that will detrimentally effect the culture of those people. Does the engineer have a responsibility to that culture that is beyond the economics and client? What do you do in those kind of situations? There is a lot of controversies you can mention like dam building.

Well, I don't think it's the engineer's responsibility to set himself up as the judge of social justice, which is what you are talking about isn't it? I think that's the politician's responsibility or the elected representatives of the people's responsibility. I don't think it's the engineers' responsibility.

You would say that when safety was involved it certainly is a responsibility of the engineer?

Yeh I believe that.

But what it comes to land-planning or natural resource planning the engineer really has no responsibility for the public?

Yeh, well it doesn't seem to me, that an engineer is educated or trained to make these kind of decisions. Those are, social-benefit type decisions and they ought to be made by the people that are going to be affected by it, not by some engineer.

Is the engineer a pawn of the client then? You're saying he shouldn't have that kind of decision placed on him.

I don't think it's his responsibility and I don't think he's qualified to make that decision. You really think he is? He's going to make it on the basis of what his basic philosophy is, and if his is all for clean water and air and to hell with the downtrodden who need the food and the water, then that's the way he'll make it. If he's the other way around, he may make it different. I don't think that's his position [his responsibility]. I think that's the [responsibility of the] representative of the public to make that decision somehow.

My personal opinion is that people are trying to blame decisions on engineers that are not properly theirs. The reason they are doing it is because engineers are making the decisions the wrong way according to them. I guess you're always going to have a problem with engineers in general who don't believe in maintaining the status quo at the medieval level, because engineers are trained, almost from birth to build things and to improve things. And they are always going to try and do it. I think they have an obligation to describe the results of their improvement.

I have talked to all five of you and I have observed that despite your being so very capable and intelligent and successful at what you do, you all seem pretty

unpretentious and humble. It seems that that is uncharacteristic of people in your position. Can you make a comment about why you five have this humility?

Well, one of the reasons I guess is that the five of us, there were six of us, are all more or less equals and if anybody tried to begin to put on the dog, or be a big shot or something the rest of us had a readily available [means] to bring him down to earth again, so nobody ever really had a chance to be that big shot.

Was anybody inclined that way though?

No I don't think so. However you put anyone of us in some other organization, IBM or Standard Oil or what not, and we got up to being the president or the executive or something, because of the tradition and the background through which we developed we might now be doing all these kind of perks and this kind of stuff.

So you think it's due to the circumstance that you're...

Well, I don't know. You know if you suddenly took charge of a company that had established all these perks and a whole bunch of people that are working for you have all got their part of those kinds of things, you probably wouldn't be able to change it very much. I don't know. I think it is because we started out together as a kind of cooperative sort of venture—what Archie sometimes calls a commune not a business—in which we shared responsibilities, and really never allowed anybody to become the big king.

I guess I was thinking it was because you came out of the Depression or the world war or your upbringing.

All of us were products of the Depression and from that standpoint we appreciated security I suppose. I don't think that really effected that humility kind of thing you're talking about. I guess you kind of had to be that way to get along, otherwise you might get teased to death about being the hotshot or something.

It's pretty amazing that you're still so compatible.

Well, if anybody had tried to be that [the hotshot] the partnership would have disintegrated.

Is there anything else you would like to say?

You've just about exhausted me of all of my recollections that I can think of. It's been kind of interesting rehashing some of those things I haven't thought of for a long time; but I think you have pretty well covered it. I told you that I thought I had neglected the contributions Cleo had made to all of this that has happened. That's all I can think of. I am talked out right now.

Okay.