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University of California
Berkeley, California

College of Engineering Oral History Series

John R. Whinnery

RESEARCHER AND EDUCATOR IN ELECTROMAGNETICS, MICROWAVES, AND OPTOELECTRONICS, 1935-1995; DEAN OF THE COLLEGE OF ENGINEERING, UC BERKELEY, 1959-1963

With an Introduction by
Donald O. Pederson

Interviews Conducted by
Ann Lage
in 1994

Since 1954 the Regional Oral History Office has been interviewing leading participants in or well-placed witnesses to major events in the development of Northern California, the West, and the Nation. Oral history is a modern research technique involving an interviewee and an informed interviewer in spontaneous conversation. The taped record is transcribed, lightly edited for continuity and clarity, and reviewed by the interviewee. The resulting manuscript is typed in final form, indexed, bound with photographs and illustrative materials, and placed in The Bancroft Library at the University of California, Berkeley, and other research collections for scholarly use. Because it is primary material, oral history is not intended to present the final, verified, or complete narrative of events. It is a spoken account, offered by the interviewee in response to questioning, and as such it is reflective, partisan, deeply involved, and irreplaceable.

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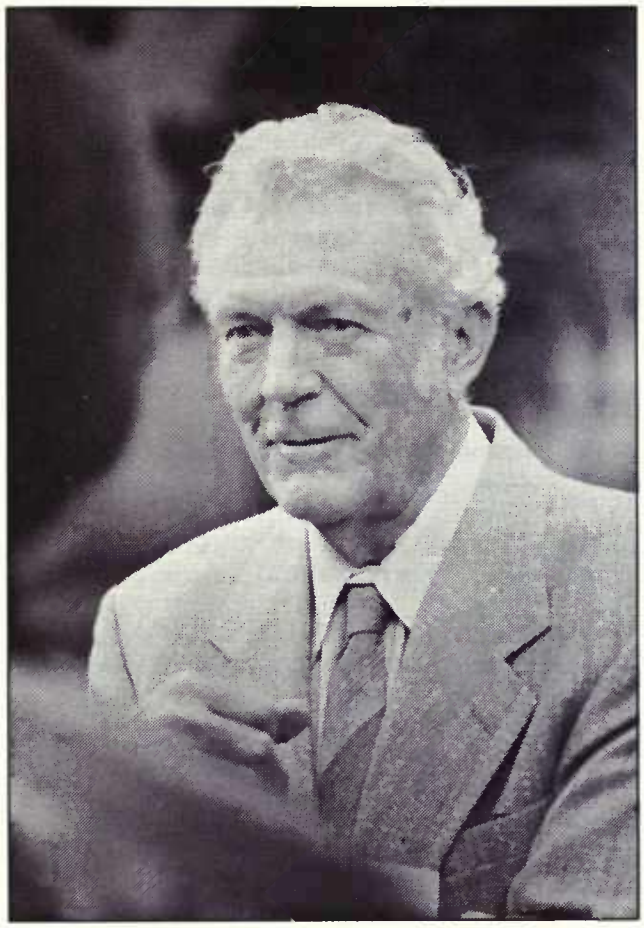

John R. Whinnery, May 1994.

Photograph by Peg Skorpinski

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Family and youth in western Colorado and Modesto, California; undergraduate education, University of California, 1930s; General Electric Advanced Engineering Program and microwave research, 1937-1946, collaboration with Simon Ramo; research program at Hughes Aircraft, 1951-1952; UC Berkeley College of Engineering, 1946-1995: postwar graduate studies, growth of the Department of Electrical Engineering, Electronics Research Laboratory, faculty recruitment and retention, undergraduate and graduate curriculum, governance issues as dean (1959-1963), former dean Morrough O'Brien; research and teaching in electromagnetic fields and waves and optoelectronics; service on governmental, scientific, and industry advisory boards, NASA Apollo program, 1964-1969.

Introduction by Donald O. Pederson, Professor Emeritus of Electrical Engineering and Computer Sciences, University of California, Berkeley.

Interviewed 1994 by Ann Lage for the College of Engineering Oral History Series. Regional Oral History Office, The Bancroft Library, University of California, Berkeley.

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INTRODUCTION--by Donald O. Pederson

John Roy Whinnery's undeniable brilliance has many outlets--the joy of knowing him is in uncovering the boundless, often paradoxical talents that make him so remarkable. Gentlemanly and unassuming, John reveals these talents with only the utmost modesty. That his many contributions are now chronicled in this volume is a delight to his admirers the world over.

John is one the world's most distinguished electrical engineering innovators and educators. For fifty-eight years, he has made superb contributions as a researcher in electrical sciences, classroom teacher, research mentor, author, academic administrator, and senior counselor and statesman in professional activities. These weighty achievements are rounded by his other personae--the gifted poet, teller of children's tales, vintner of wonderful wines, and troubled but valiant golfer. In all (even the last), he is a man of unlimited creativity.

John came from a financially poor family in Modesto, California, having started life in the remote western mountains of Colorado. He began studies at the University of California, Berkeley, in the early days of the Great Depression, but his financial plight forced him to return home to attend Modesto Junior College. His instructors there were greatly impressed with John's quick mind and fine character. They knew he would flourish at Berkeley--but funding remained beyond John's reach. Unbeknownst to John, several of his teachers took up a collection and financed a scholarship to send him back to Cal. What a record he made at Berkeley, graduating in 1937 with the University Medal, the campus's highest student honor, awarded to the top graduating senior at the University.

The award would be the first of many to come, culminating in June 1992 with the White House presentation of the National Medal of Science, the highest honor for an American scientist. John is also one of a handful elected to both the National Academy of Sciences and the National Academy of Engineering. His contributions have been acknowledged by more than twenty major awards, including the highest honors of several professional organizations: the Founder's Award of the National Academy of Engineering, the Medal of Honor of the Institute of Electrical and Electronics Engineers (IEEE), and the Lamme Medal of the American Society for Engineering Education.

In John's first professional position with the General Electric Company, he displayed his exceptional knack for identifying new and critically important fields, developing innovative solutions, and making significant professional contributions. This became a career-long pattern, first exhibited in work on microwave components and followed

over the years with similarly outstanding research in traveling-wave and backward-wave electron tubes, quantum electron devices, and integrated optics. The pattern was a hallmark of his work at Berkeley, where he joined the faculty in electrical engineering in 1946 and today holds the position of University Professor Emeritus, the first engineer ever appointed to this special status as a treasured scholarly resource at all nine University of California campuses.

John's early work led to advances in the understanding and operation of microwave circuits and triodes and to traveling-wave tubes, still in use today in communication satellites. (Significantly, he was awarded the IEEE Microwave Career Award in 1976.) He contributed to the understanding of high-frequency electrical noise in electronic devices. He was an early leader in the field of lasers and fundamental quantum electronics. Recently, he has been a pioneer in producing and using very short pulses to study fast processes in materials and chemistry. These varied advances are catalogued in more than 200 research papers.

Also an outgrowth of John's years at General Electric was his collaboration with Simon Ramo in developing the pioneering textbook on microwaves. Several editions later, *Fields and Waves in Communication Electronics* is still a classic. Former students and friends gathered in May 1994 for a special celebration honoring the fiftieth anniversary of the book's publication; they also surprised John at the event by endowing the John R. Whinnery Chair in Electrical Engineering and Computer Sciences at Berkeley.

As he has been a leader in new fields of study, John has also been at the forefront in education, developing new courses and materials and lending administrative counsel on a national scale. He contributed new curricula on his own research topics but also created new, critically needed introductory courses in electronics, as well as secondary school materials through the Man-Made World Project. For thousands of students, he has been a gifted teacher and thoughtful lecturer. He has supervised more than thirty doctoral students--the list of their subsequent engineering contributions is astonishing. He has attracted the best, and has brought out the best in all of them.

Although his main love has always been teaching and research, John also brought his best to an assortment of pivotal administrative assignments, chiefly at Berkeley. He was drafted to take charge of the campus's newly formed Electronics Research Laboratory from 1952-1956 and was chair of the Division and then Department of Electrical Engineering from 1956-1959, a time of major growth. He guided the department into the important new areas of solid-state electronics, plasmas, and system and communication theories.

From 1959-1963, John was dean of the College of Engineering at Berkeley. This was a time of great transition and stress in the college. In a characteristically quiet and effective manner, John identified not only the problems but also the politically and educationally possible solutions.

When he returned to his regular faculty role after finishing his tenure as dean, John continued to be a sought-after national adviser on matters of engineering education. He also was deeply involved as an adviser to the National Academies of Sciences and Engineering, a key figure in the creation of the Commission on Engineering Education, and a member of NASA's scientific and technical committee for the Apollo Space Program.

Finally, all who know him will attest that there is no kinder, more gentlemanly soul than John Whinnery. His many talents, worn with such humility and humanity, make him a cherished friend and compatriot. Many of us have marveled at his lovely sonnets for his true love Pat, his limericks for all occasions, and his tales of creatures of the Mendocino coast, woven for his own children and those of generations of younger colleagues. Many have enjoyed the fruits of his study and perseverance as a vintner, when in his cellar, which happens to be his garage, he produced fine chardonnay, gewurtztraminer, and cabernet. Alas, his brilliance has yet to shine on his golf game--but even a renaissance man need not break par.

Successive generations of chancellors, deans, and professors have turned to John for advice and direction, and his quiet leadership in this capacity has been wonderfully effective. Whatever his counsel, it always carries one clear message: make the best of what you have and draw out the best of those around you. John Whinnery has done no less in his own career, with stunning results. His legacy is a cadre of accomplished students, vibrant new technologies, and a strong and grateful University.

Donald O. Pederson
Professor Emeritus of Electrical
Engineering and Computer Sciences

November 1, 1995
University of California, Berkeley

INTERVIEW HISTORY--by Ann Lage

John R. Whinnery, Berkeley's nationally honored researcher and educator in electrical engineering, was interviewed by the Regional Oral History Office at the request of the College of Engineering. This was the second in a series of oral histories with former deans of the college designed to document the history of the college, as well as the lives and scholarly contributions of its deans. The series was initiated in 1988 with an oral history with Morrough P. O'Brien, John Whinnery's predecessor as dean.

Professor Whinnery's oral history makes a major contribution to this series. His connection with the College of Engineering spans a period of sixty years, from 1935 to the present, as an undergraduate and graduate student, professor, researcher in microwaves and optoelectronics, director of the Electronics Research Laboratory, chair of the Department of Electrical Engineering, dean, and member of important professional, University, and governmental committees and commissions.

From these multiple vantage points, his oral history contributes to our understanding of the growth of the College of Engineering from the provincial, mostly undergraduate, institution of the 1930s to the major research and educational institution of the 1990s. His personal account reveals the many individual decisions and the variety of faculty, staff, and students which have contributed over the years to the success of the larger enterprise.

Preparation for this oral history began with David Brown, budget officer in the Dean's Office and the coordinator of this project. He and Professor Emeritus Alan Searcy met with me to discuss the scope of the oral history, to suggest potential topics, and to put me in touch with colleagues who could assist with background information. Subsequent meetings with Professors Don Pederson and Ted Van Duzer, Professor Whinnery's colleagues in electrical engineering proved invaluable in suggesting topics and lines of questioning on his work in microwaves and optoelectronics. Professor Emeritus George Maslach, who succeeded him as dean, had many helpful insights, and former Chancellor Glenn Seaborg, who appointed Whinnery as dean, provided additional context.

Also consulted were the Whinnery papers in The Bancroft Library, covering the years 1946-1978; his publications (especially those few which are accessible to the generalist); a previous interview with John Whinnery conducted by his colleague Charles Susskind in 1988; and oral histories with Simon Ramo, coauthor with Whinnery of the classic text on

microwaves, with UC Physics Professor Charles Townes, and with Morrough P. O'Brien (references for these oral histories can be found in the transcript).

Shortly before our interview sessions, Professor Whinnery had prepared for former University President Clark Kerr's memoirs an essay on the College of Engineering and the Department of Electrical Engineering during the Kerr years as chancellor of the Berkeley campus. Rather than cover the same ground again in our interviews, we agreed to include this essay as an appendix to the oral history and to concentrate the interview sessions on the post-Kerr years. Another very special appendix is a selection from John Whinnery's poems, which reveal the many facets of this eminent scientist/engineer.

After an initial planning meeting with Professor Whinnery, we embarked on a series of seven two-hour interview sessions, which took place in his Cory Hall office from January to March, 1994. It was immediately apparent that this much-honored scholar and universally admired educator is a genuinely modest person, uncomfortable talking about himself and his accomplishments. Although he is a man who does not waste words, his comments were carefully considered and they provide insights on a wide range of topics from guiding graduate students, to the use of visualization in analyzing research problems, to the interplay between industry and the university, to his chairmanship of the Four-Letter Word Committee during the Free Speech Movement. I regretted that I lacked the scientific background to pursue in depth topics relating to his seminal research in electrical engineering, but know that his reflections here will be of interest to the generalist and the list of publications in Appendix C will guide the specialist.

The transcripts of the tape-recorded interviews were lightly edited for clarity and continuity by editorial assistant Shannon Page. Professor Whinnery then made a careful and thorough review, clarifying some passages, adding names and dates and providing further information where needed. In numerous instances he despaired of the spoken word and rewrote brief sections to make them clearer and more concise. Unfailingly, these sections provided more information, never did they remove essential material. We appreciate his careful work on the transcript. The final corrected text was proofed and indexed by editor Germaine LaBerge, with additional final proofing by the always helpful former University Archivist Jim Kantor. Tapes of the interview sessions can be consulted in The Bancroft Library, along with the John Whinnery papers.

The oral history of John Whinnery complements a number of other oral histories in our University History Series which document the

various colleges, professional schools, and disciplines on the Berkeley campus and their role in the development of Berkeley's reputation as the major public research university in the nation. We thank the College of Engineering and its generous contributors for providing funding for this oral history, and offer special thanks to Don Pederson for the graceful and informative introduction to the volume.

The Regional Oral History Office was established in 1954 to record the lives of persons who have contributed significantly to the history of California and the West. The office is a division of The Bancroft Library and is under the direction of Willa K. Baum.

Ann Lage
Interviewer/Editor

November 15, 1995
Regional Oral History Office
The Bancroft Library
University of California, Berkeley

Regional Oral History Office
Room 486 The Bancroft Library

University of California
Berkeley, California 94720

BIOGRAPHICAL INFORMATION

(Please write clearly. Use black ink.)

Your full name John Roy Whinnery

Date of birth July 26, 1916 Birthplace Read, Colorado

Father's full name Ralph Vincent Whinnery

Occupation Farmer Birthplace Saguache, Colorado

Mother's full name Edith Mable Bent Whinnery

Occupation Worked in fruit and housework Birthplace Lake City, Colorado

Your spouse Patricia Barry Whinnery

Occupation Farm manager Birthplace Cedar Rapids, Iowa

Your children Carol Joann Whinnery, Catherine Whinnery, Barbara K. Whinnery.

Where did you grow up? First ten years in Read, Colorado, next ten in Modesto, CA

Present community Orinda, California

Education Modesto Junior College (AA 1935), UC Berkeley (B.S. 1937) UC Berkeley (Ph.D. 1948).

Occupation(s) Test Engineer, Research Engineer, Professor of Electrical Engineering.

Areas of expertise Microwaves, Electromagnetics, Optical Electronics

Other interests or activities Reading, Writing poetry and children's stories, hiking, golf.

Organizations in which you are active Orinda Community Church (no formal duties at present.)

I FAMILY BACKGROUND AND EDUCATION, 1916 TO 1937

[Interview 1: January 19, 1994] ##[1]

Parents and Grandparents in Western Colorado, 1870s to 1916

Lage: We're going to start with personal background, because we want to get some sense of the things that shaped you and how your interests developed, and your skills and proclivities. I want to go into it as leisurely as we can, to get a real sense of what your boyhood was like. Shall we start, though, with your family background?

Whinnery: All right.

Lage: I know you started out in Colorado, but how did your parents get there?

Whinnery: My grandparents on both sides came to Colorado from the Midwest. My father's family came first from Ohio and then Kansas, then to Saguache, Colorado, and then to Lake City, because of the gold and silver mining boom in Colorado. This grandfather, John E. Whinnery, was a Civil War veteran. Following the death of his first wife, he married Mary Ann Fawcett, who moved west with him.

Lage: When would that have been?

Whinnery: It was actually before Colorado was a state, I think about two years before. So what would that be? About 1874.

Lage: Was that part of a gold and silver rush?

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[1]## This symbol indicates that a tape or tape segment has begun or ended. A guide to the tapes follows the transcript.

Whinnery: Yes. Not as well known a rush as the one in California. Some of George Stewart's books tell about the Colorado gold and silver rush, too. So they settled in Lake City, Colorado, where there were a bunch of mines.

Lage: Was that eastern or western Colorado?

Whinnery: It's western Colorado, west of the Continental Divide.

Lage: And mountainous.

Whinnery: Very mountainous. My father's family didn't do very well in the mines but finally got a ranch and were among the first to start cattle raising in that area.

Lage: So they quickly learned that the gold and silver wasn't always what was practical?

Whinnery: Yes. My father [Ralph Vincent Whinnery] didn't have much formal education. I think he got through the eighth grade but did not go to high school. But he showed an extreme interest in electricity and worked in the light plant, the water-operated light plant for Lake City. His brother tells about how he tried on the farm to electrify the cream separators. In fact, this brother, Webster, called Webb, who was really quite a character and lived to be 102, said once, "John, I do really believe your father discovered electricity right here in Colorado." Which of course was obviously not true.

Lage: But did he truly believe it, or was he just--?

Whinnery: I don't know. [laughter] That was when he was about 100 years old, so he may have convinced himself.

Lage: What time period would this have been, when your father had this job with the light plant?

Whinnery: It would have been in the 1890s.

Lage: These were the early days of electricity.

Whinnery: Well, not really. Much of Edison's work was before that, also Siemens in Germany, and others. But it was early for western Colorado. And then there was a government program for homesteading land, and the family bought 160 acres on the Gunnison River, near Read. This little town of Read, which you cannot find on most maps anymore, is near Delta, Colorado, at only 5,000 feet elevation. Lake City was probably 8,000 or more. My father later moved down to Read and farmed there.

Lage: Did his family homestead, or did each of the children homestead their own?

Whinnery: From my sister's writings, I understand that the family did the homesteading, but then gave one part to the daughter, Eva, who was then married to Emerson Seely, and one part to my father. Webb took the ranch up in the Powder Horn area near Lake City.

Lage: So he stayed with the cattle ranching?

Whinnery: Yes.

Lage: And your father moved to farming?

Whinnery: Yes, although he also ran a small store and the post office at Read for a while.

Lage: What had your father's family done before they came out to the mines? Do you know that?

Whinnery: There was some sort of an argument over land in Ohio when they left there and started west, and like a lot of people who moved west in that period, they didn't keep too close ties with the family back home, so I know little of the background there. In Kansas it was farming, but they found it very difficult and so decided to move on.

Lage: Sounds like a fairly typical journey out to the West.

Whinnery: Yes. They came out on covered wagons.

Lage: Did your father talk about that?

Whinnery: He was a very quiet person, and talked only really when asked. And I didn't have much interest in family history at that stage, unfortunately. He was actually born in Colorado, in Saguache, which was the first place they settled before they moved to Lake City, so didn't experience the trip west. He did tell stories about his work in the Lake City light plant, and about his experience in the Pitkin Guards, confronting striking miners.

My mother's [Edith Mabel Bent] family, the Bents, came to Lake City from Oswego, Kansas, in 1877, attracted to Colorado by the mines. They were somewhat more successful. At least one of the mines that they developed, the "Dawn of Hope," sold for $20,000, which I guess was a fair amount of change in those days. My mother's father, Charles Hammond Bent, was a lawyer, and was in the state legislature of Colorado.

Lage: He must have had better luck with the mining.

Whinnery: Financially, yes. But he died of silicosis, which was attributed to his activities in the mines.

Lage: Had he been a lawyer back east?

Whinnery: Yes. He studied law at the Lowville Academy and Antwerp Institute in New York state and was admitted to the bar in Kansas in 1867.

Lage: Did you know your grandfather?

Whinnery: No. The only grandparent that I knew was my mother's mother, Amanda Jane Carr Bent. She actually lived with us for quite a few years on the farm near Read.

Lage: Did your mother have brothers and sisters?

Whinnery: Yes. She had two brothers, Earl and Bert [Herbert]. My cousin, Ralph Bent, has written a history not only of the Bent family but of the Carrs and others that were his ancestors.

Lage: Do you know what you know about them from your cousin's work, or from things your mother told you?

Whinnery: Much of the detail is from Ralph's writings. My mother also didn't talk a lot about the family unless the occasion came up, but she did more than my father, and when I really began to be interested, I asked her more questions. I felt badly that I didn't take a recorder and record some of the stories.

Lage: Had she had much education?

Whinnery: Yes. She went at least into high school. I think she graduated from high school, so she had more years of school than my father.

Lage: Was the grandfather being in the state legislature an important position?

Whinnery: Oh, yes. He was considered a top citizen of the area.

Lage: Would that have made her go to the capital?

Whinnery: I don't remember her saying that she went to Denver.

Lage: I'm sure it wasn't a full-time legislature.

Whinnery: No, it was not full-time. And he had other positions in Lake City, including county commissioner. Bent Peak, near Carson, is named for him, according to Ralph's account.

Lage: I think what you remember about it might be the most important thing.

Whinnery: My father was first married to a Swedish girl and had two daughters, Irene and Argenta. His first wife died. He had actually known my mother before. My mother was then living in California, near San Jose, with her mother. Her father had died by that time.

Lage: Oh, and they moved out to California?

Whinnery: She was in an abstract office in the San Jose area.

Lage: What's an abstract office?

Whinnery: It's where they record deeds. Abstracts, I guess, are short descriptions of the property.

Lage: When would that have been?

Whinnery: She was there during the 1906 earthquake; their house was knocked off its foundation. So it was around then.

Lage: And then how did she get back to Lake City?

Whinnery: After my father's first wife died, he wrote to her, and they carried on quite a correspondence. I guess he visited her in California at least once, and they agreed to be married. Then they moved back to Read, Colorado, not Lake City.

Lage: My goodness. So she always had had that California experience that may have shaped things later, do you think?

Whinnery: Well, I don't know that it had much to do with that. It was really my father's decision, when he had such poor health, to try California. But her early experience here may have helped the decision.

Lage: Then did your grandmother come back at that time with her from California?

Whinnery: Yes, she came back also and lived with us at Read.

Lage: So your mother raised your two half-sisters?

Whinnery: Yes.

Lage: How old were they?

Whinnery: I think Argenta was only three or four, and Irene was five or six.

Lage: Your father needed a wife, it sounds like. Two little girls.

Whinnery: Yes. Argenta, unfortunately, died as a teenager from a heart problem. She was a lovely person, as I remember her. My sister Irene is living in Modesto, but unfortunately she is very ill right now.[1]

Lage: What did she go on to do? Did she marry, or did she have a career?

Whinnery: Oh, yes, she married and has four children, Shirlee, Marcia, John, and Steven. Two are living in Modesto, and one in the Los Angeles area. Marcia was in Michigan but died a few years ago.

Family and Boyhood in Read, Colorado

Lage: Tell me a little about growing up in Read, which isn't even on the map anymore. That's kind of intriguing.

Whinnery: Well, the interesting thing is that I can't remember much about the school at all, other than it was a three-room school with first, second, and third grades in the first room, fourth, fifth, and sixth in the second room, and seventh and eighth in the third room.

I can remember a few incidents. I hated spelling bees. They had arithmetic competitions the same way, with speed arithmetic.

Lage: Did you like those?

Whinnery: No, I hated both of them. [laughter] But aside from that, I don't remember the teachers or much of what we studied.

Lage: Do you remember enjoying going to school, or did the spelling and arithmetic bees turn you off?

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[1]Deceased February, 1994.

Whinnery: No, I don't remember hating it or being thrilled with it.

Father's Light Plant in Austin

Whinnery: Again, a very significant thing was that my father decided to buy a light plant for the town of Austin. Now, Austin is a little bit bigger than Read, but not much. They must have had about two dozen houses or something like that. So he tried to buy this little water-powered light plant that was to serve it. As far as I know, he probably was doing it on trial basis, because he did this only for two years. This was before I started school but I remember it more vividly than many things later.[1]

But anyway, we moved up near the light plant, and that was one of the most exciting things to me, to watch the turbines and the generators. And the problem with the water, which came down by ditches, was that the prairie dogs would dig holes in the ditches, and everybody would be out of power for a while.

Lage: It wasn't on a river? It was on a man-made ditch?

Whinnery: No, it was on a man-made ditch. All of that area was irrigated. Water came from the Gunnison River through a series of ditches. The Relief Ditch was the one that our farm was irrigated by. I don't know whether the ditch for the power plant came out of that, but in any event, I remember walking along looking for the prairie dog holes. Sometimes we'd have to do it at night with a flashlight. I suppose that attraction had something to do again with my later interest in electricity.

My father was always interested in machinery. He was a very fine craftsman, carpenter, blacksmith. He would take the Model T car apart every year in the spring, and spread it all out, clean every part, and put it back together.

Lage: Did you participate with him, doing things like this?

Whinnery: Oh, I watched, I suppose. Some of the time I guess I was too young to be very helpful, but I recall that at least once he made a toy car that I could take apart while he was working on the real one.

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[1]See Professor Whinnery's poem "Light (and Cider) for Austin" and others on western Colorado in Appendix B.

Lage: You could see some of the beginnings then.

Whinnery: So I'm sure that his love of machines and his being not too enthusiastic about farming--

Lage: He did this while he farmed?

Whinnery: Well, even though he worked very, very hard, there would be periods between crops. In haying, there were three cuttings of the alfalfa with periods in between. Always in the summer he would try to get one period away to go fishing.

Lage: Did he take you fishing? Was this part of your life, too?

Whinnery: Oh, yes. Again, I wasn't a very skillful fisherman. By the time I was nine or ten, the time we left, I should have been.

Lage: Did you like the outdoors?

Whinnery: Very much.

Lage: Was this something that you think had an influence, living out in that beauty?

Whinnery: Oh, yes. One of the strong memories is of Grand Mesa, which is a beautiful 10,000-foot high flat top mountain with over 100 lakes. We'd also go up around Lake City, Creede, or Gunnison. Those are certainly some of my strongest and fondest memories.

Lage: Sometimes you think that only the people who have grown up in the city and then go for vacations really appreciate the grandeur of the mountains, but it sounds like living there, that was something consciously appreciated at the time.

Whinnery: Oh, I'm sure, yes. As a kid, you don't know what else there is, so I don't know that I appreciated it in the same way as a city dweller. I did later, going into the Sierra from here.

Life in a Small Community

Lage: Tell me something about how your home was set up. Did you have electricity in the home?

Whinnery: No. My dad had generators and would make arc lights and would show magic lantern shows, but in the house we just used kerosene lamps.

Lage: So he provided electricity for Austin, but Read didn't have a source of it?

Whinnery: No.

Lage: What about a radio? Did you have a radio?

Whinnery: No. I remember when my aunt and uncle got a radio, but we didn't have a radio at any time in Colorado. The only telephone line went from our house to this aunt's house, and they had a connection to Delta.

Lage: Do you remember being excited by the radio when you were exposed to it finally?

Whinnery: A little bit. Of course, mostly what you heard was static. You could hear some voices coming through, and some music. But it wasn't tremendous.

Lage: Was the static because of your location, or because of the quality of the radios at that time?

Whinnery: Both. I don't know where the stations were, but they probably were somewheres away, and the radios at that stage were primitive.

Lage: Now, how big was Read? Austin sounds pretty small, and Read is even smaller?

Whinnery: Yes. It was listed in the census, I think, as having eighty-seven people, but they counted all the farms within a several-mile radius. Read itself was a store, a station, a meeting house, and a school at that time. There was a train which actually went through our farm on its way to the coal mines around Somerset. The eighty-seven people of Read, I suppose, would be from a dozen or more ranches or farms.

Lage: Did they gather very often? Were there social occasions?

Whinnery: Oh, yes. The meeting hall which served also as a church was the center of it. In addition to Sunday services, they had church socials.

Lage: Is that something that was important?

Whinnery: It was certainly important to the community, yes.

Lage: Was your family religious?

Whinnery: My mother was quite religious. My father came out of a Quaker background, and I think in his own way he was, but he did not go to the local church. Later when we moved to Modesto, my mother became active in the Baptist church, and he did not.

Lage: Did your mother read the Bible?

Whinnery: Oh, yes. She was very deeply religious.

Lage: How about politics? Was this discussed?

Whinnery: Yes. Uncle Webb was known as "Mr. Republican" in Gunnison. My father certainly was Republican, but he was not ultraconservative.

Lage: Did they follow the national politics, or were they mainly interested in what was going on in Colorado?

Whinnery: I think in both. Certainly at the time of presidential elections, there would be discussion of candidates.

Lage: How about your mother? Was she interested? She must have been, with her father having been involved.

Whinnery: Yes, but she didn't talk about politics as much. But I'm sure she voted about the same way.

Lage: I wonder what drew them to the Republicans at that time? Do you remember?

Whinnery: I'm not entirely sure. Whether it was started before they came to Colorado or not, a lot would depend upon the role of the two parties in the development of Colorado. But I'm not sure.

Lage: Money policy always seemed important. Silver and money policy and all of that.

Whinnery: It could be.

Lage: Was the mining industry still a big factor in the area?

Whinnery: It was certainly on its way down when I was growing up. There are still some mines operating there, I believe, but the boom period had passed.

Lage: It seems like farming wasn't too lucrative.

Whinnery: No, certainly this was a sub-marginal farm. Later, when a sugar beet plant was built in Delta, it was better, but before that,

if you had a good crop, everybody had a good crop and you could hardly sell it. This valley was so far from markets, for one thing. If the prices were right, it was because no one had a good crop. But when the sugar beets came in, it stabilized a bit, but still survival was just marginal.

Lage: What kinds of things did your father grow?

Whinnery: Before that, he hated onions, but he grew some onions, and there was one year that a plant came in to make pumpkin flour for pumpkin pies. We grew pumpkins, and that was fine, we had a lot of pumpkins, trekked them in to Delta. But the place went bankrupt, and we never got paid for them. So that was sort of the story of farming before sugar beets.

Lage: I seem to remember stories about sugar beets, and how arduous it is to farm them. Is that something that you had to do?

Whinnery: The hard part was thinning the beets, but also hoeing later for the weeds. But for thinning beets, we actually had to be on hands and knees. Seeds would be planted in a row, and they would come up close together. You would take a hoe and take out one patch of the small seedlings but then there would be maybe half a dozen left in a little packet, and you had to pick out all but one. This adobe ground was very seldom just the right consistency to get things out easily, and your knees would get sore, and your fingers would hurt.

Lage: Did your sisters and mother also work?

Whinnery: Oh, yes.

Lage: Did you ever hire people, or was this just the family?

Whinnery: The only time we hired people was for threshing of wheat. This was one of the other crops we had before sugar beets. There would be a crew that would go around from one farm to another with the threshing machine. But other than that, we didn't have any hired hands.

Lage: Was that a big part of your life, the amount of work you did on the farm? Did you have a lot of chores on the farm?

Whinnery: Yes, after I was old enough to be useful. We left when I was about ten, so there was a period of four or five years when I could be helpful.

Lage: Would it have been summertime? Did school relieve you from that kind of thing?

Whinnery: Well, some of the chores, like feeding the hogs and the cattle, had to be done every day. In fact, wintertime was the hardest time. I didn't do much milking; Mother did most of that. I remember her out in the cold and snowy weather.

Lage: It doesn't sound like an easy life at all.

Whinnery: No, it was a very tough life, particularly for my father and mother. They worked very hard, and several difficult incidents came up. Of course, the very sad one was Argenta's death.

Lage: Did that occur in Colorado?

Whinnery: Yes.

Lage: And then your father was ill also.

Whinnery: Yes. When he died of pneumonia, the doctor believed that his problem was chronic leukemia and that was the cause of his long-time illness. We were never sure of the diagnosis, since it was only an opinion after his death.

The Ten-Dollar Pig

Whinnery: Oh, I have to tell you one thing about why I didn't like farming, in addition to thinning the sugar beets. They felt in school that we should join the Future Farmers of America. Everybody was presumably going to be a farmer. They made us buy a pig. It had to be a thoroughbred pig, so a ten-dollar pig. Ten dollars was a lot of money in those days. And it couldn't be in the pigpen with the others; it had to have a nice clean place, and it couldn't be fed slops, it had to have special pig food. That pig died on my birthday. [laughter]

Lage: Oh! Your special, cared-for pig! Which birthday would that have been?

Whinnery: Oh, gosh, I don't know. I suppose about eight or something like that.

Lage: So you were getting a taste of scientific farming, and in a sense, it didn't work too well.

Whinnery: The interesting thing is I don't remember whether the people in charge of the program ever came and figured out why the pig died. I would think they should have.

Lage: Yes. Well, they weren't educating you to be an electrical engineer.

Whinnery: No.

Lage: They didn't really expect that of any of their students, probably.

Whinnery: No. I think some of the teachers were encouraging me, and because of what my dad did, I said I wanted to be a mechanic. I didn't know anything about electrical engineers at that stage.

Lage: So you had voiced this even back in Colorado?

Whinnery: Yes.

Family Pastimes and Holidays

Lage: Was your father realistic enough about farming to hope that you would get out of it, or do you remember any discussions along those lines?

Whinnery: I don't really remember.

One other thing about that period that might be interesting is that on long winter nights, my family read aloud. Of course there wasn't any radio or television. They read the Tarzan books, and Jules Verne's *Mysterious Island*, and *Swiss Family Robinson*, books of that nature. My dad liked Victor Hugo very much, but I don't remember their reading that aloud.

Lage: Was this a group activity?

Whinnery: I think it was mostly my father and mother reading. I often had to go to bed before they finished, so I had these stories sometimes mixed up.

Lage: [laughs] I would think so. So they weren't reading to you, just to each other?

Whinnery: No, it was reading to the family, and my sisters were there.

Lage: Do you know if, among the other families in the area, that was a common kind of entertainment?

Whinnery: I don't know. I would guess it wasn't universal, but probably others did it.

Lage: Was music a part of your life at all?

Whinnery: My mother taught piano, but for some reason, whether I wasn't interested or didn't have the aptitude, I didn't learn to play anything. I loved to listen to music.

Lage: Would she play for the family?

Whinnery: She played in church, but not much just for the family.

Lage: Did she have a piano at home?

Whinnery: Yes, she had a piano. I think all of her pupils were girls.

Lage: I wonder if it was thought of as a girls' occupation.

Whinnery: I don't know. But I remember teasing the girls when they came, but otherwise I didn't get in on the lessons.

Lage: Did your dad hunt?

Whinnery: Yes. I think I mentioned in one of the verses about going to Cedaredge for cedar trees for Christmas.[1] We'd always take along a gun and try to get some rabbits. I don't remember that he went deer hunting.

Lage: Doesn't sound like a big part of his life.

Whinnery: No.

Lage: What was Christmas like?

Whinnery: All the holidays, the Fourth of July and Christmas and Thanksgiving, were really quite festive. My mother would make all the kinds of candy for the week ahead--fudge, fondant, panoche, divinity.

Lage: Did family get together? Did your mother's family come, and your father's?

Whinnery: Oh, yes. All the relatives in that area would get together on all of these holidays.

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[1]"A Child's Christmas in Read," Appendix B.

Lage: Was Fourth of July a kind of civic affair in Read?

Whinnery: My father loved it and would get fireworks. I remember people coming in, and those would be some of the times he would also put on these lantern shows. The only thing that bothered me, my dog just hated it, and he would disappear just as soon as he heard the first firecracker. The parades and civic activities were in Delta.

Lage: Now, were the lantern shows slides, photographic slides?

Whinnery: Yes. They were not like our 35-millimeter, but larger.

Lage: Glass?

Whinnery: Yes.

Lage: Did your father take those pictures, or did he buy them?

Whinnery: He had pictures of scenic places around the world, but I think he bought them.

Lage: It sure is amazing, when you think of how the relatively short time things have changed, from the magic lantern show being a novelty, to television.

Whinnery: Yes, that's right.

Lage: Quite amazing. Do your children ask you about what it was like to grow up in Read?

Whinnery: They're somewhat interested in the family. Our oldest daughter, Carol, in particular, started collecting family histories. But I guess they haven't really asked me much about the individual events.

Lage: About your own experience?

Whinnery: No. They seem to enjoy it when sometimes--like when I wrote those verses, and certainly when my sister wrote the family history as she remembered it.

Lage: Did your sister play the piano?

Whinnery: Yes. She doesn't consider herself expert, but has played regularly for her Sunday school class.

The Move to Modesto, California, 1927, and Father's Failing Health

Lage: Let's find out about Modesto, and why you moved there.

Whinnery: My father's health was getting worse and worse.

Lage: Was he just getting weaker and weaker, or was he diagnosed as having something?

Whinnery: The doctor in Delta, near Read, prescribed some medicines for him, but I'm not sure of the diagnosis. After he died, the Modesto doctor thought his problem had been chronic leukemia. In any event the winters in Colorado had become increasingly difficult for him.

So one winter, about 1926, when I was ten years old, he decided to pack up the Model T Ford and try Arizona and California. He first of all remodeled the Ford so it was almost a camper and then went down to Phoenix and worked in the lettuce.

Lage: Did he go by himself, or was this with the family?

Whinnery: At that time, my sister was going to college in Gunnison, so it was just the three of us: my mother, father, and I. They both worked in the lettuce in Phoenix to get enough money to go on.

Then we went on to California, finally to Modesto, where some former neighbors had settled. Then he worked pruning fruit trees during that winter. The great thing about it was that I didn't have to go to school all that year.

Lage: What did you do while they were working in the lettuce fields?

Whinnery: There were other kids, and we had kids' games, I guess. There was a new merry-go-round in Phoenix which they let us ride for free. I did have some books to study but don't remember spending much time with them.

Lage: Sounds like a nice interlude. Did it bother your mother or father that you weren't in school? Was it something that they were worried about?

Whinnery: I don't know.

Lage: You weren't!

Whinnery: I wasn't. But when we got back, they tell me that all I could talk about were the dams that we saw along the way. We did see a number of dams, both in Arizona and California, including the Don Pedro Dam near Modesto. So I suppose that's significant in revealing my interests.

Lage: Right. So you were nine or ten then.

Whinnery: I was about ten, I guess.

Lage: And you came back to Colorado?

Whinnery: Came back to Colorado, and my father had felt so much better that winter that he decided to move permanently. The next fall we returned to Modesto.

Lage: Was that something that you looked forward to? Were you just as happy to be leaving, or do you remember?

Whinnery: I don't remember being either sad or overjoyed. I suppose I was interested, because I had enjoyed the previous year.

Lage: Of course, that meant going back to school.

Whinnery: Yes. I first went to the Roosevelt Junior High, starting at the seventh grade, in Modesto, and then the Modesto High School. As I mentioned in my note to you, I had some marvelous teachers.

Lage: Did you begin to enjoy school at that point, do you think?

Whinnery: I don't think I enjoyed junior high very much. Part of the problem was that I was very shy and looked like a hayseed to the other students. Some of them were pretty mean, not physically mean, but taunting.

Lage: That's junior high, isn't it?

Whinnery: Yes. But I began to develop friends of my own, and by the time I was in high school, had some close friends. Often the friendships came about because of the classes we liked together, the math and science classes. I really did enjoy the teachers, just marvelous teachers.

High School in Modesto

Teachers

Lage: Tell me about some of the teachers that may have been influential. Do you recall them as individuals?

Whinnery: For geometry, which I loved, there was Miss Brown. The French teacher, Miss Peron, was a marvelous person. She died only a few years ago.

Lage: Did you keep in touch with her?

Whinnery: Yes, I saw her in Modesto quite often. We had a general science teacher, Mr. Utter, and then a wonderful chemistry character, Willie Brown. He would tell stories about his safaris in Africa but also made the chemistry sound so exciting. When he got to Madame Curie and the discovery of radium, everybody was on the edge of their chairs, the way he told the story.

Lage: He was telling you about the development of chemistry and--?

Whinnery: Yes, but also we had the chemistry lab.

Lage: Did all this really intrigue you?

Whinnery: Oh, yes. In fact, at one stage I was going to be a chemist. I don't know why I changed--just got interested in a variety of things at different times, I suppose.

Denny was the physics teacher, not quite as inspiring as the others, but again, I liked it. And in English, the marvelous Barbara Barrett. I also had her again after she moved from the high school to junior college. She encouraged creative writing and made literature sound exciting.

Lage: You were interested in the humanities as well, even then?

Whinnery: Yes, particularly the English with Miss Barrett. Some history was interesting, but I don't remember that as well.

Lage: Do you remember these teachers as being particularly encouraging to you as an individual?

Whinnery: Yes, many were, Miss Barrett in particular. In fact, jumping ahead to junior college, she picked out two or three of us, and

rather than having us sit in class and do the exercises, she assigned a book for us to read and discuss together.

Lage: The three of you together?

Whinnery: Yes, and then we would have to write a composition about the book. She often read these to the rest of the class.

Lage: Did you ever think about going on in that field, when you were studying?

Whinnery: Not seriously. But I keep intending to collect some of the things I write and still may, some day.

Lage: It's always been an interest, it sounds like.

Whinnery: Yes.

Friends, and Hobbies

Lage: Do you have any recollection of how inquisitive you were about your studies, in comparison to your peers?

Whinnery: Well, Don Martin, Vernon Doslaugh, and John Sardis were the three friends that I was the closest to during this period--we always had some project going. Now, as I look back on it, it sounds terrible, because I don't think we ever finished any of these.

Lage: What kind of projects?

Whinnery: Building a radio, making a telescope--when we were in general science, we got really excited about astronomy, and we were going to grind the lens for a telescope. And in chemistry, we were going to make a sulfuric acid plant.

Lage: That's ambitious.

Whinnery: One which got nearest to being finished, but my dad did a lot of it, was also in general science; it was building a miniature light plant. At that time, we were on a farm which had a creek running through it, so we built a dam and then a water wheel, and that worked all right. And then a little generator, which my dad pretty much made. And then we were going to make a storage battery, charge the storage battery and bring it back up to the house, but we never got that far. For the astronomy

project, we never even got the money to get the blank to start grinding the lens.

Lage: Because these things all did take money.

Whinnery: They did.

Lage: Did the teachers help you with those, or was it on your own and with your father?

Whinnery: I particularly remember asking Mr. Utter questions about the generator and the telescope. But I guess most of it was on our own.

Lage: That seems like something that's pointing to your later interest.

Whinnery: Oh, I'm sure it did. But I am embarrassed to think that I was getting excited and starting so many projects, but didn't seem to get many of them finished. Others seemed to finish fairly ambitious projects.

Lage: When you say other people were finishing them, do you mean other people in your school?

Whinnery: Not so much in the school. For telescope makers, there was a little magazine for amateur astronomers, and you'd see these pictures of persons our age and the telescopes they had made.

Lage: Probably few and far between really got finished.

Whinnery: And certainly in terms of amateur radio, there were a lot of "hams", and I never did get the license.

Lage: Was part of that money constraints also?

Whinnery: Some of it was, because when we were trying to build a radio, we'd try to pick up old radios and take parts out of them. But I think there was something beyond that.

Family Life in Modesto

Lage: How did your mother feel about all your interests? Was she encouraging as far as education went?

Whinnery: She wasn't pushing me but was certainly encouraging.

Lage: She hadn't laid out a goal for you to pursue a higher education?

Whinnery: No.

Lage: Did the family continue their evening reading in Modesto?

Whinnery: Not so much. By that time, there were radios, so we would listen to Amos 'n' Andy instead.

Lage: And you lived on a farm again?

Whinnery: We did for a couple of years. My brother-in-law and my father were going to try to buy this little farm. That didn't work, but for two years we were on it while they had an option to buy. Even then, my father was working in the pruning and picking fruit, but his health continued to decline, and after a few years, he couldn't do that. So my mother was doing housework and such things to get most of the family income.

Lage: And your sister, did she come out with you, or stay?

Whinnery: My sister came with us when we moved permanently to Modesto. She also had a health problem and had to give up the college. She came out and got married shortly after that.

Lage: And stayed in Modesto?

Whinnery: And stayed in Modesto.

Lage: So that's probably why you keep your tie to Modesto and have seen the teachers over the years.

Whinnery: Yes. The high school class has a reunion every five years starting with the twenty-fifth, and they just recently had their sixtieth, but I probably wouldn't have gone to many of them if it hadn't been for my family being there. But we have enjoyed them.

Lage: Do those three special friends go to the reunions?

Whinnery: Don Martin is now married and has a family which he started at age fifty. He lives in Utah, but comes to nearly all of these. John Sardis was a very successful structural engineer, but died of a heart attack ten or more years ago. But until then, we kept in touch regularly. Vernon Doslaugh joined the navy and after a time we lost contact.

Lage: Did they go off to college?

Whinnery: Sardis graduated as a civil engineer from Berkeley, and Don Martin is from the chemistry program at Berkeley. I think he later came back for a master's degree. I don't know about Doslaugh.

Lage: Was Berkeley sort of a common route for the people in Modesto who were going on?

Whinnery: Yes. At that time UCLA was the only other campus of the University of California, and did not have engineering. The junior colleges were marvelous. I think maybe it was because of the depression that they had such good teachers.

Lage: That has an effect, doesn't it, the economic situation of the times.

Whinnery: Yes. Well, there are still some very good ones, but I think it's harder for them to keep the same quality now. There's so much competition with the state colleges and universities.

Lage: And they also probably got a better quality student then, who couldn't afford to go on to four-year schools?

Whinnery: That's right.

Modesto Junior College

Lage: You went to Modesto Junior College?

Whinnery: Yes.

Lage: And how was your education there?

Whinnery: Again, just marvelous.

Lage: Good math and science as well?

Whinnery: Yes. The physics professor was William Martin, who was the father of this Don Martin that I mentioned. Chemistry was Green, I think he was one of the few that had a doctor's degree, and was very good. Geology, Professor Von Eschen was fine. Math, interestingly enough, I don't remember the teachers so well, but there were sound calculus courses. And then there were two fine engineering faculty members, Franklin Rose and Atkinson. They made us work very hard, which is part of what you have to learn to do in engineering.

Lage: Were they giving you an overview of engineering, or was there any specialization?

Whinnery: The things at that time every engineer had to take, whether they went here or anywhere else, were drafting, surveying, and introduction to mechanics. But they also had some special elective courses. Atkinson gave one in electricity, with a lot of demonstrations.

Lage: What kinds of things would he have presented? Can you recall that detail?

Whinnery: The demonstrations were fairly simple, but I recall being especially impressed by the behavior of alternating-current circuits with inductors and capacitors. This went well beyond the treatments we had had in physics classes.

Lage: Did any of this affect your early teaching?

Whinnery: I don't know. It might have.

Lage: It seems like the intriguing classes that you had often shape how you go about trying to intrigue students.

Whinnery: Yes. I hadn't thought about that course, but it may well have had an influence.

Lage: Was there any particular person that served as a role model to you or who helped give you a sense of what you might want to go on to do?

Whinnery: William Martin took a strong personal interest in me and helped very much. I have already mentioned Barbara Barrett. And there was another very fine English teacher, much more formal and strict, Dr. Cooper. We had Shakespeare and Browning's poetry. So I certainly enjoyed those.

Lage: Did you always know you would go on to the university?

Whinnery: No. First of all, when I graduated from high school, I didn't think I had enough money even to go to junior college. I got a $50 scholarship which I think was just made up by the high school teachers. So I went to junior college, and again wasn't sure I could continue beyond that, but I did get a scholarship from Berkeley. I don't remember how much that was, but it probably wasn't very much by current standards.

Lage: Well, in the mid-depression, it probably didn't cost nearly as much.

Whinnery: My room and board then was $25 a month.

Lage: When you came up here?

Whinnery: Yes. Books were about $5.

Lage: My daughter just spent $200 on books for two classes.

Whinnery: Yes. I believe it. The registration fee at Berkeley was $17, as I recall.

Lage: Did you work while you were in junior college and then later up here?

Whinnery: Yes. Most of my work was summer work in the dry yards, in the apricot and peach industry of Modesto. I didn't work up here.

Lage: Did your parents ever feel that they needed you to work to help them out? Was there a sense that your going off to school would make it hard for them?

Whinnery: No, I don't think so. It probably did make it harder for them but they certainly wanted me to go on.

University of California, Berkeley, 1935 to 1937

Lage: What was it like, coming up to Berkeley from Modesto in 1935?

Whinnery: Well, it was exciting, and a little bit scary at first. Fortunately, I was rooming with Don Martin, the friend I have mentioned, so we did a lot of things together.

Lage: Did he come up at the same time?

Whinnery: Yes. Also John Sardis, although I think he may have stayed an extra term in Modesto. But in any event, much of the time he was here too.

Lage: Where did you live?

Whinnery: Well, my first year was in a boarding house on College where the dorms are now. There were places where one got room and board for $25 a month. The second year, I moved in with a family that I had known in Modesto, on Walnut Street.

Lage: Where on Walnut?

Whinnery: It was about two blocks north as you walk from the university.

Lage: So you lived with them rather than with other students?

Whinnery: Mrs. White, who was divorced, had two daughters and a son. The son, Jim, was a little younger than I but we were good friends. He lives up in Tahoe now. We haven't seen each other for years, but we still exchange Christmas cards.

Social Life

Lage: Was there much social life for you, or was it mainly studying?

Whinnery: I went to the Baptist church here and attended a youth group called the Roger Williams Club.

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Whinnery: Jim and his sisters were active in the Roger Williams Club, so I went there quite regularly. But also, after I became inducted into Eta Kappa Nu here, I met other students who became friends.

Lage: Is Eta Kappa Nu an engineering society?

Whinnery: It's the honorary electrical engineering society.

Lage: And it had a social component to it?

Whinnery: Yes. There were often trips to some industry with a picnic before or dinner after. It was very exciting going to San Francisco then, because we could only go by ferry. I was a secretary of our chapter for a time and made many friends there. Stanley Elliott, who made a career at Bell [Telephone] Laboratories; Wilton Abbott, who taught here before going to Lockheed; Will Fenn, who was later active at the MIT Radiation Laboratory; and Joe Pettit, who became dean at Stanford and later president of Georgia Tech, were among these.

Lage: So you still have ties with some of these classmates.

Whinnery: Yes.

Lage: Any interest in the sporting activities on campus? Did you go to football games?

Whinnery: Oh, yes, we went to all the football games, and most of the basketball games, and track meets. We took them very seriously.

Lage: Do you remember political activities on campus, or did you get involved in any?

Whinnery: No.

Lage: During the depression?

Whinnery: No. Well, yes, I was on a strike in Modesto.

Lage: In junior college?

Whinnery: No, in the fruit industry. I started at fifteen cents an hour, then got seventeen and a half cents an hour, and finally twenty cents an hour. Then I moved to a different place where I got twenty-five cents an hour, when most of the workers there joined an area-wide strike. I didn't really know what was going on, but joined the strike, which quickly failed. So then I went back to my former job at twenty cents an hour. [laughter] Not many people know about the agricultural strike of 1935 or so.

Lage: Did you have a sense of being very emotionally committed to it?

Whinnery: No. [laughs] One of my friends who didn't join the strike said I just didn't know what was happening. That's probably true.

But coming back to Berkeley, I suppose there was political activity at Sather Gate, but it wasn't very obvious, at least to those of us on the north side of campus.

Education in Engineering at Berkeley

Lage: Let's talk about the engineering program at that time and contrast with how it's developed since.

Whinnery: Yes. The first obvious difference is that it was nearly all undergraduate. There were a few master's students around, but only one or two Ph.D. students. Only one in electrical engineering, Lyman Fink. So the emphasis was on the undergraduate program. We had some very good teachers. The first one that I got to know and who was extremely helpful, and a very good teacher, was Abe Tilles. He later left the university and worked at PG&E for a while, then at Lawrence Livermore Lab, and has since retired.

Lester Reukema was the powerful lecturer. He had everybody slightly afraid of him, but I greatly admired his lecturing style.

Lage: What was his lecturing style?

Whinnery: First of all, he didn't use any notes. He would come in and start filling the blackboard with equations. A lot of that was showmanship, which I later learned was not really as good educationally as the presentations of others who were a little more informal. But he also was very good at following the literature and bringing in new developments. I remember, for example, that the concept of feedback was just published, and within a day or so after the article came out, he had a complete lecture on it. He had essentially photographic memory. He could look at an article and reproduce it, but he also clearly understood the significance.

Herb [Herbert] Scott was another very fine person who had good physical pictures and clear explanations. He was especially close to his students.

Lage: Were these electrical engineers?

Whinnery: The ones I've mentioned so far are electrical engineers, but I had to take--[laughs] I shouldn't say <u>had</u> to take, but I was taking mechanical engineering and civil engineering courses too, and had some good instructors in these.

Lage: When did you specialize?

Whinnery: At the junior year.

Lage: You chose a field of engineering?

Whinnery: Yes. Now you have to choose your major when you enter as a freshman. Until about 1960, you didn't have to choose a branch of engineering until your junior year.

Lage: But even then, you took classes in the other branches?

Whinnery: Yes, but now our students don't take very many. We had to take full-year courses on heat power engineering, analytical mechanics, and a civil engineering course on strength of materials. The instructor for that, [George E.] Troxell, was very good.

Lage: Did you have personal contact with them?

Whinnery: I did with Abe Tilles, whom I went to see several times. For example, I didn't think I could afford to join Eta Kappa Nu, which cost $25, but he convinced me that the association with the students of that group would be worth it. But also it would look good on my record when I went to get a job. Getting a job at that time wasn't very easy.

Lage: Twenty-five dollars: an entire month's room and board. That was expensive.

Whinnery: That's right.

Also Herb Scott, although at that time I had him only for a laboratory. He hired my friend Stanley Elliott and me to work on a frequency standard that had been given to him. He said later that it wasn't so much to get the frequency standard working but to give us work. He was a marvelous person.

Lage: Were these men mainly Ph.D.'s?

Whinnery: Reukema was, and Tilles was. Also Leonard Black. It certainly wasn't unusual to have one, but it wasn't as universal as it is now.

Lage: Would that affect their style of teaching?

Whinnery: It certainly could, but there are other things that affect it.

Lage: It wasn't something you noticed.

Whinnery: Not directly. I liked the style of Tilles about the best, because he was clear and very thorough, but still somewhat informal. He was a great admirer of Reukema and has said that he copied certain techniques from him.

Lage: Was there give and take in the classroom?

Whinnery: These were big classes, 120 or so, so not an awful lot.

Lage: Things haven't changed, or have they? Are your classes that large?

Whinnery: There are still some that are that big, but most of the classes are forty or fifty, or less. [This is changing with the decreases in faculty. -J.R.W.]

Lage: So they were actually larger than now. How large was the program?

Whinnery: I think in electrical engineering there were around 200 in the class that I was in.

Lage: It was the only public program in the state.

Whinnery: Yes.

Other Coursework

Lage: Did you have classes outside of the College of Engineering? Did you take math and science?

Whinnery: Yes, I took math. The instructor there was [Elmer C.] Goldsworthy. The math was okay, but the main thing I remember is that he took us to breakfast at the Faculty Club on the last day of class. I always thought that a marvelous thing to do, so I did that a few times with some of my classes.

In physics, I had a course called modern physics, which went beyond the classical, with Robert [B.] Brode. At the time, I thought him a very poor lecturer, but I probably learned more from that class than any other class. He gave very tough problems, so to work them you had to go to the library. You couldn't get the needed information from any one book; you had to look through several books, which is of course what you have to do after school. So that was probably the single most valuable class that I had, but at the time, I judged it by Brode's lecturing style. I think this is pertinent to class ratings, where so much of it is the lecturing style. Only later do people fully realize how much they really learned from a class.

Lage: That's interesting. I've heard from your colleagues that engineering was much more practically oriented at the time. Did that make physics seem much more theoretical?

Whinnery: Yes, I think there was probably a bigger distinction then than there is now.

Lage: Were you drawn to one or the other, the practical or the theoretical, at that time?

Whinnery: I certainly liked the theoretical. One of the things I had in mind, though, was making a living, and even though it was tough to get a job in anything, there were more jobs for an

undergraduate B.S. in engineering than there were in either physics or chemistry.

Lage: When you came to Berkeley, you knew you wanted to be an engineer. Was this still coming out of the sense that you wanted to be a mechanic?

Whinnery: [laughs] I think it was in high school that when I said I wanted to be a mechanic, it didn't impress anyone. [laughter] So I learned that being an engineer was a step up. But I don't remember exactly where it happened.

Lage: Well, of course, the dam builders were engineers.

Whinnery: Yes. It may have been one of the first teachers there, that suggested engineering when they saw the direction of my interests.

University Medalist

Lage: Now, you were University Medalist. Tell me about that. Is that based on grades?

Whinnery: Yes, at that time it was almost strictly grades. Now I think they have a pool of top grade-point persons with reference letters, interviews, and so on. But at that time, it was just on grades. The thing that surprised me was that I was here only two years, but was included along with the people who'd had to struggle four years.

Lage: I wonder if they took your grades from junior college? They must have.

Whinnery: I don't know. You think so? I always assumed not.

Lage: Were there ceremonial activities connected with that?

Whinnery: There was one commencement exercise for the whole university at that time, and there were 2,500 graduates that year. Graduation was held in the stadium, and Robert Gordon Sproul--

Lage: Who was a young president then.

Whinnery: Yes, I guess he was pretty young. He presented the medal, and I was scared to death. In fact, at that time, it made all of the papers the next day, with pictures of me getting the medal, the

Oakland Tribune and the *Berkeley Gazette* and even San Francisco papers. One of them even referred to "the frightened recipient." [laughter] So it showed that I was scared stiff. I didn't have to say anything.

Lage: Did it make the Modesto papers?

Whinnery: Yes. I hadn't told my parents, and I guess they had mixed emotions: annoyed with me for not having told them, but proud, of course.

Lage: They didn't come up for your graduation?

Whinnery: No. I guess they would have tried if they had known although my father wasn't well. I first learned of it from the dean of engineering a day or so before graduation.

Lage: Who was?

Whinnery: Dean [Charles] Derleth [Jr.] He said, "A lot of people say you have to live up to this, but I'm telling you you've got to live it down."

Lage: [laughs] I wonder what he meant by that?

Whinnery: Well, I think I know what he meant. I suppose he meant, "Don't let it go to your head."

Lage: Right. It's just the beginning, not the end.

Whinnery: Sure.

Lage: Very interesting reaction. Did you have a chance to take any classes outside of engineering and math and science?

Whinnery: At Berkeley? No, I think the courses were engineering, math, and physics.

Lage: You didn't get to go on with your English?

Whinnery: No.

Lage: That's too bad. You would have enjoyed that.

Whinnery: Yes. It's very interesting, because now the accrediting agencies require that engineers have a certain number of humanistic, social courses. Maybe I had enough from junior college to fulfil the requirement. Everything I took here was a required technical course, amounting to eighteen units a term.

Looking for Work During the Depression

Lage: Where were most of your fellow students planning to go? Were many of them thinking of graduate school?

Whinnery: No. A few went on to the master's program, including my friend, Stan Elliott. Because of that, he was able to go to the Bell Laboratories, which hired only persons with a master's degree or higher. I was feeling sad that I couldn't think of going to Bell Labs, but GE [General Electric Company] had a training program which turned out to be very good for me.

But it was very tough getting a job of any kind. This was 1937 and was about the first year that GE started recruiting after the depression.

Lage: Were there many people here recruiting?

Whinnery: No. GE had a recruiting team, and Westinghouse also. I also interviewed for a job with Shell Oil Company in San Francisco but didn't get an offer.

Lage: Have we gotten a good enough picture here of the undergraduate experience? Is there anything else that you can think of we should cover? Any fellow students or more on professors, or contrasts with when you came back after the war?

Whinnery: The big contrast, so far as the university was concerned, was with the postwar period when graduate studies and research grew so rapidly. I'm sure we'll talk about that more later.

Lage: Did you keep in touch with fellow students?

Whinnery: Well, yes, some. I mentioned two or three, including Joe [Joseph] Pettit, who became dean of engineering at Stanford and then president of Georgia Tech.

Lage: So he was here with you as an undergraduate?

Whinnery: I'm not sure he was in the same class, but I knew him primarily through the Eta Kappa Nu organization. Ed Ginzton, who was at Stanford and then the head of Varian Associates, was in the master's program when I was an undergraduate.

Lage: Did you know him?

Whinnery: Yes. I didn't know him as well as Pettit. I think that he didn't take as much of an active role in Eta Kappa Nu, but

everyone looked up to him. He was obviously a very unusual person. He went on to Stanford for his doctor's degree, as did Pettit.

Lage: Did Stanford have a good reputation in electrical engineering?

Whinnery: Oh, yes. Fred Terman was already building the reputation of Stanford in electrical engineering, so quite a few of the people with master's degrees from other institutions went on for their doctor's degree at Stanford.

Lage: Did you keep in touch with Ed Ginzton over the years?

Whinnery: Yes. A lot of our association has been through one organization or another. I certainly see him at conferences quite often.

Lage: And Lyman Fink you mentioned.

Whinnery: Yes. Lyman Fink became a vice president at GE, and I saw him occasionally in Schenectady, but we didn't ever work closely together.

Lage: Okay. Well, maybe this is a good time to take a break and pick up with GE next time.

II GENERAL ELECTRIC, SCHENECTADY, NEW YORK, 1937 TO 1946

[Interview 2: January 26, 1994] ##

Lage: Today we're going to begin with your experience at General Electric. We ended last time talking about how scarce jobs were in the depression. Were there any other offers except General Electric that you remember?

Whinnery: I think that I had an offer from Westinghouse, but I considered the GE program much better than the Westinghouse program. What I really wanted was Bell Laboratories. Even then, it had a reputation in electronics, but they required a master's degree or higher. I mentioned the interview with Shell Oil.

Lage: What was General Electric's reputation?

Whinnery: Their test program and the advanced engineering program were already well known around the country. And as we'll see, it certainly was a tremendously valuable program for me.

Lage: A chance for growth.

Whinnery: That's right.

Lage: Now, I read Simon Ramo's oral history,[1] as I told you, and then I got *The Business of Science*.[2] He tells a wonderful story about how playing the violin helped him get his job with GE. Were they interested in your other interests?

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[1]Simon Ramo, *Entrepreneurs of the West*, Oral History Program, University of California, Los Angeles, 1985.

[2]Simon Ramo, *The Business of Science*, Hill and Wang, New York, 1988.

Whinnery: I don't remember anything other than their concern that I wasn't in Tau Beta Pi. They thought that maybe I hadn't been asked and couldn't believe it when I said I couldn't afford the initiation fee.

Lage: You didn't have to bring a portfolio of poetry, or anything like that?

Whinnery: No. [laughs] I had written a few things by that time, but it wasn't anything that was widely known--or should have been.

GE Test Program, Erie, Pennsylvania

Lage: You said this was a critical period of your career, these years at General Electric. I'm drawing on Charles Susskind's interview.[1]

Whinnery: Yes, that's certainly right.

Lage: Why was that?

Whinnery: Can I start with the Test Program and the Advanced Engineering Program, and the assignments I had on the program, which were the key things?

Lage: Yes. That one question could take us the whole interview. What was the Test Program?

Whinnery: All the engineering graduates hired by GE at that point were called student engineers and had to go through the Test Program. They were assigned to departments on a rotating basis with most of the work testing the machinery before it went out. Some of the tests were routine, and some were interesting and quite difficult.

Lage: These were their commercial products that you were testing?

Whinnery: Yes. My first assignment on test was in Erie, Pennsylvania, testing railway contactors. It was pretty routine. I don't remember learning much other than that the contactors were

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[1]Interview with John Whinnery, 21 June 1988, conducted by Charles Susskind, Department of Electrical Engineeering and Computer Sciences, University of California, Berkeley.

supposed to open and close at certain current readings, and if they didn't, you sent them back.

I did enjoy the period in Erie, because it was autumn, I was on the night shift and had the days to get to know Lake Erie. But I had reported late and the exam for the advanced course, which I hoped to enter, was scheduled for about two weeks after I arrived in Erie. So there wasn't time to do much studying.

But I took the exam and must have passed, because I was invited to Schenectady. I was only in Erie three or four weeks.

GE Advanced Engineering Program

Lage: So you weren't too long with the Test Program?

Whinnery: No. The assignments for the Advanced Engineering Program were generally a cut above, although one was not, as we'll see in a moment. But in general, they were either with research or development groups, or the testing of more advanced apparatus.

In addition to the assignments, there was class one morning a week with lectures by experts in the company. There were quizzes and tremendous assignments that took typically twenty to thirty hours a week. In the assignments they tried to have problems that came out of the company's needs. As I learned later when I was a supervisor, you couldn't find enough of these, so you made up quite a few yourself. But they had three characteristics. First, they tried to make you go back to fundamentals. For example, there would be a lecture on Maxwell's equations one week and then a problem on radiation from antennas designed by their transmitter department.

The second characteristic was that one had to make approximations and idealizations, as in most real problems. A third goal--which didn't always happen--was to have a problem that mixed electrical, thermal, and mechanical elements together. Not all the problems were ideal, but they were more representative of real engineering problems than the more artificial ones of a typical class.

Lage: I see. So even at the time, did it seem that way to you, that you were getting a more practical course of training?

Whinnery: [laughs] I guess so. We mostly complained about how hard the problems were. For most of us, twenty or thirty hours were required, though a few claimed ten or less.

Lage: Was this in addition to your regular workday?

Whinnery: That's right, except for the four-hour class.

B. D. Bedford

Whinnery: I still think the most valuable part was in the assignments. One I remember best as being great was an early one with B. D. Bedford on DC power transmission. This was the beginning of transmission by direct current rather than alternating current, an approach now used in many long-distance power transmission systems.

Lage: So that was a new direction?

Whinnery: It was new at the time. There was a thirty-kilovolt working system from Schenectady to Mechanicville thirty miles away. We had a model of it in Building 37. The problem was that it had faults and breakdowns, so Bedford's problem was to try to improve the system. Some of the problems came from the thyratrons and ignitrons that were used at that time, and some from the protection transformers and selsyns. So Bedford would dream up changes that my partner, Ed Kenefake, and I should try.

Lage: Just the two of you?

Whinnery: That's right. And we would sometimes have to go to the other end of the plant to find the motors or selsyns to use. Often the new system didn't work and there would be a breakdown with much sound and light.

Lage: Was it intriguing?

Whinnery: Oh, yes, intriguing, and Bedford was such an inventive person. I believe he had the record on patents in the company at one time. He was a marvelous person to work with. And he gave us opportunity to try things on our own and report back what we found. I don't know that we made any great improvements in the system.

Lage: You didn't solve the problem?

Whinnery: No, but we learned a great deal.

W. C. Hahn

Whinnery: Two important advanced course assignments were for W. C. Hahn, who was working on microwave tubes of the velocity modulation class. These are very closely related to the devices now known as klystrons, but before the klystrons were announced by the Varian brothers [Russell H. and Sigurd F.].

Lage: But these were close in design to the klystrons?

Whinnery: It's the same velocity modulation principle. The principle was originated by the Heils in Germany in 1935. Hahn was working with Chester Rice trying to guide planes by microwaves for aircraft landing purposes using the Doppler principle. They didn't have the right sources, so began the development of the velocity modulation tubes. Hahn's tube had tremendous amounts of power for that time.

Lage: Was this a principle that you had studied on the campus here, or was it too new?

Whinnery: No, it was entirely new. Hahn was a marvelous experimenter, a marvelous theorist, and pretty tough on some people, but very nice to young persons working with him.

Lage: Was he a Ph.D.?

Whinnery: I don't think so. He was an MIT graduate, and had worked in sales for a while before Rice recognized his--I would say genius; he was truly a genius.

In any event, I learned a tremendous amount from the two six-month assignments with him. In the second year there were six-month assignments.

Lage: And the first year was--?

Whinnery: In the first year, they were mostly three-month assignments.

Simon Ramo, and Collaborating on *Fields and Waves in Modern Radio*

Whinnery: Between the two with Hahn, I had one with Ramo, which was the most important one of all.

Lage: Okay, tell me about that one.

Whinnery: Ramo and [John] Blewett were then working on magnetron-type microwave tubes using rotating space charges. The magnetron principle had been developed by Hull, at GE, some years before but had not been useful at microwave frequencies. The breakthrough work in microwave magnetrons was done in England. Ramo and Blewett had the right idea, and it's a little puzzling to know why their devices didn't work any better than they did.

Lage: You mean the reason for Ramo's device not working as well is still not apparent?

Whinnery: I think we know some of the reasons, but not all. They had rotating space charges interacting with microwave resonators. One of the things that was missing was a system for mode control. The British did this by a system called strapping. Even so, I would have expected more interaction than they obtained.

Ramo was also working at that time on electron microscopes --perhaps that came out in the oral history you read. So I got to talk to him about both things. That was when he asked me to join with him on the book, which was very, very surprising in view of my lack of expertise.

Lage: Early on, he saw something in you.

Whinnery: I have a story I have to tell you. When people ask why the book was so successful, I say, "Well, it's very simple. You take one very bright person who understands the subject thoroughly, and one rather slow person who doesn't know anything about it, and by the time the first one explains it to the second one, if you can record it, you have very good pedagogy." But I refuse to tell which person is which.

Lage: [laughs] Now, you'll have to tell it in this oral history.

Whinnery: Well, you can guess. But he said he asked me because he liked my poetry.

Lage: How interesting.

Whinnery: I said, "I don't know enough about electromagnetics to write a book." He said, "Don't worry about it; I'll tell you."

Lage: How did you work together?

Whinnery: He did have a marvelous concept of what was needed at the time. He'd followed the literature closely--literature was then a little easier to follow. It was mostly in the *Proceedings of the IRE* [Institute of Radio Engineers] and the *Journal of Applied Physics*, with other journals, of course, including some foreign journals. At the time he asked me, he had an outline of the whole book, which we changed a few times, but nevertheless, even the first outline was good.

So then he would make a chapter outline listing the articles that I should read and the general development. He dictated the introductions to these chapters to his wife while he was wiping dishes, and they were part of the reason the book was so successful, his physical pictures and analogies were so clear. I would then read the articles and write a draft. He would then do a second draft, and this went back and forth several times.

Lage: Was this over a period of years?

Whinnery: Yes. It started in 1940 or 1941.

Lage: And it was published in '44.

Whinnery: Yes. During 1941, and part of 1942, I was supervisor of the high frequency course of the Advanced Engineering Program. We used a draft in the course and got some feedback from the students.

But the last thing we did, after many drafts, was to read the thing aloud to each other. We were working six days a week, but we'd get together every Sunday in his place or our place; I was living with my mother then. It was amazing; in spite of the fact that we'd been back and forth so many times, when we read something aloud, there were always matters that didn't sound right or didn't seem clear. So we'd mark that part, and one person would have the assignment to revise it for the next week.

Lage: It sounds like you worked well together. What was he like to work with?

Whinnery: Oh, he was marvelous. He was not only great as a mentor, but so generous to me in lots of respects.

Lage: Such as?

Whinnery: When I finished my two years of supervision of the high frequency course, he arranged for me to join the Electronics Laboratory as head of the theoretical section. I think his title was head of the physical electronics section. I should have been working for him, but he set it up so we were parallel. I appreciated it at the time, but probably not until later did I realize how generous it was.

Lage: Well, he must have seen a lot of promise in you, or more than promise.

Whinnery: I don't know. Maybe it was the poetry.

Poetry Writing

Lage: Now, tell me more about the poetry, because we didn't pick that up.

Whinnery: I don't know exactly how it started. I had to write a few things for English classes, and hated it. A poem was required for the Eta Kappa Nu initiation, but it wasn't much. Somewhere at GE I began to read and write verse more regularly. The worst assignment I had on the rotating assignment program was in testing of searchlights. The tests were simple--largely measuring current to the lights--and the two permanent people certainly could have done the testing.

Lage: Doesn't sound like it took too much advanced knowledge.

Whinnery: No. So there was time to work on the advanced course problems, and from time to time I began to write some verse. Most of it was light verse, but in some I tried to put down some more thoughts.

Lage: And you did show them to people, it sounds like. I think that's always a big step, when you can actually show others your poetry.

Whinnery: Yes. I don't remember when that happened. But it became known, and I did share them with a number of people, including Ramo.

Lage: And maybe it indicated to him that you could put words on paper.

Whinnery: I suppose. I certainly didn't know enough about electromagnetics to co-author a book at that time.

Lage: Writing that book must have been a great learning experience in itself.

Whinnery: It was, and that's why I consider it the key period in my development.

Work Assignments in the Advanced Engineering Program

Lage: Shall we talk more about your assignments? I don't think we've covered all the various assignments, the ones that are most important.

Whinnery: In addition to the ones with Ramo, Hahn, and Bedford, which we've talked about, and the searchlight testing, there was an interesting assignment with Clifford Fick on radio transmitters. That was less research oriented and more directed toward an immediate problem. Fick's group built radios for aircraft. One of the problems was that humidity caused the frequency to shift. So I was asked to find ways of compensating for this frequency shift. I think they had already suggested the use of resistors which respond to humidity, to compensate for the dielectric changes. The tests were encouraging but I don't know if the idea was used in a practical system. The engineers I worked with had the immediate assignments of designing radios that worked in aircraft. They were all very helpful, and I learned something from their approaches.

Lage: When you had to solve a practical problem like that, did you solve it by tinkering with things, or by talking with others?

Whinnery: All of the above. There certainly was a lot of discussion. In the case of the transmitter, we actually built models and tested them. The report on that was one of the earliest of my GE reports.

Another interesting assignment was on a novel idea for color television. Only black and white was available then. That was with Siegfried Hansen and Millard Smith, whom I'd see again at Hughes.

Lage: In working in the various labs on the assignments, were there deadlines and senses of urgency?

Whinnery: In the research labs, like Hahn's or Ramo's, no. They were trying something new and hoped to have results as soon as possible.

Lage: Something new, but in what way would they be connected with GE's commercial purpose? Did you get a sense of the larger mission?

Whinnery: Both Hahn and Ramo had clear ideas concerning the potential of their microwave tubes, but there wasn't a very close tie between their labs and the departments that would have to make the commercial developments. I believe that Hahn was ahead of the Varians in the development of the velocity-modulation class of tubes at one point, but GE did not follow up with production versions.

Lage: That's interesting that they had this research lab doing the important things, and then the commercial side didn't pick up on it so much.

Whinnery: Yes. Of course, I shouldn't give the impression that it's easy to know which research results deserve commercial development. I'm telling this with the advantage of hindsight.

GE During World War II

Lage: Where were you when the war descended on all this work?

Whinnery: I was still an advanced course supervisor in 1941 when the Japanese bombed Pearl Harbor. But I think it was the following summer that I took the job in the electronics laboratory working with Ramo.

Lage: In the theoretical section?

Whinnery: Yes, but the "section" consisted of me and a young lady, Theo Eloise Robbins. She did computing using a Marchand mechanical calculating machine. But we did some fairly useful calculations, much of this at Ramo's suggestion.

Lage: Were the wartime assignments then more directed by government needs?

Whinnery: Yes. The main products of this laboratory were some microwave triodes called disk seal triodes. They came to be known widely as lighthouse tubes because of their characteristic shape. They were used in some radar systems, both as receivers and

transmitters, mostly at somewhat lower frequencies, but even up into the important microwave frequencies.

Our job was to try to improve the tubes, which required studies of the transit-time effects across the tubes. Another goal was to improve the circuits that the tubes worked in. For this I made much use of a method that Hahn had developed for analyzing discontinuities in microwave circuits. At that time it was a very difficult electromagnetic problem.

Lage: Was this something that you had learned in working for Hahn, and you applied it?

Whinnery: That's right.

Lage: Was there ever cross-fertilization? Was it a work situation where people interacted?

Whinnery: Oh, yes, surely. It was a small laboratory with not more than a dozen engineers, but there was a great deal of interaction among them. In addition to the work on triodes there was work on magnetrons and high-voltage circuitry. It was very good work but did not have as much impact as the triode work.

Lage: And all of this was applicable to radar equipment?

Whinnery: Primarily radar but also beacons and communication equipment.

Lage: It was a classified lab?

Whinnery: Yes. At that time, everything related to radar was classified.

Lage: How did that affect the work environment? Or did it?

Whinnery: Well, internally, it didn't. It did mean that much of the work couldn't be published, or at least not until after the war when it was declassified.

Lage: Was most of it declassified later and published?

Whinnery: A lot of it. Some not.

Lage: Was the work that you did there taken up and actually used later?

Whinnery: Yes, the work on discontinuities and the transit-time work especially.

Lage: Ramo mentions another lab where more important radar-related research was being done.

Whinnery: The MIT Radiation Laboratory was a huge laboratory, and the center for microwave radar research.

Lage: Were you in communication with them?

Whinnery: Yes, there were trips back and forth. In fact, I found on one of the trips that work on discontinuities in transmission lines and wave guides, which I was doing by Hahn's method, was the subject of intense work at the Radiation Lab. Julian Schwinger, who is now a Nobel Laureate, had developed many powerful methods for attacking these problems. Nathan Marcovitz and David Saxon, later president of the University of California, were important contributors.

Lage: David Saxon was working for Julian Schwinger?

Whinnery: I don't know that he was working for him, but he wrote up the notes.[1] I have a copy somewhere.

The Influence of the War on Electronics Research

Lage: With the pressures of war and the support for labs, did that make a big difference in the direction of and accomplishments in the field?

Whinnery: Yes. Everybody hoped their work would be useful to the war effort, and a tremendous amount of it was. Yes, we were very conscious of hoping that our work would be useful.

Lage: But it dwelt on things that had already been thought of?

Whinnery: To some extent, but there was a tremendous amount of advance during that period. When you compare it with other three- or four-year periods, the amount of advance is amazing.

Lage: I guess that's what I'm trying to get at: how much the war contributed to that advance.

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[1]Julian Schwinger and David S. Saxon, *Discontinuities in Waveguides: Notes on Lectures by Julian Schwinger*, Gordon and Breach, New York, 1968.

Whinnery: Yes. To use the MIT Radiation Lab as an example, there had to be exploratory work, then experimental models, and finally production systems.[1] It is amazing that this was done in a few years. You've probably heard the story of how the submarine battle was won. The Germans didn't believe that anyone had microwave radar and couldn't understand how their submarines were being detected.

Lage: Had the Germans worked in this area?

Whinnery: Yes, but not at that high frequency, and apparently they didn't think radar could be done at microwave frequencies so quickly. The MIT Radiation Laboratory deserves tremendous amounts of credit.

GE was building radars, but originally at lower frequency. But they were conscious of the value in extending them to microwave frequencies.

Lage: And of course, you probably had a lot more resources than you would have had otherwise. Did the government put a lot of money into the lab?

Whinnery: I suppose so. But I believe our lab was financed by GE, presumably out of profits from military systems sales.

The heads of the lab were [E. D.] McArthur and [William] White, who were very nice people to work with. They reported to W. R. G. Baker, who was determined to build up electronics in GE. He wasn't much impressed by our laboratory, so he later turned it over to the research laboratory and started his main laboratory in Syracuse. It's still going on and does very good work.

Lage: I'm trying to connect this with your experience: were you a part of that, or connected with the Syracuse work?

Whinnery: No, although we had some cooperative ventures. I had no direct dealings with Baker except later in the Institute of Radio Engineers.

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[1]See, for example, *Five Years at the Radiation Laboratory*, Massachusetts Institute of Technology, Cambridge, MA, 1947.

Fellow Researchers at GE

Lage: Is there anything else that we should talk about about that work, or the people? You mentioned White and McArthur; is there more to say about them? Their background?

Whinnery: Both White and McArthur had worked on a variety of vacuum tubes for GE. I believe it was McArthur who had the idea of making triodes work at microwave frequencies by using very small electrode spacings and designing the tubes to fit coaxial circuits. Jim Beggs perfected the designs and made the tubes. Other engineers in the lab were Bill Jamieson, Anatole (Toli) Gurewitsch, Norman Lavoo, and Rudy Dehn. They worked to develop better microwave circuits for the tubes and much of my work was in analyzing the circuits. So we all became close friends. Ralph Bondley and Bill Teare worked with magnetrons and I cooperated some with them, as I did with Harold Lord, who worked with pulsed circuits for radar.

Lage: Were these people older than yourself?

Whinnery: Jamieson, Gurewitsch, Lavoo, and Dehn were about the same age, but the others were older.

Lage: How many of these people stayed on with GE after the war?

Whinnery: Most of them. Jamieson left because of a health problem of one of his daughters. He was one of the ones responsible for getting Ramo into Hughes Aircraft, which is an interesting story in itself.

Leaving GE

Lage: Why did you leave? I want you to comment also on something that Ramo said, that he felt GE was not innovative, was badly out of date, and was bureaucratic. Was he talking about the later period, or do you think he was talking about his own experiences?

Whinnery: Well, it certainly was bureaucratic, although at my level and with my assignments, it didn't matter very much. But if you had a larger view of things, as Ramo had, the bureaucracy would be very frustrating.

Lage: To get a new project set up?

Whinnery: Yes. So when you say it was not very innovative, there were certainly innovative people there, but the management was pretty conservative. But Baker, although not much interested in our laboratory, was successful in building a very large electronics operation in Syracuse.

Lage: Is that one of the reasons you might have left? Or, what were the reasons?

Whinnery: Once we were transferred to the research lab, it became obvious that one was a second-class citizen there if one didn't have a Ph.D. So I decided that I needed to go back to school. Also, Ramo had left because of his wife's health about a year earlier, and I certainly missed him. But the basic reason was my decision to work for a Ph.D.

More on Simon Ramo

Lage: Just to say a little more about Ramo: he comes across in his books as being a very confident, kind of dynamic person.

Whinnery: Yes.

Lage: Could you tell me a little bit about his personality, his ways of working?

Whinnery: Yes. He's a very strong personality, and in fact, some people think he has too much ego. But I've told you about his generosity, not only in work assignments, but also in helping me, giving me advice--just a marvelous person, and he also has a wonderful sense of humor.

Lage: Does he strike you right off as being an inventive, innovative sort?

Whinnery: Yes. He was always trying out new ideas. One of our favorite sayings there was that you have to be careful about rejecting ideas because an idea that at first seems to be absolutely worthless, upon careful study, will be found to have no value whatsoever. [laughter] So each morning he'd have two or three ideas, all the way from using radar in cars for collision avoidance to aids for the blind.

Lage: So he saw the bigger picture.

Whinnery: He was always thinking in the large. Not all the ideas were great, but he was always imagineering, I guess is the word for it.

Lage: When he'd throw out an idea like this, was this just in conversation, or was this something that you were supposed to follow through on?

Whinnery: Not necessarily. We would discuss it for a while, and if it seemed like it was worth following, he would write it in his notebook and have it witnessed. He might or might not follow through with a patent or more development work later.

Lage: He really seems to have kind of an inventor's mentality.

Whinnery: Sure, inventive, but also a vision of what's coming in the large. The reason he has been so successful with Hughes and TRW is that he could see a decade ahead what was really going to be important. For instance, with computers. When they first came out, he realized what they could do for inventory control and other applications in industry. I suppose there were others who saw this, too, but many people still thought of them as just large calculators.

Lage: That's interesting.

Whinnery: Electronic funds transfer; he was talking about this years before the system was in place.

Lage: It makes me wonder what he would have done if he hadn't had to put so much of his energies towards defense work, what kind of commercial, peacetime applications he might have pushed.

Whinnery: Well, of course, TRW [Thompson-Ramo-Woodridge, Inc.] has quite a lot of non-defense business.

Lage: I think he mentioned in talking about Hughes that that was one of the things he was dissatisfied about. He wanted more peacetime research.

Whinnery: That's right. At Hughes, he tried several times to start more commercial projects, but there were many pressures to remain in the defense area at that stage.

Other Activities in Schenectady

Lage: What, apart from work, did you do in Schenectady?

Whinnery: Hiking, canoeing on the Mohawk and nearby lakes, some attempts to ski in winter, occasional trips to New York. Many of these activities came from a group called The Questors, sponsored by the YMCA and YWCA. Larry Ferguson and Margaret Hauser were the counselors. There were short hikes, record concerts, and record dances nearly every month and two or three weekend trips a year. I learned much of my love of mountains and interest in classical music from those activities.

Lage: Anything else?

Whinnery: After my father died, in 1941, my mother came to live with me in Schenectady. At first we had an apartment, but later bought a house. Si Ramo helped persuade me to do that, and it turned out to be a very wise move. (Pat wasn't interested in meeting me when she found I didn't have a car, but relented when she found I had a house.) After the house there was gardening, mowing, and shoveling snow in winter.

Marriage to Patricia Barry, 1944

Lage: You were married during this period.

Whinnery: Yes, September 17, 1944.

Lage: Tell me something about your wife and meeting her.

Whinnery: She was a combination math and music major from the University of Colorado. During the war when there weren't enough engineers, they hired math majors, even home economics majors because of their familiarity with appliances.

Lage: This was at GE?

Whinnery: At GE. Pat was working with jet engine impellers in the same building as I, but we didn't meet until a wedding, when my former roommate introduced us. She was a bridesmaid and all the next week, when I was hiking in the White Mountains, I couldn't forget how lovely she was. We were married about a year later.[1]

Lage: Was she from Colorado, or had she just gone to the university?

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[1]See "Notes from the White Mountains to One at Home," Appendix B.

Whinnery: She was from Iowa. She went to Rockford, Illinois, for two years, and then graduated from the University of Colorado at Boulder.

Lage: So you had even that in common, a little tie to Colorado.

Whinnery: Yes.

Lage: Was she career-minded at all?

Whinnery: No, I don't think so. She worked about six months after we were married, but before we left Schenectady had left her job.

Lage: And that was a real pattern at the time, that women left their jobs when they married?

Whinnery: Yes. In fact, this will sound terribly sexist, but Boring, who hired the college graduates, said that he only picked very pretty girls because he wanted them all married and out of the way when the war was over. [laughter]

Lage: Oh, my gosh. Yes, it does sound sexist, but I think it's a bit of social history.

Whinnery: Well, at the time, that didn't sound so terrible.

Lage: So you think there was even a conscious sense at the time that "we want the men to come back to these jobs"?

Whinnery: Yes, I'm sure it was a common attitude. But there were some very fine women career persons, engineers, in GE even then.

III RETURN TO UC BERKELEY, 1946 TO 1952, AS GRADUATE STUDENT, LECTURER, ASSOCIATE PROFESSOR

Graduate Student

Lage: Let's get you back to Berkeley, but also think of what other possibilities there were. Why did you come to Berkeley?

Whinnery: After I decided that I should return to school for a Ph.D., and before I had looked very broadly at opportunities, Charles Dalziel approached me about a teaching position at Berkeley. He was a faculty member in electrical engineering at Berkeley, but at that time on leave to Division 13 of NDRC [National Defense Research Council]. He visited Schenectady to see former students whenever he could. On one of these visits near the end of the war, he said, "We need some faculty at Berkeley, and would you be interested?" I said, "Well, I want to get a Ph.D." He said, "Good. You can teach and work for your Ph.D. at the same time."

Lage: And that must have been appealing.

Whinnery: Yes. I probably should have looked more broadly, but it was comfortable, I guess, because I like Berkeley and I liked the people.

Lage: So you didn't look into what were more prestigious programs at the time?

Whinnery: No, I didn't. It was probably foolish not to have at least looked at other opportunities.

Lage: Well, when you look back and think it was foolish, would you have done more, or advanced more, if you'd gone to Stanford or MIT?

Whinnery: It would have been different. I'm not sorry the way it turned out, but considering the status of the department at that stage, MIT or Stanford would certainly have offered more advanced work.

Department of Electrical Engineering, Postwar

Lage: Okay, let's talk about the status of the department at that time, when you came back right after the war. That was '46?

Whinnery: Yes. There were ten regular faculty members in electrical engineering at that time, counting Dalziel, Herb Scott and Larry Marshall, who had just returned from wartime service. Others were Thomas McFarland, the chairperson, Lester Reukema, Burtis Robertson, Leonard Black, Paul Morton, Dan Finch, and Troy Graybeal.

Lage: Were they working on more traditional EE?

Whinnery: Mostly they were teaching. There were only a few research projects at that time. Teaching loads were very heavy because so many decided to return to school, as I had done. We had the ex-G.I.s, both undergraduates and graduates. So what had been a very small graduate program suddenly had maybe 100 students all at once, and undergraduate classes were overflowing.

Lage: What were they after?

Whinnery: Electronics. Typically, they either had been in radar during the war, or some other aspect of electronics. So classes were full. I was supposed to be doing advising at the same time I was trying to sign up for classes, and there were long lines everywhere. Students would finally reach you, and you'd sign their program, and then you'd see them again a few hours later: all those classes were full. But I admired the patience that they had.

Lage: Of course, many of them were returning G.I.s, and they probably learned to stand in line in the army.

Whinnery: Probably so.

The main research program at that stage was one in antennas. [Morrough P.] O'Brien in his oral history[1] says that he set it up with the Naval Electronics Lab in San Diego. I hadn't realized that. McFarland, as department chairman, was nominally in charge, but Leonard Black was the faculty member who was most active in the project. There was some very good work, even though a lot of the work was routine--flying over antenna systems, measuring patterns, and recommending design changes.

Lage: So it was more like the GE testing program than a research lab.

Whinnery: That's right. But there were some very good people in the project, and some very good fundamental work.

Lage: Were the people graduate students?

Whinnery: Some were full-time employees, but some were students working for doctor's degrees. Jack Bolljahn was one of the more original ones, and he was working for a doctor's degree.

Lage: It must have been an interesting situation. It sounds almost as if you came back and there was nobody here more advanced than you in your field.

Whinnery: By that time, our book was out, and I was immediately asked to give a course based on the book. Reukema understood electromagnetics thoroughly, but even he attended my lectures. [laughter] That was a little embarrassing.

Lage: What other research work was going on?

Whinnery: The next major project in the department was on high-power microwave tubes called resnatrons. Larry Marshall, during his wartime leave, had worked with [David] Sloan, who was then at Westinghouse, on very high-power tubes for radar jamming purposes. He obtained a contract with the Wright Air Development Center for setting up a large program in high-power microwave tubes. Dave Sloan was the primary technical person on that. He was a very talented person, full of ideas, but he had one weakness: he didn't like to finish projects. Sounds like what I said about my problem in high school with projects that I never finished.

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[1]*Morrough P. O'Brien: Dean of the College of Engineering, Pioneer in Coastal Engineering, and Consultant to General Electric*, Regional Oral History Office, University of California, Berkeley, 1988.

Lage: You had changed by this time, I would think.

Whinnery: Sometimes. But returning to Sloan's lab, there were some excellent graduate students that came out of that--Bill Beaver, Bill McBride, Peter Kafitz, Dan Goodman, and George Feher.

Lage: Did you work on that at all? Was it related to your research?

Whinnery: I had worked on microwave tubes, but only at lower powers. Nevertheless, I should have been able to find something related. But Leonard Black encouraged me to join the antenna project, and the discontinuity work that I had done at GE appeared to be relevant to that. So I did my thesis on antenna problems. Of course, I was teaching part time, and everyone encouraged me to take advantage of the background I had.

Lage: Did the GE educational program you'd been in help?

Whinnery: It certainly helped. When we were in the GE advanced course, we were convinced that it was very much better than a Ph.D. program. When I got here, I discovered that, well, they're just different. Certainly one is not a substitute for the other.

Lage: How was the Ph.D. program different?

Whinnery: As I said, in GE's course, we would have a four-hour lecture on Maxwell's equations, rather than a full course. Then the problems, even though they did teach you something about approximations and the interdisciplinary aspect of things, they too often were artificial problems too, in spite of the fact that they tried their best to get them out of the problems of the industry. So there was somewhat more of an orderly way, I guess, and depth in the Ph.D. program.

Requirements of the Ph.D. Program

Lage: You finished in two years, so you must have been able to cut corners somewhere.

Whinnery: Yes.

Lage: What did you have to accomplish to get the Ph.D.?

Whinnery: We had to go through several oral exams, we had to take courses, and of course we had to write a thesis. At that time there were also exams in two languages.

Lage: Was that something you were prepared for?

Whinnery: I had taken high school French, and technical French is pretty easy, because you can almost read it if you know nothing other than the Latin names for things. German is much more difficult. But at that time, my advisor professor, Reukema, thought Russian was the language to learn.

Lage: How interesting!

Whinnery: So I started to learn Russian along with the German, and discovered that they are two very, very difficult languages. All that was required was a reading knowledge in one's technical field, but nevertheless, they were difficult languages for me. So I was struggling away with Russian, but one day, when I was having my interview with him, he asked, "How are you coming in your languages?" I said, "Well, I'm finding the German very difficult, but I think I should be able to take the exam." He then said, "And how is your French?" I said, "I think it's coming along fine." [laughter]

Lage: He forgot the Russian?

Whinnery: He had forgotten the Russian. So I took my exam in French.

Lage: It's interesting that he perceived that Russian was important. Do you have any idea of his thinking there?

Whinnery: Oh, sure, and he was right.

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Whinnery: There was so much excellent work in Russian. Most of the major Russian journals eventually were translated to English. So in that sense, it wasn't as important as it might have seemed. But nevertheless, Russians were doing excellent work in our field and there was a delay in the translations.

Lage: Was there free exchange of information?

Whinnery: For basic work, yes. Not so much for applications and these became more restricted as the cold war worsened.

Lage: You implied that you don't have to have two foreign languages any more. Is that correct?

Whinnery: The language requirement is different for different departments. There is no language requirement in EE at present.

Lage: Do you think that's a good direction to go, or not?

Whinnery: One reason that I wouldn't reinstate the language requirement is that English is the international technical language now. On the other hand, I think I would certainly encourage students to learn some languages early, because travel is now much more universal than it was. My high school French and my Ph.D. German help a little when I travel in France or Germany, but I wish I were much more proficient.

Lage: Does this mean that technical papers that come out of Germany and France are actually written in English?

Whinnery: Most of them.

Lage: Not just translated?

Whinnery: There are certainly technical journals in the language of the country. But if the authors want to have international notice, they will publish in one of our journals. In some of the French and German journals, there is a choice: papers can be in English or the native language. English is the official language of most international conferences in our field.

Lage: The burden is on them to have a really high-level knowledge of English?

Whinnery: That's right. And it is also true in Japan. There are journals that just publish in Japan, but if they want to be internationally known, they publish in English. For the journals in my office, I'm sure you'd find a third of the authors Japanese.

Lage: Oh, really? So they're doing a lot of important work, of course.

Whinnery: Oh, yes.

Growth of the Department

Lage: You mentioned the huge increase in student population after the war. Were you in on any of the discussions on how the department would respond to it?

Whinnery: Not really at a policy level at that stage. I took part in discussions on how to teach the large classes.

Lage: How large were the classes you were teaching?

Whinnery: One hundred twenty to 150 students, something in that range.

Lage: Would you have a teaching assistant?

Whinnery: Only for laboratories, but not for lecture classes. We graded our own papers. For final exams, we had to have the grades in the next day. [laughter]

Lage: Oh, my lord!

Whinnery: So we'd stay up all night grading these 120 exams, and making out the grades. They were tough on you if you didn't drop them in that mailbox by the time they were due.

Lage: That's a contrast with today.

Whinnery: Yes. And class loads were high also. After I became full time, I recall having two undergraduate lectures, a graduate course, and an undergraduate lab in one semester.

Lage: I think you'd have quite a lot of complaint if professors had to go back to that.

Whinnery: That's right.

Lage: Did this leave you much time for research?

Whinnery: No.

Lage: How did you manage?

Whinnery: Well, that was one of the reasons I took the leave at Hughes, which we'll discuss later.

Lage: And then you were an assistant professor, once you got your Ph.D.?

Whinnery: No, I received an associate professorship, but at a lower salary than listed for that range, as I found out later. I went to see Dean O'Brien to see if this represented their opinion of my abilities. He said no, and an adjustment was made.

Lage: This was before you left for Hughes?

Whinnery: Yes. In those two or three years, I had a couple of very good graduate students. One of them, Weigan Lin, returned to China, and is now a member of the Chinese Academy of Science. Another

was Sriramamurti Yadavalli. The ideas I suggested to them really grew out of my GE work. There wasn't much time for new ideas.

Lage: And was this discussed in the department, or was it not troubling for the older generation?

Whinnery: I'm afraid it was considered fairly normal to those who had been in the department for some time.

Samuel Silver

Whinnery: The biggest change came when Samuel Silver joined the department. He was one of the most important persons in changing the culture of the department.

Lage: Do you remember when he came?

Whinnery: A year or so after I arrived.

Lage: And did he come as a professor, not as a student?

Whinnery: He was either associate professor or professor.

Lage: Was he your age group or older?

Whinnery: I think he might have been a year or so older. But he did have his Ph.D. from MIT, and he was very familiar with a research-oriented program.

Lage: So he knew what the top-level research universities were doing.

Whinnery: That's right. One example is his change of the antenna project. It was built up as a wartime program and was about to be ended, but Sam, realizing what good work was going on, convinced the Office of Naval Research to support a smaller but research-oriented program in antennas. That went on for years. But also, in such things as teaching loads, curricula, and policies with respect to graduate-level examinations, he was tremendously influential.

Lage: He must have been quite a leader, to sort of turn things around.

Whinnery: Yes, he was. He had very high standards and convinced others largely by moral persuasion.

Lage: I am curious why he came to Berkeley. Do you know that?

Whinnery: He was one of the most active persons in radar antenna research at the MIT Radiation Lab. After that, he went to the Naval Research Lab and continued antenna work. He and Reukema were on an advisory committee together, and Reukema convinced him to come here. I don't know all of the reasons, but the Bay Area is attractive to many people and, although the department did not have a major reputation, the university as a whole did.

Lage: He didn't have a tie to the area?

Whinnery: No.

Lage: Did you have a sense that this older generation, like Reukema, wanted to make Berkeley more research-oriented? I saw in O'Brien's oral history where he calls the pre-war electronic engineering professors the "fuddy-duddies." [laughter]

Whinnery: I don't think that's quite fair. I think they certainly were interested in making the department stronger, and they did give us support. Nevertheless, teaching had priority, and teaching loads were high. I remember our department chairman, McFarland, saying something like, "Well, you should be willing to teach graduate courses without credit, because that's where you have fun." That's true to a certain extent, but they also take a lot of work.

Lage: I want to talk more about this whole change, and I don't know if this is the time to talk about it or after we get you through Hughes. Where is it more appropriate?

Whinnery: I think after we get through Hughes, since most of the changes occurred after that.

IV HUGHES AIRCRAFT, 1951 TO 1952

Lage: How did you happen to go to Hughes?

Whinnery: Maybe it's important to first tell how Hughes developed into such an important electronic center. I mentioned that Bill Jamieson left our GE group because of his daughter's health. At that time there was very little electronics industry in California. He did find that Hughes had a small contract in Identification Friend or Foe, which is a radar system that tells whether the plane you are tracking is on your side or on the other side.

So he got a job there. At that time, Ramo was acting as liaison with GE at the Jet Propulsion Lab in Pasadena. He had moved to California because of his wife's health, but he realized that was not a career job. He almost went to UCLA, but that didn't work out. Perhaps his history explains the reason. He certainly would have been a marvelous teacher.

Lage: I don't remember him talking about that, but maybe he did.

Whinnery: But in any event, Bill Jamieson convinced him to look at Hughes, saying something like, "There's a pot of money here if somebody knows how to use it." So he joined Hughes. I don't know the details of the negotiations, but later [Dean] Wooldridge, who was at Bell Laboratories, joined him. They had been classmates at Caltech [California Institute of Technology] and were good friends. There were many good people anxious to come to California after the war, so once this became known, they had their pick of some marvelous people. And an enormous change occurred in just a couple of years.

In 1948, after I finished my Ph.D., I spent one summer at Hughes, working on antennas again, and found it very stimulating. It was already a very dynamic place. When I left, Ramo gave me an open invitation to come either as a permanent

employee or on leave as soon as I could, with a choice of areas to work in.

Lage: That's a nice kind of invitation.

Microwave Tube Research Section

Whinnery: So as I began to realize that I needed change, I decided to accept the invitation. At that time, Ramo and Wooldridge were starting a new electronics laboratory with research on microwave tubes and storage tubes.

Lage: At Hughes?

Whinnery: At Hughes. It had a very fine person, Andrew Haeff, in charge. Haeff had already hired some of the young people that turned out to be stars, and then he and I together did some more recruiting.

The group was an amazing group, because it included [Dean] Watkins and [H. Richard] Johnson. They later formed the Watkins-Johnson corporation. Watkins, you know, is a regent of the university. There was Ned Birdsall, who is now next door; Tony Siegman, who is a very distinguished faculty member at Stanford; Orrin Hoch, who became CEO at Litton; and George Brewer, who stayed in the Hughes Research Labs and did some excellent work on ion propulsion. There were others; it was an amazing and exciting group to work with. We had a lot of fun for a year and a half.

Lage: You were there a year and a half?

Whinnery: Yes.

Lage: How did you work? Was this a collaborative kind of research?

Whinnery: I was appointed head of the microwave tube section of the lab, but it was my first administrative assignment, and I didn't know how to administer. [laughter] I thought of the others as colleagues, and we just worked together.

The other section of the lab was concerned with storage tubes. It also had some excellent people--Siegfried Hansen and Millard Smith, with whom I had worked on television at GE, and George Smith, who later became director of the Hughes Research

Laboratory. There was intersection with these three, though not as much as with members of my section.

Working Conditions at Hughes

Lage: Could you just describe what it was like? I can tell from your voice it was very exciting.

Whinnery: The goal in setting this up was to develop new tubes for novel radar or communication systems. And in the end that happened. The Hughes tube division was key to some of the success in satellites. But we were given complete freedom to choose the ideas. Some of the work--increasing power, increasing tunabilities, and decreasing noise--was obviously important. Other ideas which seemed promising at the time turned out not to be very important. But they were all very exciting intellectually.

Lage: As administrator, would it be your job to talk to people about what they were doing, and guide them?

Whinnery: We discussed the ideas as a group, and with Haeff, but I didn't give orders.

Lage: Was everybody on their own problem?

Whinnery: They tended to work in couples. Birdsall and Brewer worked very closely together. Siegman was just a young person taking a master's degree at UCLA. He worked then for Dean Watkins, but was already a contributor.

Lage: Did you work with somebody?

Whinnery: I interacted with each of the groups, the degree depending upon where I could make a contribution. The main areas I recall were with Watkins on noise, Birdsall on reactive-wall amplifiers, and Johnson on tunable oscillators.

Lage: How about something as mundane as the working conditions, compared to what you had left here?

Whinnery: The antenna lab at UC had a reasonable setup for the measurements of concern there, and Sloan's lab had a good budget and was getting good equipment. But at Hughes it seemed a different order of magnitude. I wouldn't say we could get any instrument we wanted, but there was a generous budget for

equipment. Of course, the lab was just being set up, so there were probably special allocations for that purpose.

Lage: Was there much bureaucracy there?

Whinnery: There were frequent changes in operating procedures because of the rapid growth of the organization, but nothing serious at my level. Haeff, as head of the laboratory, handled most of these problems. He was a very exciting person with a lot of ideas and did have strong feelings about the direction of our research, but I can't remember any time when he turned down anyone wanting to work on a problem.

Simon Ramo and Dean Wooldridge

Whinnery: Ramo and Wooldridge were co-directors of the whole Research and Development Laboratories, which by that time were becoming quite large. They worked together beautifully. They're entirely different personalities, but if you went to one, the first thing they'd ask was, "Have you talked to Si (or Dean) about this?" If you had, of course, they wouldn't reverse the other without at least discussing with them. But if you hadn't, they would almost always come out with identical decisions, in spite of their different personalities.

Lage: Was Dean a less assertive personality?

Whinnery: When *Time* published a cover story about them, they were referred to as the salesman and the professor. But intellectually, they were both tremendous in terms of analyzing a problem.

Lage: Did you have much relationship with both of them then?

Whinnery: Not a lot. I was a member of an advisory council which met with them about every two weeks. The purpose was to discuss policy issues, but I don't remember making many policy suggestions.

And I did have meetings with Ramo concerning the first revision of our book. He didn't have a lot of time for it, but he did look over all the changes and made some very useful suggestions.

Lage: The first revision was done during that year at Hughes?

Whinnery: That's right.

Research and the Cold War

Lage: We talked about during the war having a sense of contributing to the war effort. Was there a sense of that at Hughes, any urgency in developing new technology for the cold war?

Whinnery: Yes. Certainly the importance of defense and defense technology was felt. Si was already concerned with commercial applications, but at the working level, the emphasis was on radar systems or missile guidance systems.

Lage: And did they do it with the sense that, "We have to develop these things before the Russians do," or was that not so prominent at that time?

Whinnery: I think the Russian aspect became stronger later. I suppose it must have been there already. Otherwise, why were we doing it?

Lage: It was fun. You bring that out.

Whinnery: It was fun. And that, unfortunately, may have been three-quarters of it.

Comparing Industry and Academia, and Return to Berkeley

Lage: I noticed in one of your sets of papers in the Bancroft [Library],[1] I think you had written to someone to try to get them to come to Berkeley from an industry lab, and they didn't want to leave. They were curious why you had come back and wanted to talk to you about evaluating life in an industrial organization as compared to the university. Is that something you could do now? I don't know if you ever had that conversation with this person.

Whinnery: I don't remember that letter, but many people are puzzled about my return when I talk about the fun we had at Hughes and the difficulties I had had here. I often wondered myself, although I am not sorry that it happened that way. The strongest reason was from the efforts that Sam Silver made to convince me to come back. He consulted at Hughes, so I saw him regularly, and he

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[1]John R. Whinnery papers [ca. 1946-1977], The Bancroft Library, University of California, Berkeley.

kept me informed. He was then working to have the Electronics Research Lab set up.

Lage: So he was setting something up at Berkeley that might compete as a place to do quality research?

Whinnery: Yes, although the immediate motivation was to consolidate what we had. He could have been the first director, but he didn't want to be at that time, although he was later. He wanted me to come back and be the director. It took quite a bit of doing.

Lage: To persuade you?

Whinnery: Yes. His argument was that Hughes was going to go on, but that I could make a much bigger difference at Berkeley. We had many discussions about the problems here, and the promise.

Lage: I did notice several letters back and forth with O'Brien negotiating on your position when you came back. Do you remember that?

Whinnery: Not in much detail. I remember a discussion with Associate Dean Everett [D.] Howe, who had the impression that I was just jockeying for salary, which is not what I thought I was doing.

Lage: Were you jockeying in part to have a more limited teaching load?

Whinnery: I don't remember the details. I do know that it was not an easy decision, and that I was trying to find conditions that would make it possible to accomplish something useful.

Lage: Was this a decision that your wife had a role in? Did she care one way or another?

Whinnery: We certainly talked about it. In all of the moves, she has been very supportive, maybe with varying degrees of enthusiasm, but we certainly discussed each move.

Lage: In a job like the one at Hughes, how long is the work day? Was this something that extends into the evenings and weekends?

Whinnery: There are certainly jobs at Hughes that do. To get a satellite out on a schedule, work is around the clock. In a research environment there are occasions when you are trying to finish a paper, or have results so exciting that you want to continue all weekend, but there are not the same deadlines. And it was not the same as in the university, where there are lectures to prepare, theses to read, and committee meetings, so that you work as much as you can stand.

Lage: So the hours were not as demanding in industry?

Whinnery: I think that's one of the things that Pat mentioned. "You aren't working nearly as hard here as you were." But then, we discussed some of the nice things about the university: summers, when the pressure is off a bit, and the sabbatical leave system.

Howard Hughes

Lage: Do you have any Howard Hughes stories from your experiences there?

Whinnery: I saw him once. He came in with a group of generals who were visiting our lab. He was in old cords and stayed in the background. One might have thought him a mechanic or driver.

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Whinnery: My friend, Bill Jamieson, was a person that Hughes decided to call to fix his electronic equipment, which he had to augment his poor hearing. According to Bill, he would call at three a.m. with a request something like, "Bill? This is Howard. Were you doing anything?" [laughter] "No, Howard, not a thing." "Well, could you come over and look at my radio," or whatever it would be. And when he got there, there would be one of these lovely starlets that Hughes was famous for.

Lage: I'm surprised he didn't get his outfit working on hearing aids.

Whinnery: He didn't pay much attention to the electronics part of the company until later. When he did, it became impossible for Ramo and Wooldridge, so they started their own company.

Lage: Just as well to have him on the outskirts.

Whinnery: That's right.

Lage: Ramo had some good descriptions of Hughes.

Whinnery: Oh, yes, in the book, *The Business of Science*.

Hughes Aircraft and the Value of Industrial Experience

Lage: Is there anything else that we should say about your experience at Hughes, and how it may have shaped your future?

Whinnery: All of the industrial experiences were critical in my career. Just as the GE experience carried me through a few years here, the Hughes experience really affected the whole program I had for the next decade in microwave tubes.

Lage: When you say it affected it, you mean what you learned there?

Whinnery: What I learned technically, acquaintance with good people, and sources of support. The later year at Bell Laboratories was influential in getting me into optics. So the industrial experiences have been tremendously key elements of my development. Hughes certainly was one of those.

Lage: Now, is that true of your colleagues? Have they also dipped into industry periodically?

Whinnery: I think to varying degrees. Quite a few of them have taken industrial leaves. Others find a sabbatical at a university a perfectly good way of rejuvenating themselves. Of course, quite a few come to the university with an industrial background.

Lage: Well, that's a good place to stop, and take up next time with what you found when you came back to Berkeley.

Whinnery: All right. Before we do, I might tell one additional story. Birdsall likes to tell of how we would often eat lunch together at Hughes on the roof of our laboratory. I would tell these stories of bureaucracy and frustration at Berkeley.

So when I told him that I was going back, he thought I was crazy, or that I'd been misleading him all along. [laughs] I probably did exaggerate to make a good story.

Lage: And then were you the one who recruited him here?

Whinnery: Later, yes.

Lage: You had do to some fancy talking at that point?

Whinnery: He came on a leave during my first sabbatical in Switzerland. He was on leave from GE and could have gone back. So it is his own fault if he didn't learn what he was getting into. [laughter]

V VICE CHAIR, DIVISION OF ELECTRICAL ENGINEERING, AND HEAD OF ELECTRONICS RESEARCH LABORATORY, UC BERKELEY, 1952 TO 1956

Collegiality and Personnel in Electrical Engineering

[Interview 3: February 9, 1994] ##

Lage: We're going to talk today about division, department, college, and lab matters, and you wanted to pick up with some issues from before your time at Hughes.

Whinnery: Yes. Last time, when we talked about the period just after the war, I emphasized some of the problems of the department. But I did want to describe an important characteristic, which I'm happy to say is still retained. Members of the department were very friendly, and even though they argued tremendously over issues of curriculum and space, no one seemed to take the issues personally. They could argue heatedly in a department meeting, and then go out to coffee together.

Lage: When you say department, are we talking about what was then the Division of Electrical Engineering?

Whinnery: Yes, it was then a division of the Department of Engineering.

Lage: Do you have a sense of why that sense of collegiality occurred?

Whinnery: Certainly Tom McFarland, the chairman, was a very friendly person. He and his wife had the whole faculty in their home several times a year, and other members of the faculty likewise entertained each other. There was a spirit of working together, even when members disagreed on particular issues.

Lage: Somebody pointed out to me that there's a greater sense of collegiality in electrical engineering than in some of the other departments.

Whinnery: I think so. I think it had something to do with the group that started it that way; this is why I wanted to mention that.

Also, as we mentioned last time, the tremendous teaching loads with the returning G.I.s required some buildup of the division. Much of the hiring had to be temporary persons with lectureships, or other temporary positions. But some were regular appointees. We've talked about Sam Silver, who was terribly important. But Bob [Robert M.] Saunders, who later became the department chair, and following that, dean of engineering at Irvine, came at that time. And Otto Smith. I'll perhaps think of some others.

Lage: And they were hired in this immediate postwar period?

Whinnery: Yes. In fact, some of them within six months or so of the time that I came.

Early Computer Research

Whinnery: Another important development was Paul Morton's decision to start the work on computers. He and [Derrick H.] Lehmer in mathematics--Lehmer at the beginning was quite closely associated, but later the emphasis was on Paul Morton's work. This was, of course, a very early project in computers. At that time, most of the significant work on digital computers was being done in universities: the Project Whirlwind at MIT, ILIAC at Illinois, MIDAC at Michigan, and SWAC at UCLA.

Lage: And they were at universities, whereas so much of the other work was based in industries?

Whinnery: Yes. A lot of people have forgotten this, that for about a ten-year period, the major digital computer research and the working digital computers were all in universities, and all supported by the government.

Lage: Do you have a sense of why that occurred?

Whinnery: It started with the ENIAC at the University of Pennsylvania that was done specifically for a wartime project of ballistic trajectory calculation. Most people thought that these computers would only be used for military projects, and that there would only be a need for three or four in the country.

Lage: They didn't see the civilian applications for computers?

Whinnery: Well, some people undoubtedly did, but most didn't.

Lage: And these were all digital-based computers?

Whinnery: The electronic digital computers. Of course, the first ones used vacuum tubes, and were not nearly as powerful as a laptop computer today. There were rooms full of vacuum tubes, and rotating magnetic drums for storage.

But anyway, the project Paul Morton started was a key project, and very, very important in our getting into the computer field and in educating some very top people for the computer industry.

Lage: Should we mention names of that group, or is that another story?

Whinnery: Al [Albert S.] Hoagland, Doug [Douglas C.] Engelbart, Torben Meisling, and John Haanstra are some of Paul's students, or students in the computer research project, who became very influential in the computer industry, but there are others.

Lage: That's an interesting story in itself that really should be documented.

Whinnery: Yes, it certainly is. When Charles Susskind carried on his interview with me, it was planned that Paul would do one too. Paul just didn't feel up to it, I guess.

Lage: He's still alive, though?

Whinnery: Yes. Until recently at least, he played tennis every morning. [Paul Morton died May 2, 1995. -J.R.W.]

Lage: That would be nice if we could get at least a brief interview with him.

Whinnery: Yes. He was a terribly important person in the buildup of the department, for his leadership as well as his computer research.

Lage: Did his research go on in the direction that computers have taken, or was it more this initial thrust that was important?

Whinnery: In addition to his computer research, he started the first computer service center on the campus. But when he became division chairman, he had less time for either activity and others had to take over the leadership. So I suppose the key contribution to the computer program was in his initial thrust.

Returning to UC Berkeley

Lage: Anything else we should say about that earlier period?

Whinnery: Maybe one other point about my return to Berkeley. I mentioned the work of Sam Silver in convincing me, but there was also encouragement from some of the graduate students I had worked with, especially from Mal Currie. He had done a master's thesis with me, which at that time were substantial pieces of work. He visited me once when I was at Hughes, trying to convince me to return. Mal Currie, as you know, later became CEO of Hughes Aircraft Company.

Lage: Was he going to be going on for his Ph.D., and he wanted you to come up and guide that?

Whinnery: Yes.

Lage: So the tie to the graduate students provided an ongoing relationship to the university?

Whinnery: Yes, and although Sam's influence was greatest, Mal's certainly had an effect.

Lage: It reminded you of that part of the university that was missing in industry, perhaps.

Whinnery: That's right.

Morrough O'Brien and Sam Silver

Lage: From looking at some of the correspondence, particularly with Sam Silver, it does look like the two of you were planning a lot. You'd had discussions about what direction the department should take on an ongoing basis.

Whinnery: Yes. Certainly we were trying to look at it.

Lage: So it struck me that, although in your piece that you did for Clark Kerr[1] a lot of credit is given to O'Brien--as I'm sure it

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[1]Draft of a chapter on the College of Engineering in the 1950s, prepared for inclusion in a work-in-process by Clark Kerr, on the his years as chancellor at Berkeley. See Appendix A.

should be--but Silver refers to pushing O'Brien to develop the graduate program and pushing him to hire a research faculty. Should we be sure that that gets recorded?

Whinnery: Yes, but I think again for the college as a whole, O'Brien deserves a tremendous amount of credit for the number of areas that he was trying to build--the faculty, the students, the facilities and research support.

Lage: He seemed to have had a broad conception.

Whinnery: He had a very broad conception, and I often refer to it as a systems engineering approach. You couldn't build one area without the others that supported it. But although he didn't ignore electrical engineering, he spent less time with electrical engineering than with any of the other major departments. I suppose that's partly because of his background. I don't think it was because he felt we were at that time so strong that he didn't have to. And I think that Sam felt more could be done.

Lage: Sam, too, seemed to have a conception of what could be and what should be.

Whinnery: Oh, yes, that's right. He was tremendously important in setting standards for all of us.

Lage: What kind of a person was he?

Whinnery: He was a very quiet person, but he could be quite scathing for projects or persons that he thought were going in the wrong direction. Very thoughtful, and a very strong theoretical person, not only in electromagnetic theory but in other areas of applied physics. I learned a lot from him. I came thinking that I knew a lot about electromagnetics, having written the book, but I went to his graduate courses, and learned a lot more. I also learned that nobody knows it all.

Lage: Especially in a field like that, with everything advancing at once.

Whinnery: And he was a very good friend. Our families did a lot of things together.

Lage: Did you have families of the same age group?

Whinnery: I think his children were a little older than ours, but they were roughly the same.

Lage: And how about his skill or adeptness in getting research money?

Whinnery: Oh, that was tremendous. Because of his contacts coming from the MIT lab and his later work at the Naval Research Laboratory, he knew the key players in the military research organizations in Washington, and was very highly respected.

Lage: Did O'Brien recruit him, do you know?

Whinnery: My impression is that Reukema made the contact, in a committee they were on together concerning antennas for the military. At that stage, I had no role in it.

Electronics Research Lab: Establishment and Federal Funding

Lage: Should we turn to the lab, to your coming back and heading up the lab?

Whinnery: All right.

Lage: Had the lab just been formed?

Whinnery: Yes. At that time there were three major projects, the resnatron project of Sloan's, the antenna project, which had changed from Bureau of Ships to ONR [Office of Naval Research] sponsorship, and Paul's computer project. These were sort of independent and somewhat competitive. They didn't necessarily have the same salary scales for students, for example, and Silver thought this wrong. I think it was his impetus that got O'Brien to set up a committee to recommend how to coordinate things better.

At that time, there were models at MIT and at Stanford of electronics research labs, where there was more cooperation and uniformity, and more original ways of going after other projects. So the committee proposal was to set up such a laboratory. Silver could have been the first director, but at that time, he chose not to be.

But O'Brien chose not to go through the committee work of getting it as a formal organized research unit and instead set it up within the department.

Lage: On sort of an informal basis?

Whinnery: Yes, and I was made vice chairman of Electrical Engineering in charge of it.

Lage: Was there a reason for not making it formal?

Whinnery: I think it was just not to go through the committee work of setting it up. It goes through many committees and finally to the regents. Organized research unit approvals are looked at very carefully, and quite properly.

Lage: So that was done later?

Whinnery: That was done at the time I became department chair. Silver then agreed that he would be director, provided the laboratory could be set up formally, and that was done.

Lage: As I was looking at this kind of from a distance, it really seems like an important story historically because this was an era when federal support for research just grew dramatically. Maybe it's an era that's ending; I don't know what you think about that.

Whinnery: Yes, it certainly is changing. At that time, nearly anyone with a good idea could get support from one agency or another. That's not true now.

Lage: So I think this should be part of our story.

Whinnery: Yes. The ONR, I believe, was the first of the military research organizations, with the Office of Scientific Research of the air force, and the Army Research Office following soon after. And then NSF was started in 1950 following Vannevar Bush's report "Science--the Endless Frontier." Bush was director of the Office of Scientific Research and Development during the war.

Lage: Did all of these organizations equally fund engineering and science?

Whinnery: Yes, both were funded but not equally. Funds for engineering in NSF were quite limited at first.

Lage: When you were director of the lab--or informal director, whatever we should call you--was this part of your job, to get research grants?

Whinnery: Yes, but I was never as good at that as Silver and some of the other directors. But I did spend a great deal of time with

funding for the resnatron project. The Wright Air Development Center, which supported that project, was interested in getting tubes to use in systems, and I mentioned earlier the difficulty we had in getting Dave Sloan to finish a project. He always had a new idea, better than the one he was working on. There was good work and good students who got their degrees through the project. Looking back on it, I'm amazed at the patience of the Wright Field people. Every year it would be the same story, that the tube they'd hoped to get had been abandoned because we had a better idea.

Lage: They were looking for an end product?

Whinnery: Yes, so a lot of my time was spent in trying to get something finished on this end, and trying to explain on the other end that we had accomplished something. You had a query [in a pre-interview letter] about why I once made the comment that it was one of the worst administrative experiences I had. I had forgotten I said it, but it must have been with respect to being in that middle-person position.

Other research funding activities were to obtain support for new faculty members. I believe we helped George Matthei (now an emeritus professor at UC Santa Barbara) when he was getting started.

Lage: So the faculty would come up with the projects that they were interested in and wanted help in finding support?

Whinnery: Yes, and it still is that way. The ideas have to come from the faculty. The director of ERL suggests agencies that might be interested. The director also visits agencies to help sell specific proposals and to find the agency's interests for the future. But the research proposals come from the individual faculty.

Lage: Did you have much staff support?

Whinnery: Yes. Aleen Simmons, who was first a secretary and later an administrative assistant, was very good. And then one of the engineers on the antenna project, Dayton Axtell, was very good at making arrangements, and helped greatly.

Lage: Who did the actual writing up of the grant proposals? That seems to be such a big thing today. Would that be done by the faculty?

Whinnery: Yes, although we worked with them. For new faculty especially, and for proposals that were initially turned down, we tried to

help. But the faculty would write the proposals and the reports. We spent quite a bit of time working with them on the reports. At that time, monthly reports were required for many of the projects, and quarterly reports on nearly all. Very few grants now have that requirement.

Lage: That's pretty rigorous.

Whinnery: Yes. So somewhere there are files and files of reports.

Lage: Let's not look at those. [laughter]

Whinnery: No.

Lage: Later I saw in your papers that you were on the NSF committee that reviewed proposals, or reviewed the process of reviewing proposals.

Whinnery: I've been on several NSF committees. I was on the advisory committee for engineering, which was first a section, then a division, and presently a directorate. The biggest job, a number of years back, was as chairman of a committee which had to do with applied research in NSF. I've been on other committees to review proposals. But I'm not sure which committee you're thinking of.

Lage: Well, this is out of context. They seemed to be reviewing the process of approval, and there was some talk about maybe an old-boy network type of--

Whinnery: The peer review system.

Lage: Right, the peer review system, that was it. Was there anything that formal in the early days? Were there formal processes of review?

Whinnery: Different agencies work differently. NSF uses peer review, but sometimes by mail and sometimes in group meetings. The Army Research Office has used the National Research Council to manage its peer review. I'm not sure if that's still the case. In some agencies the project manager simply decides which proposals are to be supported depending upon agency interests and budget limitations.

Lage: Was there a sense that if they were defense-related, there was eagerness of the government to support the research?

Whinnery: For the defense agencies, that was certainly the case, but most of the time they hoped for commercial "spinoff." And this

happened--the most important example being that of computers, which we discussed earlier. Only with the Mansfield amendment was specific justification for defense use required for all DOD-supported research.

Lage: When was that?

Whinnery: During the Vietnam War. Congress passed this amendment that any research supported by DOD had to be shown to be relevant to DOD.

Lage: What was the impetus there, I wonder?

Whinnery: I don't know. Wasn't Mansfield opposed to the war? So maybe he was trying to separate the issues. I've forgotten the arguments.

Lage: We'll get to that later. Here we are back in the fifties, and no one was thinking of issues like that. It really didn't come up at that time, did it, whether it was wise to be so--

Whinnery: No, it didn't. It was simply understood by everybody who had been through the experience that science was applicable to defense. And, obviously, to civilian life too. But still, the majority of the money was coming through defense agencies.

More on Morrough O'Brien and on Organizing EE Research

Lage: What other things should we discuss in relation to the lab? Am I diverting you with minor questions?

Whinnery: You've mentioned relationships with O'Brien, and there are a couple of interesting stories. I had almost no firsthand relationship with him. I worked through the department chairman, who was first McFarland and then Morton. We kept in good contact, but there was little contact with O'Brien. In one incident, though, he started to transfer our laboratory to the Institute of Engineering Research rather than the department. This made a lot of sense in some ways. We worked through the Institute of Engineering Research. Paki [Henry] Schade was its very fine director, and very easy to work with.

Lage: You had worked with him before?

Whinnery: Yes. It was a service organization that processed our grants and did much of the accounting. Schade called me up and said, "Did you know that you'd been put under me?" and I said, "No, I

didn't know." He said, "Well, what do you think about it?" I don't remember the details of what I said, but I didn't want to lose the close tie with the department. Although, as an organized research unit, it is interdisciplinary and works with several departments, the majority of electronics research is in Electrical Engineering.

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Whinnery: Schade, as I recall, said, "Well, I don't see any reason to change the relationship we now have; it's working." So he called O'Brien, who said, "Oh, well, it wasn't very important, so leave it the way it was." But it did bother me that it had happened without prior discussion.

There was another incident involving a number of lathes and milling machines, which we had mostly obtained through the Wright Air Development contract.

Lage: It's Wright Air?

Whinnery: Yes, after the Wright Brothers, Wright Air Development Center, in Dayton, Ohio. Anyway, the machines were in a shop in the bottom floor of Cory [Hall], and nominally assigned to the college. Dayton Axtell one day called me up, "Did you know there's a Bigge [Bigge Crane and Rigging Company] truck going to move those out to the field station?" And I said, "No, I didn't," so we went down and stopped it until we could find what was happening. O'Brien had decided to consolidate machine shops with these machines, which were nominally under the college, but the fact that it was happening without discussion was what bothered me. I think eventually we got some agreement on what could be moved and what we needed really close at hand.

Lage: That is interesting that he would do that without thinking about consulting.

Whinnery: Yes. As you know, I'm a great admirer of Mike and all he did in building up the college, but at that particular time, I wasn't very happy with the modus operandi.

Lage: Right. It's the style of leadership that maybe has disappeared, the one-man show.

Whinnery: I don't know.

But on a more positive note, we had a committee that met regularly. Silver of course was a very strong member, but there were representatives from each of the research groups. We were

trying to work out common policies for the graduate students. At that time it was quite variable as to how graduate students were paid, and even whether they could use paid work for their thesis. Some groups would not let them use anything for a thesis for which they'd been paid.

Lage: Some groups within engineering, or across campus?

Whinnery: Certainly within engineering, and I suppose across campus and across the various campuses. The concept of a research assistant, with uniform policies, was developed later. I think we had a fairly strong role in developing this model, which already existed at MIT and Stanford.

Lage: And what were the key things in developing that?

Whinnery: Well, that it would be looked at more as a fellowship than a job, with a uniform pay scale. Now this concept is universal, but at that stage it was not. So our effort was to work out these details between our three principal groups, and then to have them approved with the campus.

Lage: I assume you included that they could do their thesis research and get paid for it.

Whinnery: Oh, yes.

Lage: Was there a sense of competition with the other schools for good graduate students?

Whinnery: Sure. We had some very good students, but we certainly did not have the uniformity of standards that Stanford or MIT had--I keep coming back to those two.

Lage: So when you had a committee, you were looking at other schools to develop the standards.

Whinnery: Sure.

Lage: These years that we're talking about from the time you came back here in '52 to the time you left the deanship, that's only eleven years, and it was during that period that Berkeley rose up to become one of the top two engineering schools. So all of these things must have been very important in the progress.

Whinnery: Yes. Again, let me say that what O'Brien was doing for the college as a whole was terribly important. But in our department certainly, the role of this group was critical.

Lage: Well, I know it's just one portion, but after all, it's the one we're talking about.

Whinnery: Yes. Sure.

Patents on Faculty Research

Lage: This came up in your papers and I wondered if it was important: there was some discussion about policies on patents for faculty research products. Was this a period when that was being worked out?

Whinnery: Yes. At that stage we were probably more careful than we've been since in submitting things for patent review. But it's not been a major issue in development of the department. There are a few patents from the department that have paid off, but for the most part, it's hard to market the things that come out of research. There is also the feeling that the main purpose of the university is to put things in the public domain. There are still people that differ on this view. As you know, at the university level, there has been a lot of argument that we should do more in exploiting our innovative ideas.

But at that period, we tried to submit to the patent department any idea that seemed original. And it was time-consuming if the university decided to follow up.

Lage: But there was never an issue over whether faculty might be able to retain the patents themselves? Is that standard at all the universities, that the university owns the rights to a faculty member's research developments?

Whinnery: I'm not sure of the numbers in the current agreement, but the basic idea is that revenue is shared between university and inventor if the university decides to take out the patent. If it decides not to, the inventor can have the rights but must bear the costs of the patent procedure. Of course the agency supporting the research may have rights also, if spelled out in the grant or contract.

Lage: What about the rights of industry, if it's an industrial contract that the faculty member is working under?

Whinnery: Yes. That has been a difficult issue, not only for industry-supported research but also for visitors from industry. Our

visitors from Bell Laboratories, IBM, GE, and other industries have contributed a lot to our programs.

Lage: Visiting professors?

Whinnery: They are usually given the title of visiting lecturer. Appointments are typically for one year but may be more or less. The university would want the visitors to sign a patent agreement, and their company would object on the grounds that many of the ideas they would contribute were started in their company. We had a couple we were never able to work out. That got to be a major issue with IBM in particular that other chairpersons had to struggle with, and I believe finally got some sort of agreement.

The Loyalty Oath, and Classified Research

Lage: Talking about signing reminded me of something else we didn't discuss earlier: the loyalty oath, and how that played out in the College of Engineering.

Whinnery: I guess it wasn't much of an issue. I suppose that means that people signed it.

Lage: Was the ill-feeling on the campus--do you remember any spinoffs from that in the college?

Whinnery: I don't remember that it affected us much. There were certainly individuals in the college who supported the non-signers, and a number of us contributed to a fund to help those not getting paid. But I think it was much more of an issue, understandably, in the social sciences.

Lage: Especially since you were working on a lot of government contracts. Did you have to sign things for that to get clearance?

Whinnery: Yes. I guess that was why it didn't seem so much of an issue; we had already signed so many things, getting clearance.

Lage: Were a lot of the research projects classified?

Whinnery: At the beginning there were some, but it was fairly quickly realized that we were not in a position to have the security that was needed for classified work.

Lage: All your graduate students would have to be investigated.

Whinnery: That's right.

Lage: Was that an issue, the question of should the university do classified research?

Whinnery: Many persons objected in principle but it was also obvious to nearly everyone that it was impractical.

Lage: Even obvious to the government agencies?

Whinnery: I think so, yes. They realized that universities were not the right place to do their classified research. I guess there are still some classified projects in some universities, but they're now a rarity.

VI CHAIR, DIVISION OF ELECTRICAL ENGINEERING, 1956 TO 1958

Division versus Department

Lage: We don't want to get too compartmentalized into time periods, but should we move on to your chairmanship of the division? It still was a division.

Whinnery: It still was a division, although I've been calling it a department most of the time.

Lage: Does that make a difference?

Whinnery: Yes.

Lage: It meant you didn't have budgetary control?

Whinnery: Yes. O'Brien set up a Department of Engineering of which he was the chair as well as being dean of the college so that he then had budget control. Since appointments initiate in a department, whereas a dean normally is only in the review process of an appointment, this gave him much more control in the early stages. He felt that was a key point in building up the college. I think at the time that he did it, it was a good idea, but as the divisions became stronger and stronger, it became obvious that it was just an annoyance. At that point I don't think it changed things very much. We initiated the appointments.

Lage: You put forth the recommendations, and did he take an active role in evaluating them?

Whinnery: Yes. He had a very good, very strong confidential review committee, even though I don't think it is in the senate manual. Its recommendations were very helpful and we were all working to get very high-quality faculty, but the whole process of getting

an appointment through was very lengthy. I guess it still is. At the time, I was very impatient with it.

Lage: I can guess. I ran across that in some of your papers, too. [laughter]

Whinnery: I'm sure you did. But looking back on it, I think that's one of the things that has kept the standards of the university, the careful senate review.

Paul Morton's Resignation; Whinnery's Appointment as Chair

Lage: You came in as chair because Paul Morton resigned in some frustration. Do you want to talk about that, to set the scene here?

Whinnery: Yes. Actually looking back, there were quite a few excellent appointments made during Paul's chairmanship. Maybe it's a little hard to see why he was so frustrated, but certainly we didn't have the faculty we needed for the students who were admitted. At that time, there was no screening beyond the state engineering exams. Once the students were admitted to engineering, they could choose any department. We were getting large numbers of students, and having a hard time appointing enough faculty to teach them. So Morton felt that we were not getting the support from Dean O'Brien that we should have. I suppose he was turned down in a specific request, so wrote a letter of resignation in which he described what was needed. O'Brien looked at it very carefully, and worked with Chancellor Kerr to obtain more appointments. So I came in with, I think, six or seven new authorizations.

Lage: Had O'Brien initially wanted electrical engineering to restrict students also? Was that one of his solutions?

Whinnery: No, I don't think so. I think his idea was to be sure that we had students with the aptitude for engineering. At that time, in most all undergraduate programs, there was a tremendous dropout level, and O'Brien felt this very inefficient. Much of it was because many students didn't have the math background or capabilities. So he instituted examinations at the freshman and junior levels, but I think he thought of it as for engineering as a whole rather than for each specialty.

Lage: But he didn't expect you to solve your problems in the department, or division, by reducing the students?

Whinnery: No. Not that I know of. And although we limit by department now, in the ideal you'd like to give students a free choice of major.

Lage: So Paul Morton made a stand and made it a little bit easier for you coming to head the division.

Whinnery: Certainly.

Lage: You had seven appointments?

Whinnery: I think it was about seven open positions.

Recruiting Faculty

Lage: Let's talk about how you recruit and choose faculty.

Whinnery: At that time, I worked with a very good executive committee--Silver, Paul Morton, Bob Saunders, and Don [Donald O.] Pederson, although he was only an assistant professor when he became a member. It was agreed that he would leave every time we were considering personnel matters at higher levels. He was already becoming a very important person in the department and has been one of the key leaders--heading the Electronics Research Lab, starting the program in integrated circuits, and developing the SPICE [Simulation Program witn Integrated Circuit Emphasis] program which started our strong role in CAD [computer-aided design]. The SPICE program is now the most universally used computer-aided design program.

So the first goal was to determine areas that were important to build in. By that time, we had good strength in microwaves and electromagnetics, so the three that we had as priorities were computers, solid state electronics, which was just beginning to be important, and information theory, which now we'd call systems theory or communications. This last was becoming an important field in tying together all of the systems work.

Then we advertised, and asked those traveling to conferences or other universities to look for prospects.

Lage: How do you advertise?

Whinnery: In the professional journals, there would be pages and pages of open positions. There still are. Now you have to advertise.

Lage: That's what I was thinking. I had the impression that this kind of open advertisement was something of a more recent requirement.

Whinnery: I think at that time it was not a statutory issue, but a way of reaching people.

Lage: Did many people come in that way, or did most of them come in through direct referral?

Whinnery: Most of them came in through personal contacts, but some who applied were appointed after appropriate evaluation.

Lage: Was the idea to get young people that would grow with the university, or to get some experts and people with established reputations?

Whinnery: Some of each. Just to take a couple of examples: Don Pederson was appointed during Paul Morton's chairmanship. He had applied, and I had the pleasant job of interviewing him in New York. He was then at Bell Laboratories. He quickly became a key person in the department, as mentioned earlier.

Lage: Did you know him before?

Whinnery: Yes, I had met him when he was a graduate student at Stanford. I didn't know him well, but knew he was highly regarded by his thesis supervisor, Joe Pettit.

Lage: Was it hard to convince him to come?

Whinnery: No, since he had applied, he was motivated to come. There was some negotiation on the offer, but he wasn't hard to recruit. Once he was here, he talked to two of his colleagues at Bell Labs, Ernie [Ernest S.] Kuh and Charles Desoer, who also became very key members of the department. So that was one of the contacts.

Other somewhat different examples were Vic [Victor H.] Rumsey and Lotfi Zadeh, who were already well established at other universities. At that time we tried not to "raid" other universities, though the only formal agreements I know of were with Stanford and other UC campuses. So we approached such people only if we learned of their interest. Rumsey was then at Illinois and Sam Silver learned of his interest. We had discussed Zadeh, but did not approach him until we were told by one of our faculty members that he was considering leaving Columbia. Within minutes we reached him by phone, set up a meeting in New York, and that important appointment followed.

Lage: When you were looking at people, were personal qualities important at all? Was this talked about?

Whinnery: Yes.

Lage: What kind of aspects were looked at?

Whinnery: Well, we'd want to be sure that the person would work well with a group, be cooperative. We made some mistakes along the way, which I'd rather not discuss in detail.

Lage: I can understand that. But that was something you looked at? I would think that would have something to do with the collegiality in the department.

Whinnery: I think so, yes.

Lage: Cooperation. Maybe this is a hard question to answer: was it a different kind of person who would come to the university and stay in the academic world, versus the kind who went to industry?

Whinnery: It is a hard question to answer. The first obvious point is that they had to be interested in the university and realize that not all of the outside pictures are correct. It isn't just an ivory tower, as some people think; it is just a very hard job, but a rewarding one if you like it. There are certainly people, if you think of the Bell Labs and the IBM research laboratories as examples, that could well go either way.

Lage: It's not that great a gulf between the two?

Whinnery: I'd say not, if you're looking at organizations like that.

Lage: Did you have a way of judging their teaching ability?

Whinnery: Well, we tried, of course. Nearly all had given papers at conferences, which provided some information. Comments from their colleagues on how they explained things helped. But that's one of the hardest things to document, even for people already teaching.

Lage: Is it hard to evaluate them once they're here, even?

Whinnery: Yes. We have the student evaluations, but they're not 100 percent accurate. You find a number of students, after they've been out a couple of years, suddenly appreciating an instructor they didn't rate very high when they were taking the class.

Lage: And then you have the ability to teach to a group versus the ability to foster a graduate student, which may be two different things.

Whinnery: Yes. For some persons, they're good at one and not the other, but others are superb at both.

Lage: So you didn't come up with a foolproof method of anticipating that ability?

Whinnery: No, I don't think so, and as I say, I don't think we even have a foolproof way for people we know well, that have been here a few years.

Lage: Once you got people here, was it hard to keep them?

Whinnery: No. We've had people leave, usually for dean's jobs in other places or something like that. But I'd say the turnover has been small. And in general, for someone like Tom Everhart, who went from here to a dean's job at Cornell, then to a chancellorship at Illinois, and then to the presidency of Caltech, the continuing contacts are good for us too. He's still very positive about his experiences here.

Lage: Last time we talked about the individual who asked you why you went back to the university. It wasn't Everhart, it was Quate.

Whinnery: If it's Quate, no, he didn't come here. He went to Stanford many years later. He's an outstanding person but I don't remember the correspondence.

Lage: It was early on. It was about '51 or '52. I think you mentioned somewhere that the [John H.] Mackay [Jr.] endowment helped in recruiting.

Whinnery: Yes. Mackay was one of the pioneers of radio and had one of his locations on the West Coast. He gave money to a number of universities; Harvard has a very large Mackay endowment. The endowment here, when it was given, was enough to support a faculty member. But with inflation, it was not enough. There was worry about what to do with it.

Paul Morton realized that a good use was to bring in visiting people. So we've had a large number of distinguished visiting people here as Mackay professors, including Dennis Gabor, the inventor of holography. [Balthazar] van der Pol, the mathematician famous for the van der Pol oscillator, was another. Peter Elias from MIT contributed a lot, and Chap [C. Chapin] Cutler was the first of many distinguished visitors from

Bell Labs. I'm not sure all of these held the Mackay appointment, because we used any available funds once we found how valuable the visitors were.

Lage: Did the visitors teach classes?

Whinnery: Some taught regular classes. Sometimes they were here for a shorter period and gave a series of seminars, worked with graduate students, and gave advice on research. In the early development of the department, these visitors were especially important.

Lage: Was it also a way of kind of checking out people? Did you ever bring people on the Mackay endowment that you were considering as faculty?

Whinnery: Bob Brayton is a recent example, and I think there were others. But those who returned to their home institution remained as friends of the department and often were Ph.D. recruiters or cooperative researchers.

Electrical Engineering Curriculum

Lage: What we haven't gotten into in terms of the division under your leadership is the curriculum of the division, and that seems like a big area.

Whinnery: Yes. Before Paul Morton became chair, we had three or four courses at the junior level, one in circuits, one in machines, and one in instrumentation. Paul saw the need for some unification and instituted a seven-unit course, EE109, to bring more unity to the treatments.

Lage: To combine those aspects into one course?

Whinnery: Yes. Obviously there are relationships among them, and instead of trying to look at each individually, they were combined. Also, you could avoid some duplication. I think it was a very important pedagogical idea.

The problem was in getting people to teach the course. It was a tremendous load. Also, you had to have very good teachers, because if you had that much in one package and an uninspiring teacher, it was a disaster. Nevertheless, it was, I think, a very important step. It later was given up just

because of the impracticality of getting good instructors for this seven-unit course over the long term.

Lage: Seven units is a lot.

Whinnery: Some of that was lab, so there were TAs working with the instructor, but it's still a lot. I know when I was chair, trying to get people to do it was tremendously difficult.

At that time, the curriculum was a very active subject for every department meeting, and we had such meetings about once a month. We'd typically go over one course in detail to see if changes were necessary before the next offering. There would be tremendous arguments, but once issues were settled, everyone would go out and work together on getting the changes made.

Lage: What were the arguments over? What kinds of things really ignited people?

Whinnery: The arguments might be over the amount of material in a course, the order, or the prerequisites. But the major ones had to do with the extent to which new approaches, coming out of current research, should be brought into undergraduate courses. For example, control theory was changing from a deterministic subject to one based more on statistics, and it was not clear how rapidly this approach should be brought into the undergraduate control courses, and the statistics prerequisites that would be needed. Another example was the role of the new information theory in changing the classical communications courses.

Lage: Were the same kind of revisions going on elsewhere, do you think? Was this an area where you looked to other schools and saw what they were doing?

Whinnery: Well, yes, we followed what was going on in other schools, but at this point were beginning to take a leadership role in a lot of these things.

Lage: It's interesting; maybe I think this from the humanities, but I think of professors designing their own courses, what they're going to cover in their own courses. But you're describing a different setup.

Whinnery: Probably there's now less group discussion than there was then. The review of the curriculum and course content goes on. There's not the same degree of argument over it now that there was in that period. Whether it's good, bad, or indifferent, I don't know.

Lage: But you saw the education of the electrical engineer as a whole. Each class seemed to fill a different niche? Is that why so much attention was given to it, because regardless of who was teaching it, you wanted the students to get the same education?

Whinnery: Yes. That was, at least, the theory behind it.

Science versus Application

Lage: Were there also debates over how much science versus how much practical subject matter there should be?

Whinnery: Yes, and that's still going on. Of course, one of the outside influences is the accreditation group. Now, their emphasis is making sure that there is enough design experience in the curriculum. They felt that engineering for a while became too scientific. We have our accreditation coming up in a few months, so it will be interesting to see what they think of what we have now.

Lage: Who does the accreditation?

Whinnery: It's an organization called ABET, which is Accreditation Board for Engineering and Technology. It has appointees from the various professional societies, like the IEEE [Institute of Electrical and Electronics Engineering] and the ASME [American Society of Mechanical Engineering], ASCE [American Society of Civil Engineering]. Teams of inspectors visit, look at facilities, faculty qualifications, and course materials. They then write a report, recommending accreditation, removal of accreditation, or perhaps a warning.

Lage: Has that happened in this department?

Whinnery: We've had warnings.

Lage: On what kinds of things?

Whinnery: Maybe not enough design in the curriculum. But so has MIT, so has Stanford, so has Caltech. If they should disaccredit you, then politically you'd be in some trouble.

Lage: It's just interesting that the universities that are top in the country are still being shaped by the outside--by the profession, I guess.

Whinnery: That's right. And sometimes it is frustrating. It depends a great deal on the team you have. If you have a good, intelligent team that is familiar with your graduates, the members aren't going to get too sticky about details. But if you have a team that is going by the letters--"Well, you don't have this many units of some requirement," you can get in trouble.

Lage: So that is something you pay attention to.

Whinnery: You have to.

The Common Lower Division Curriculum

Lage: But this debate--somehow I did run across this in the papers. I can't remember the particulars, but it sounded as if there were occasions where faculty really went at it over curriculum.

Whinnery: Yes. While I was speaking only of the [EE] department, there were also tremendous arguments about curriculum in the college as a whole. Much of it had to do with the lower division. O'Brien had felt, with some justice, that it was well to keep a common lower division, so that the students didn't have to choose their major until the junior year. And for years, that was the situation.

That comes to another curriculum point: the thing that was always bothersome to EE was that we had no role in the lower division. We would say, "If students are choosing a major, they don't see anything from electrical engineering."

Lage: There was no electrical engineering class that was part of the lower division curriculum?

Whinnery: No. The courses for many years were surveying, drafting, analytical mechanics, and a materials course. The surveying and drafting courses became modified quite a bit, and finally we did get an electrical engineering course [in 1963]. Don Pederson and I taught it together.

Lage: Was this the one you developed the book for?[1]

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[1]Pederson, Studer, Whinnery, *Introduction to Electronic Systems, Circuits, and Devices* (New York: McGraw-Hill, 1966).

Whinnery: We developed a book, yes. It was never a success.

Lage: How do you measure success?

Whinnery: [laughs] It wasn't used in many other places. It worked well here until we went to the quarter system. Then it didn't work too well here.

Lage: So the course you developed that book for was a course for all engineering students?

Whinnery: Yes, for a while. Then the college decided that students could start their major at the freshman year, which is the way it's been now for a couple of decades.

Lage: That's a major change.

Whinnery: Yes.

Lage: Was that something you were in favor of?

Whinnery: No. There are arguments both ways, and considering the pressures, it probably had to be done that way. But I think there is advantage of having some interchange at the lower division, particularly to give students a chance to pick a major. When they are just out of high school, they don't often have much view of the different specialties. At the moment I don't have a solution between the two alternatives.

Lage: Well, it did seem a tremendous amount of attention to coursework, which is gratifying when you hear criticisms of the university: is it really interested in teaching?

Whinnery: That's right. And later, Kuh and Desoer had a very innovative circuits course which was copied widely around the country.

Lage: Did they do a book for that? Is that what gets copied?

Whinnery: Yes. And Zadeh and Desoer in systems theory had a major influence on those courses.

O'Brien's Policy and Budget Committee

Lage: Shall we say anything else about this period? It seems like we've just sort of skimmed the surface. I'm not sure what we've left out of leadership in the division.

Whinnery: You have a question about relationships with O'Brien, which we've talked about, and the chairs of other engineering divisions. O'Brien did have a committee, which was not quite the same thing as the dean's coordinating advisory council. He called it Policy and Budget Committee, on which he had the chairs and a few selected persons.

Lage: Do you remember what those committee meetings were like?

Whinnery: O'Brien would raise matters on which he wanted advice, but I don't recall many major issues. In fact we sometimes joked that we talked about everything but policy and budget. But it was a place for the chairs to get to know one another.

The relationships with the other divisions were fine. In fact, Harmer Davis, who was then chair of civil engineering, carried the ball in convincing O'Brien that it was time for us to become departments.

Lage: Would that kind of thing get brought up at the Policy and Budget Committee, or was that too large an issue?

Whinnery: It was brought up first by telephone conversations among the chairs, asking, "Shouldn't we bring this up to O'Brien?" Then there was a meeting to discuss the issue. He sort of agreed. I think Clark Kerr may also have been asking him about the special organization in engineering, but I'm not sure.

Clark Kerr and Morrough O'Brien

Lage: Do you know very much about what went on between Kerr and O'Brien? I read or was told by one of your colleagues that there wasn't much love lost between the two of them.

Whinnery: Most of what I know is what Clark has said himself, that he didn't appreciate O'Brien until later when he had the chance to look back at what he had done, particularly when the ratings came out, which were very important to the university as a whole. He said that he was worried about Mike because--well, first of all, he was always pressing for something. He got a lot of it, but [laughs] Kerr looked at it as an endless pit, almost.

Lage: Of new faculty and--

Whinnery: Faculty, buildings--

Lage: Oh, buildings, that would be a big thing.

Whinnery: Whatever. Budgets. I think now Kerr appreciates that O'Brien was trying to build something major, and did. But the other thing he has said is that he was worried because Mike spoke so much about the art of engineering, as though he were playing down the science of engineering. But some of his own recruiting of people like Earl [R.] Parker and John [E.] Dorn, and Sam [Samuel A.] Schaaf, who was a mathematician, shows that he was quite aware of the fact that a very strong science base is needed.

Lage: It seems that way, that he recruited a lot of scientists.

Whinnery: Yes. Clark has said that when they talked, he got the impression that O'Brien wanted just practicing engineers and not persons who would do research. And of course, the point that O'Brien was making is correct: engineering is different from physics and chemistry and math; if it weren't, you wouldn't need a separate college. But that doesn't mean to say that those subjects don't play a key role in the background in the tools that you use. O'Brien, in his writings on engineering education, always made this point.

Lage: I heard that O'Brien tried to keep his relationship to Sproul, and sort of left Kerr out of things. Is that something you were aware of?

Whinnery: I don't really know. I've heard the same thing, and I can imagine that it was true. Many of the things that O'Brien did at the beginning were with Sproul's full support.

Lage: Do you know much about the circumstances of O'Brien leaving the deanship?

Whinnery: Not really beyond what he said, that he felt that the building that he had done was just about as far as he could go, and he wanted to go on to other things. I think he felt that a number of the innovations that he'd started were either being turned down by the senate, or not getting full support from the administration.

The Academic Senate and Engineering

Lage: I want at some point to talk about the relationship with the Academic Senate, maybe best while you're dean. But was that a

problem under O'Brien, that the Academic Senate was putting the brakes on some of the innovations?

Whinnery: In some cases.

Lage: Would that be hiring, or curriculum, or buildings?

Whinnery: Some of the appointments didn't survive the senate review. Some of these were of the engineering type that didn't have a strong research record. He felt that a mix of persons with an engineering base and a research base was needed.

Lage: More the professional engineer?

Whinnery: I think some of those. But he also tried, without success, to get chemical engineering into the college. When that didn't happen, he started process engineering as something similar and certainly in competition. That caused a lot of hard feelings on the other side of the campus.

Lage: He just changed the title and started up a program here?

Whinnery: He thought of it as being somewhat different, but there were enough overlaps that it certainly didn't sit well with chem engineering. Chem engineering and chemistry, of course, have always been very strong departments and major players in the Academic Senate.

Another issue was that of the engineering entrance exams. Somewhat to my surprise, when I looked at the dates, it seems that the stopping of the exams for engineering didn't occur until after O'Brien left, but I think the movement to stop them was started near the end of his term.

Lage: So there was some resentment that the college was putting students through this extra set of exams?

Whinnery: It wasn't so much resentment as a philosophical point that once students are admitted to the university, they should be able to go into any program. Of course, now we have our own screening simply because we couldn't possibly take all of those that are admitted to the university that want electrical engineering. But now it's not done through special examinations.

Lage: You evaluate your own incoming students.

Whinnery: That's right. And I think they say they're about seven to one, seven times as many applicants were admissible to the university as you could take in the department.

Lage: So that was another issue he was unhappy about.

Whinnery: That's right.

Lage: Is there sort of a bias in the Academic Senate against the professional schools, would you say?

Whinnery: At one point, yes, but I don't think that's true now.

Lage: This might have something to do with the growth of stature of the college.

Whinnery: Yes, and with the key people we've had in the senate and the administration.

Lage: People from engineering, you mean?

Whinnery: Yes.

Lage: Was this a conscious thing? I ran across that somewhere, maybe it was Paul Morton, urging people to get involved in the senate.

Whinnery: Yes. O'Brien did that, Paul Morton certainly did, and Earl Parker I know played a role in trying to get people in key positions. He was one of the first, I think, to be on the budget committee.

Lage: That's a pretty powerful committee.

Whinnery: That's right. Bill [William G.] Oldham is the most recent member that I know of.

Lage: So that helps.

Whinnery: Yes. And we've had good people on other key committees including the Committee on Committees.

Lage: I like this quote I saw in a letter to you--this was later when you left the deanship--O'Brien wrote you and said, "The university system is incredibly bad, but there it is." [laughter] He was approving of your decision to leave the deanship.

Whinnery: Yes.

Lage: Did he have some bitterness? I picked this up in his oral history too, that there was a bit of bitterness towards the university.

Whinnery: Yes. I received the same impression. I suppose because he was turned down on some things he thought very important, and certainly the mechanism is very complicated--no one would argue that.

Lage: The bureaucracy.

Whinnery: For someone who was a direct-action person, he undoubtedly had many frustrations. On the other hand, if you think of all the support he got and all that he got accomplished, he shouldn't have been bitter.

Lage: Well, maybe we should stop here, and get into your deanship next time. Does that sound reasonable?

Whinnery: Yes.

John R. Whinnery's mother, Edith Mabel (Bent) Whinnery, circa 1890.

John Whinnery with his father, Ralph V. Whinnery, Modesto, California, circa 1930. The thresher and "tractor" pictured were made by Ralph Whinnery.

The Whinnery family, 1970s: Cathy, Pat, Barbara, John, and Carol.

Engineering Alumni Society meeting, 1984, honoring Donald McLaughlin as charter recipient of the Distinguished Alumnus Award. Left to right: Deans and Associate Deans Robert Wiegel, Karl Pister, John Whinnery, Virgil Schrock, Clyne Garland, Donald McLaughlin, A. M. (Mac) Hopkin, George Maslach, Ernest Kuh, and the invaluable executive assistant, Frances Eberhart.

Presentation of the National Medal of Science to John R. Whinnery, White House Rose Garden, June 23, 1992. Dr. Allan Bromley, Assistant to the President for Science and Technology, President George Bush, John Whinnery.

The 50th anniversary celebration of "the book" and announcement of the John R. Whinnery Chair in Electrical Engineering and Computer Sciences, May 1994. Photographs by Peg Skorpinski.

Top: John Whinnery with many generations of his students. Right front, Ron Schmidt, chairman of the committee to establish the Whinnery chair.

Bottom: Steve Elliott (left) editor at John Wiley & Sons, presenting leatherbound copies of the third edition of the classic book, *Fields and Waves in Communication Electronics*, to the authors (left to right) Simon Ramo, John Whinnery, and Theodore Van Duzer.

VII DEAN, COLLEGE OF ENGINEERING, 1959 TO 1963

Appointment as Dean

[Interview 4: February 16, 1994] ##

Lage: Today we're going to talk about your deanship of the college of engineering from '59 to '63, which is really the focus of this series of interviews. Last time, we talked about O'Brien leaving the deanship, and you evaluated, I thought very nicely, his contributions. So let's pick up with your appointment, how that happened, how you were selected, or as best you know about that.

Whinnery: Yes. I was on a sabbatical leave in Zurich in 1959, and much of the search for the dean was going on during that period. Bob Saunders was acting chair while I was gone, and I returned expecting to hold the position of chair of electrical engineering for another year or so. By that time, it was a department.

Lage: It was converted to a department before you became dean?

Whinnery: Yes. It became a department in 1958. So I returned as chair of the department, and in not too long--a month or so--Glenn Seaborg called me in and asked me to take on the position as dean for a limited period. Two to three years is the way he defined it. He didn't want it to be acting, and he asked that I not tell people that it was a limited appointment. I was smart enough to get it in writing. [laughs]

Lage: Now, when you say "I was smart enough to get it in writing," explain what you mean by that.

Whinnery: Well, Seaborg left to become chairman of AEC [Atomic Energy Commission], and Strong became chancellor. He was somewhat

taken aback that he had to worry about getting a new dean again, but he did respect the original agreement.

Lage: Would you have taken the deanship if it had been a normal appointment and not limited?

Whinnery: That's an interesting question. I don't know that I've been able to answer it myself. After it was known that this was a limited appointment, some people said, "Weren't you very hurt by this?" I said, "No, actually it was a tremendous advantage," because I could have it either way. I knew if I did a good job and wanted to stay, there would probably be no problem in continuing. And on the other hand, if I didn't, so many of the administrative positions around here are considered as rotating, there would be no problem in leaving. At least then the conditions under which I had accepted it would be clear.

Lage: So it was sort of an interim position, but not an acting position? Seaborg wanted you to have full authority?

Whinnery: Yes. He preferred that it not be widely known that it was a limited period, because he wanted me to have the full authority of the position.

Lage: Otherwise, you'd be a lame duck when you first came in?

Whinnery: That's right.

Lage: Did he convey to you what his concerns were, or what he wanted you to do?

Whinnery: Yes. He said he wanted the college to become more scientific, which I didn't argue with too much, but I believed that many people on the other side of the campus didn't realize how much advance there had been in that direction. There still was a widespread opinion that, since O'Brien talked so much about engineering as different from science, he was negative about science, which was not the case at all. I felt that there was an opportunity to show what the college had accomplished.

Lage: And actually continue the direction that you had been headed in?

Whinnery: Yes. I don't think there was any marked change. So my guess is that, since Seaborg was relatively new to the chancellorship, he set the limited time so that he could have a chance to review everything himself and see where we were going. I don't know what the search committee's report was. There were two very strong candidates. I expected one of them to be asked as dean, and maybe they were and turned it down: Earl Parker and Harmer

Davis, who were both very distinguished persons who had done a lot for the college.

Lage: Which sections did they come out of?

Whinnery: Harmer Davis was civil engineering, and Earl Parker was materials science.

Lage: Did they both have a scientific bent?

Whinnery: Parker certainly did. Harmer was a very sound engineer, and as head of the Institute of Transportation and Traffic Engineering, had built that entity into a very distinguished unit. He had been chairman of civil engineering and had held numerous jobs on the campus.

Lage: So he had a lot of administrative experience.

Whinnery: That's right. They were both very fine persons.

Lage: I guess it would be hard to find somebody from such a big and diverse group of people who could unify the whole college.

Whinnery: Of course, that's what search committees are for, and they don't always agree. Maybe this one didn't either. I probably could have found out more about its report, but there didn't seem to be any reason to do so.

Lage: Did Seaborg give any more direction?

Whinnery: No, that was about it.

Lage: It's a very general sort of charge, and then you're left to work it out.

Whinnery: Yes, but as we discussed, no major change in direction was necessary.

Improving Relations with Other Colleges

Lage: What did you see as your task?

Whinnery: Well, as I've indicated before, the building of the college had really occurred to a marked degree, but it was not fully appreciated. There were also some sore points with relation to O'Brien's style, which some people saw as too autocratic. So

much of what I saw was a need for smoothing things out within the college itself, and making known across the campus a bit more about what we were.

Lage: That hasn't been brought out too much, the task of public relations on campus.

Whinnery: I think it was an important one. Of course, it was tremendously helped by the time our ratings came out, but that was after I left. I think there had been some improvement in our relations with the other colleges.

Lage: How do you go about improving the relations? Can you recall specific things that you did along those lines?

Whinnery: Well, first of all, I talked to other deans. I found Lincoln Constance extremely helpful, and also Ken [Kenneth S.] Pitzer, who was dean of chemistry. And also, working with senate committees.

Lage: Lincoln Constance was dean of L & S [College of Letters and Science] at that time?

Whinnery: That's right. Well, he was at the beginning, and then Walter Knight was, I believe.

Lage: Oh, I see, so there was a transition. I always think of Lincoln Constance as being a little aloof from the professional schools. Did you find that at all?

Whinnery: No, I found him very helpful in giving advice and cooperating. Walter Knight and I had one disagreement which we smoothed over. I don't know whether this is the time to talk about it or not, but it was over the policy of our college for students who were subject to dismissal for scholarship reasons. Our policy was to give them a period to try anything they wanted to see if they could bring up their grades. This was because the College of Letters and Science would not talk to them if they were below the C average.

Lage: You would allow them to transfer to letters and science?

Whinnery: They remained in engineering but could have a period to see if they had aptitudes in other directions. Some of them may not have belonged in the university, but others were just in the wrong field.

Well, the assistant and associate deans of our college began to call this the L & S program, which was certainly

incorrect, and Walter Knight wrote me, explaining that they were very proud of their program, and they didn't want other people calling something L & S which they hadn't reviewed. And he was perfectly right in this.

But I explained the reason for our policy that L & S wouldn't consider the students as long as they had a deficiency of grade points. So he made sure that at least someone would discuss the conditions for transfer with them. So I think we worked that one out.

Lage: Seems like you had a good solution to it, beneficial to the students.

Whinnery: I don't know whether that policy still goes on or not, but it was an attempt to give the persons a chance to see if they had aptitudes in other directions before dismissing them from the university.

Organization of the College

Mechanical Engineering

Lage: What about the organizational issues within the college that you referred to in the list you gave me?

Whinnery: The main problem at first was with mechanical engineering. Part of it was organizational, and part in determining the direction in which they should move. I found that mechanical engineering was having difficulties after the war in many schools, including MIT. I talked with Gordon Brown about the problems there.

Lage: The same kinds of problems?

Whinnery: Problems of direction. Unlike electrical engineering, which moved into new fields and kept them in the department, mechanical engineering had separated out many new fields--nuclear engineering, which had started in mechanical engineering, industrial engineering some years before, naval architecture here, and in some places--fortunately not here--aeronautical engineering.

Lage: So they spun out into different divisions, and then you're left with the older core that might not be as modern. Was that the problem?

Whinnery: Yes. What direction should they take next.

Then a second problem was the argument between the scientific approach and the design approach. This was the strongest in mechanical engineering, where there were very capable design people and very strong theoretical people. Civil engineering also has a strong tradition of practice along with a very sound research aspect, but I found civil engineering the easiest department to work with.

Lage: So they sort of brought the two together with more ease.

Whinnery: It seemed so. But in mechanical engineering there was much argument about it.

Matters came to a head when I didn't handle the survey for the chairpersons quite properly. Mechanical engineering had three divisions at that point. The instructions to survey faculty for a department chair seemed unclear about a department with divisions. So I consulted the chancellor's office, and it was suggested that the survey of individual faculty should be at the division level. Then I should talk with the division chairs concerning the department chair, who is the one that they worked with.

Lage: Let me just interrupt your flow to ask: how often did you have to appoint the division chairs? When the new dean comes in, does everything change?

Whinnery: No. Appointments are typically three to five years. The first one that came up was in the aerosciences division of mechanical engineering. And that's when I asked for the ruling on how it should be done. Of course, it would have made good sense to survey all faculty for both division and department chairs, and that was done in all later cases.

Lage: But instead, the survey was for the division head, and then--

Whinnery: When [Clyne F.] Garland asked to be relieved as department chair, I talked with the division chairs and a few other people but did not survey the entire mechanical engineering faculty. At that time the procedure seemed reasonable because the main job of the department chair had been as a coordinator among the division chairs. It became obvious from the discussions that no one person would be acceptable to all because of the differences of opinion concerning the emphasis to be placed on design. I decided to recommend Sam [Samuel A.] Schaaf, who seemed to me to be doing a good job as chair of the Aeronautical Sciences Division, and he was appointed by the chancellor. A number of

faculty were disturbed by the appointment, and by the procedure, and wrote to the chancellor asking that it be done over.

Lage: Was Sam Schaaf representing the research side of the division?

Whinnery: Yes, I suppose he was. His degree was in mathematics, not mechanical engineering, and that bothered some people. But he had been working with the aero group very successfully. I think it worked out in the end. After talking with Seaborg, Seaborg decided not to ask him to step down, but let him see if it worked. Schaaf chose to have the department concentrate on the undergraduate curriculum, and had a series of faculty meetings. Although there remained differences of opinion, there seemed to be a sense of unity to the department. But it was pretty traumatic for a while.

Lage: When you say it was traumatic, did you get a lot of personal response from people?

Whinnery: Some. But I felt especially badly because I hadn't handled it properly.

Lage: Were you involved subsequently with mechanical engineering in working out the balance there?

Whinnery: They pretty much handled it internally, and from my position, matters went quite smoothly from then on.

Lage: Would the direction they took have been sort of a compromise, or did they head off in the more theoretical direction?

Whinnery: I don't think it was more theoretical than before. There were very good people who began to develop the new postwar directions, and they were able to attract some outstanding young faculty, including a young assistant professor, Chang-Lin Tien [who became Berkeley's chancellor in 1990].

Communication within the College and Beyond

Lage: Were the department heads then part of an advisory group to you as dean?

Whinnery: Yes, the Dean's Coordinating Advisory Council.

Lage: How did you use that group?

Whinnery: Mostly for information exchange. There were meetings at the chancellor's level and various campus levels, trying to keep everyone informed. Looking back on it, we probably took way too much time. But I thought communication extremely important. In addition to the meetings, I wrote notes, I think about twice a year, concerning major issues going on both in this campus and other campuses about engineering.

Lage: Who were those written for?

Whinnery: The college faculty.

Lage: Oh, I see, to circulate.

Whinnery: Yes. Paul Morton had started for the division of electrical engineering division notes, and I carried this on in the department. But it was interesting that Fred Terman of Stanford, who often was very critical of Berkeley engineering, was nice enough to visit me after I became dean and gave me two pieces of advice. One was to communicate with the faculty through some sort of a bulletin. Since I had done this in electrical engineering, that was natural. And the other was, don't take your problems to bed with you.

Lage: [laughs] Good advice.

Whinnery: But some nights, I would lay awake wondering how. He didn't tell me how he did it!

Lage: Did your poetry come in handy with that, kind of letting go of things?

Whinnery: [laughs] I don't think it was a highly productive poetic period.

Lage: You say you also communicated a lot with the chancellor's office.

Whinnery: Oh, yes. The chancellor's office had formal meetings with advisory councils on both administrative and academic matters. And certainly both chancellors were approachable whenever I wanted to talk to them on an individual basis.

Lage: Were those meetings of the chancellor's groups primarily for you to advise the chancellor on campus-wide issues, or for him to inform you?

Whinnery: Both. The chancellor would describe policy matters that would affect the university, and quite often would ask for advice.

For instance, at that time was when there was a possibility of moving into the California School for the Deaf and Blind.

Lage: Way back then?

Whinnery: Yes. Should we do it, and what were the alternatives if one wanted to expand to a satellite campus. So he would ask advice on matters such as that.

Lage: Were there other committees that that group spun off? Did you actually get involved in working committees?

Whinnery: I don't remember any directly from that group. There certainly were other committees going on.

Lage: Were there differences in Strong's and Seaborg's style that you observed?

Whinnery: No radical difference in policy. They were different people certainly, but both were thoughtful and quiet people, and good listeners. I think there was perhaps more of a contrast with Kerr's style. Of course, I'm remembering Kerr from when I was a department chair.

Lage: Elaborate a bit more about the contrast with Kerr's style. How was that different?

Whinnery: [laughs] I'm trying to think how much it was personality and how much it was really a difference in content. I have the feeling that we got deeper into problems with Kerr than we perhaps did with Strong, and explored them in more depth. But it may be that these were early parts of Seaborg's and Strong's administrations, so that comparing a person who had been in for ten years or so with someone who was just starting is unfair.

Lage: Because you were in connection with Strong just for two years, and Seaborg was only here for two or three years as chancellor.

Whinnery: Something like that.

Small Departments: Naval Architecture and Materials Science

Lage: Okay, let's see what else we have on the list. You mentioned the problem of small departments. Some of these spin-offs from mechanical engineering became small departments?

Whinnery: Yes. The smallest, but actually one that worked very well, was then called naval architecture. Now it's naval architecture and offshore engineering. It was then a three-man department.

Lage: That is small!

Whinnery: And everybody that came in to give advice would say, "Well, that ought to be combined with either mechanical engineering or civil." Its faculty had relations with both. But it was a distinguished department and ran very smoothly. They'd trade off the chair position pretty regularly.

Lage: They all got along?

Whinnery: They all got along fine.

Lage: Were they theoretically oriented? It sounds like such a practical field.

Whinnery: Both, but [John V.] Wehausen in particular was a very strong hydrodynamic theorist.

Lage: So there weren't necessarily problems with small departments.

Whinnery: Not necessarily, no. But one of the problems was materials science, which was a very, very distinguished group. There were two issues there. One was that they had a hard time getting many undergraduates interested in the program for a while. One of the things they did, somewhat later, was to start joint programs, so students could have a combined major of, say, electrical engineering and materials science. There are a number of these joint majors now. Nuclear engineering has done much the same thing.

But the other problem was that the department had in it the mining-oriented people and material-oriented people. There were inevitable differences of opinion in that respect.

Lage: Do they relate very closely?

Whinnery: Some did and some didn't. But there were some strong differences of opinion between the two sides on many issues.

Lage: Would they be differing on things like designing a curriculum, or monetary support, or what?

Whinnery: Most everything a department has to work together on.

Lage: That must be very hard. Did you have a tendency to encourage unity, or to think that maybe the two should have been spun off?

Whinnery: Well, because of the small undergraduate program it was relatively small already. Maybe it would have been better to divide it, I don't know. But there are arguments for areas of interrelationship between the two subjects.

Lage: Educationally?

Whinnery: Educationally, yes.

Lage: How did you deal with things like that? Were you called in to sort of smooth the waters?

Whinnery: I mostly talked, of course, with the chairpersons of either the departments or divisions, and tried not to do anything that would undermine their positions. Often we would talk to people together, or get a group together to discuss where to go from there.

Lage: It sounds like you had a very collaborative style.

Whinnery: Yes, I think so.

Lage: In contrast to O'Brien?

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Whinnery: Yes. I think that O'Brien certainly had a collaborative style too, but I think that I did a bit more.

Lage: It seems like it was called for at that particular point in time.

Whinnery: Yes, I think so.

Lage: You must have felt you were sitting on top of a tremendously diverse organization.

Whinnery: Yes.

Personnel in the College of Engineering

Whinnery: Somewhere along the line I want to say that I was very honored to have this position, because by that time the college was

highly respected all over the country. It was an opening to a lot of things nationwide that I got into, by virtue of this. But the other part was internally, I got to appreciate how good the various departments were, and how many excellent people we had. I think before I finished I knew most of them on a first-name basis. There were two hundred and some faculty, and there may have been a few that I didn't know well. I think I still knew their first names, but may not have been on much more than a hello basis. But usually, I had had discussions with nearly everyone on some issue.

Lage: Well, that's gratifying. Had the departments already been in place long enough that there wasn't too much transition? I would think just having the departments in existence and handling their own budgets would have been an administrative challenge. Did you have to oversee that?

Whinnery: The budget certainly had to go through the dean's office. Here, I want to talk about the staff that I worked with. Frances Eberhart, who was Woertendyke before she married Howard Eberhart, was tremendously helpful.

Lage: And she was the administrative assistant?

Whinnery: Yes, at the highest level. She had handled things for O'Brien, and in fact, at that time a lot of people called her Dean Woertendyke. [laughter] She gave tremendous help and understood the university system thoroughly. In fact, Clark Kerr has referred to her very often as one of the most competent persons that he had to work with. She was especially helpful with the budget.

Lage: In what way? What would be her responsibility?

Whinnery: She collected the data and the proposals from the various departments. All of the background material would be compared with that from previous years, what we'd requested and what had been turned down, what arguments we'd given, and what we might do differently if we wanted to go after something again. She worked with the department chairpersons, helping them make the best possible case for their requests.

Lage: Sounds like a good person to have at your right hand.

Whinnery: Oh, yes. I don't know what would have happened if she had left and I'd had to start with somebody new.

And then another essential person was Don Horning [lecturer and research engineer], who administered the facilities,

including the Richmond Field Station and the planning of buildings. The main new building that was being planned during that period was Etcheverry.

Lage: What was his background?

Whinnery: He had an engineering degree, and had worked with O'Brien for many years. On all of the building projects, he worked with Louis DeMonte of the office of architects and engineers on the campus. There were also minor capital improvements on existing buildings and always plenty to do in maintaining and improving the Richmond Field Station.

Construction of New Buildings

Lage: Davis Hall was also being built, wasn't it?

Whinnery: No, that was somewhat later. Initial planning began when I was dean.

Lage: What about the approval process for it? Was it on the books when you came in?

Whinnery: I don't think so. Do you want to talk about the buildings now?

Lage: Yes, let's do that.

Whinnery: Let's start with Etcheverry [Hall]. I think it was about the week after I became dean when I was called in to a meeting on the final plans for Etcheverry. The architects were Skidmore, Owings & Merrill. They had designed a very lovely building with multiple levels, terraces and so on.

Well, the first thing I found was that the faculty was not too happy with it functionally. They thought that it spread things out too much. But after much discussion, we decided to go ahead with it. It was approved by the university but was turned down in Sacramento as looking too fancy. The architects said that they had saved money by saving on excavation costs with this multiple-level design. But the answer came back which I always paraphrase as saying, "Our buildings don't gotta be cheap, they just gotta look cheap."

Lage: [laughs] That's why we have Barrows Hall.

Whinnery: Yes. Anyway, they redesigned Etcheverry into the basic form it has now.

Lage: Did they redesign the interior too?

Whinnery: Oh, yes, they had to, because of the different layouts of the terrace-type levels. And I don't know whether it was a good idea or not. If the faculty had not been somewhat negative concerning the functionality of the building, I would have fought harder for the original design, but I decided to accept the revision. But I've often thought that it might have been better to have had the original design. It certainly would have been prettier.

Lage: Did the faculty get to feed into the layout on the second go-around?

Whinnery: Oh, yes, a tremendous amount of work goes into designing a building. Everybody that's going to be in the building has to look at the space that they'll be concerned with, and then there has to be concern about the interrelationship among spaces.

Lage: That must be quite a process on its own.

Whinnery: It is. But again, Don Horning was tremendously helpful in handling that, and of course, Louis DeMonte of the office of architects and engineers.

On Davis Hall, T. Y. [Tung-Yen] Lin was then the chair of the structural division in civil engineering. The building that was planned for civil engineering was to be on the site of the naval architecture buildings, the wooden buildings on the north side of the campus. It looked like it would be seven years or so before it could be funded. T. Y. discovered that additions to buildings took priority over new buildings. Although it sounded silly to add a huge building onto a small one, we did decide to propose the addition--what is now Davis Hall--to the small Engineering Materials Lab. And it was approved.

In thinking back on it, it may have been a mistake. If they had waited for the original site, they could have designed the building without the compromises they had to make to attach it to EML. I understand that there have been some difficulties with the facilities and the interconnections, too.

Lage: Although at this time I can't imagine them tearing down the naval architecture buildings.

Whinnery: I think at that stage it would not have caused much of a problem. When Dean [Ernest S.] Kuh proposed that site for the Bechtel Center, there was an outcry that they were national landmarks. But there was a different climate at that time. They were, as I understand it, not even recorded in the [John Galen] Howard notebooks, since he thought of them as temporary buildings.

Lage: Anything else about Davis Hall? Is it named after Harmer Davis?

Whinnery: No, after Raymond E. Davis, who was a very distinguished civil engineer. Civil engineering was probably the best-known of the departments around the world at the period before O'Brien. R. E. Davis and colleagues had done important work in studying concrete.

Lage: Is the choice of name suggested by the department, or the college?

Whinnery: Now it's suggested by giving money. But at that time most buildings were named after famous campus figures. Anyone can make suggestions and there is a campus committee that makes recommendations to the administration. We tried to get Etcheverry named O'Brien Hall, but it was not approved. I think quite frankly it was because some people were not too happy with Mike O'Brien. Anyway, his name was given to the small addition to Hesse, which originally had just been called the Hesse annex.

Lage: Who was Etcheverry?

Whinnery: Bernard A. Etcheverry. He was a distinguished professor of irrigation engineering but had not had the impact on the whole college that O'Brien had had.

Lage: Who was Cory?

Whinnery: [Clarence L.] Cory was dean of what was then the College of Mechanics [1901-1929], which was mechanical engineering and electrical engineering together. His picture and biography are near the entrance of Cory Hall. It's especially interesting to find that he was appointed as an assistant professor at age twenty and as dean at age thirty.

Richmond Field Station

Lage: We haven't talked about the role of the Richmond Field Station. How did that operate and relate to the rest of the college?

Whinnery: This was something that O'Brien started when he was working with Sproul. His argument was that there were certain kinds of projects that couldn't possibly fit on the campus that were pertinent to engineering--sanitary engineering was one, some of the large structural tests related to earthquake engineering another, seawater conversion, transportation and traffic where some of the tests need a test highway. The story of how he got it is in his oral history, so I won't repeat that. But it was working very well for persons who realized they couldn't be doing what they were doing without it. Transportation and traffic with Harmer Davis was certainly a good example, and the sanitary engineering research facilities another. At that time, [Percy H.] McGauhey was in charge of sanitary engineering, and that worked very well.

But there were some people that were put there just to get space, and they were not very happy.

Lage: To be away from the campus?

Whinnery: Yes.

Operations Research Center

Whinnery: The one that I spent the most time with was the operations research activity headed by George [B.] Dantzig. Ron [Ronald] Shephard had encouraged Dantzig to come here. Dantzig was certainly one of the very brilliant persons in the field of operations research, and Shephard had promoted the Operations Research Center with Dantzig as director.

Lage: And that was created during your deanship? In '61?

Whinnery: Yes. But the only space we could find for it was at Richmond. Since Dantzig and colleagues were largely doing theoretical work, they were never very happy, and it took some while to find space on the campus for them.

Lage: Where did you finally find it?

Whinnery: I started to say it was in Etcheverry, but that wasn't finished at that time. Etcheverry is where it eventually ended up. I don't remember the exact location before that but it was compromise space, and Dantzig finally left the university to go to Stanford. I've often wondered whether it was because he didn't feel that he was given the facilities that he should have had.

Lage: Did this Operations Research Center create a new program? What was the thinking behind that?

Whinnery: Yes. Operations Research grew out of World War II. It was an analytical method for handling complicated operations. In World War II, it had been applied to military operations. Dantzig was certainly one of the pioneers; Shephard was another, in showing that it could be applied to any large-scale operation--industrial, international, or government. They did some very brilliant work.

Lage: It sounds like a really interesting field.

Whinnery: Yes.

Lage: Did you help set up that center?

Whinnery: I had to help with the administrative work and the arguments, but Ron Shephard was the person that supplied the expertise.

Lage: That has to go on up through the university administration?

Whinnery: Sure. A center is an organized research unit and I believe requires approval up to the regents level.

Lage: Anything else about the various institutes, your relationship with traffic and transportation studies, and sanitary engineering?

Whinnery: Both of those had very good directors, Harmer Davis with ITTE [Institute for Traffic and Transportation Engineering], and McGauhey with SERL, Sanitary Engineering Research Lab. I visited them quite often. Harmer Davis had conferences every year with the traffic people of the state. One of the good things about it was that not only did it do original research work, but worked with transportation people throughout the state and had a tremendous amount of support. So I went to those meetings, but largely as an observer.

Lage: Ran themselves.

Whinnery: Yes.

Lage: Well, that's gratifying, something doing so much good work that you didn't have to troubleshoot.

Whinnery: Yes.

Faculty Recruitment

Lage: We haven't talked at all about faculty recruitment. What does the dean do there? Somewhere I ran across the figure that you had twenty-three positions to fill when you came in. Could that be right?

Whinnery: Not when I came in, no, certainly not. That might have been the cumulative total over the period. But the initiation is really at the department level. One of the reasons, of course, that O'Brien wanted to be head of the department of engineering as well as dean of the college is that even though much of the initiative came from the then-divisions, he had the right to appoint people--or to initiate the process.

Lage: But in your case--?

Whinnery: But in my case, I reviewed the department requests, although quite often there would be discussion ahead of time before the case was presented formally.

Lage: Would you have a role in trying to get a key person to come here?

Whinnery: Sometimes. I recall discussions with Hans [P.] Mark, who was being recruited by nuclear engineering, and George [L.] Turin for electrical engineering. There might be questions on facilities, but the main purpose was to convince them that they would have support at higher levels. Our Chancellor [Chang-Lin] Tien likes to say that I hired him, because I was dean when he was hired, but I think that was such a strong case when the department presented it that I didn't do much other than enthusiastically support it.

Lage: Just the mention of Chancellor Tien reminds me: this is totally off the subject, but I just want your reaction. At the campus-wide open house last spring, the Oral History Office had a little recording station for people to come in and record five minutes of their experiences at Berkeley or with Berkeley. And

of course, the chancellor was the first one. He told about coming here and not being able to find housing because he was Chinese. He was looking for a place on the north side [where more faculty and graduate students live]. I forget where he ended up, someplace on the south side [where more undergraduates live]. Would that be something that would ever be brought to your attention, or that you were aware of?

Whinnery: I learned later that Ernie Kuh had a problem when he was married and looking for a place in north Berkeley. He did find a nice place in Kensington. I wasn't aware of the problem at the time.

Lage: It wasn't something discussed; probably Tien didn't discuss it either at the time. But it just was kind of shocking to me. That was only '59, I believe. I just wondered if that kind of personal problem that faculty might run into would ever come to the attention of a chairperson.

Whinnery: It certainly would be appropriate to bring such problems to the attention of a chairperson or dean. On a related matter, we had two or three tragedies with students, including a suicide from the Campanile [campus bell tower].

Lage: That was an engineering student?

Whinnery: An engineering student. There were also some difficult personal problems with one of the faculty members, a couple with research personnel, and one with a staff member. I'd rather not go into details.

Women and Minorities

Lage: Was there talk in those early times of questions like we hear so much of today, women in engineering and other minorities?

Whinnery: It was not as much of a formal issue. When I edited the book on *The World of Engineering*, I asked Irene Peden, a very fine woman engineer, to write a chapter on women and engineering. So we were aware that women in general did not consider it a main-line career. But those who went into it generally found it a fine career.

Lage: And she found it a very rewarding career. I remember reading that book. Did you have--you must have had some women.

Whinnery: Yes. We always had some women. Even when I was in school, there were two or three in my class.

Lage: Were they treated with equality, do you think?

Whinnery: Well, I don't know how they felt about it, but I didn't ever see problems. I'm sure when you're that much of a minority, you must notice it. But there was not anything--

Lage: No harassment that you--

Whinnery: That I could see, no.

Lage: How about the Chinese professors? Was that a matter for comment or consideration when you were hiring a minority professor?

Whinnery: Well, it certainly wasn't in our department. It was not an issue. But some of the letters that came in [laughs] would say things like, "He has a very good personality for a Chinese."

Lage: These are letters of support?

Whinnery: That you solicit from outside.

Lage: Well, that's interesting.

Whinnery: And to the credit of our faculty, they would get furious. We had one black professor in electrical engineering, Joe [Joseph T.] Gier, who was very fine. He transferred to UCLA at the encouragement of Dean Boelter, because they had worked together here. I don't think he left because of any way he was treated here.

Lage: Well, good. I hadn't really anticipated getting into those issues, but I think it's important. Because they weren't in the public eye at that time, but the issue is still there.

Whinnery: Yes, that's right.

Recruiting Mistakes

Lage: You mentioned, I think to Professor Susskind in the interview, that there were some mistakes made in faculty recruiting. Can you talk about them? You don't have to mention names, but how do mistakes get made, and what kinds of mistakes were made?

Whinnery: That comment referred to the period when I was chair of Electrical Engineering. We had so many positions all at once, and may not have been as careful as we could have been in a couple of them. Certainly we tried to solicit information in the usual way, and the appointments did go through the usual senate procedures. But I don't want to make too much of this. I don't think there was permanent damage to the department.

Lage: It doesn't seem that way. As dean, in considering faculty appointments, would you pretty much just take the department's paperwork and review it--

Whinnery: O'Brien had set up a committee in the college office which so far as I know is not required, and may not be used now, to review all the cases that came through. Anyone who thought that O'Brien was not strong on the research and the scientific approach should look at the people he appointed to that committee. They included Earl Parker, Sam Silver, and others who clearly had a strong research record. They were to advise both the dean and the department chairs. Sometimes the appointment seemed good but the case could be strengthened.

So I continued this, and it was very helpful. I did certainly go over the paperwork, and in many cases met the individuals when they were being recruited, as mentioned earlier.

Lage: Did you ever turn down at your level a recommendation of the department?

Whinnery: I certainly didn't without discussing it. I think we may have had discussions on some in which we jointly came to the conclusion that there were better candidates.

The Budget Committee of the Academic Senate

Lage: Once you approved and prepared the paperwork and all that, did you have any difficulty getting the budget committee [Committee on Budget and Interdepartmental Affairs] to sign on in the Academic Senate?

Whinnery: Yes, we had some problems. We had more problems with the budget committee on promotions than we did on initial appointments, as I recall. And there were more in the beginning of my term than later.

Lage: What kinds of things would they call into question about promotions?

Whinnery: Typically the research record, or some of the letters might seem to them not as strong as they should be.

Lage: Was this a process you could say was helpful, or did you see it as a roadblock?

Whinnery: Well, I was pretty aggravated at times. On the whole, I think it was helpful. It certainly made us very careful on our standards. But sometimes it was the length of time that was the issue. I believe we lost some good candidates because other universities could move faster.

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Lage: Do you think your problems with the budget committee were a result of their not understanding the requirements of research in engineering?

Whinnery: Yes, I think in some of these cases, that was correct.

Lage: How did you handle that?

Whinnery: Well, I would try to explain the reasons for our recommendations. This was part of the process of relations with the other side of the campus that we discussed earlier. I think by the time we finished there was a better understanding. Part of the success came from the good people that we had on the budget committee.

Lage: So you had some representation from engineering there.

Whinnery: We had some representation, and that helped.

Lage: Did you ever have to go to the chancellor to plead a case, do you remember?

Whinnery: Any appeal to the budget committee had to go through the chancellor, of course. That was the line of communication. So we did, yes, I remember more in the promotions than in the appointments. But I think there were at least some of the appointments that were appealed. In some cases, it was just a need for more information.

Lage: Some mention is made, and I think it was again in the Susskind interview, about recruiting students as being a concern.

Whinnery: Particularly at the graduate level, but also at the undergraduate level. This was the main reason that O'Brien put in examinations, to try to be sure that we had students that were bright and also had the capabilities for engineering. But the key characteristic of a strong graduate program is not only to have a strong faculty but outstanding students.

Lage: Did you have a role in that as dean?

Whinnery: We had an associate dean for graduate matters, and one of the points of discussion in a lot of our meetings was how to improve the quality of the students. Part of it is advertising, part of it is selection, part of it is financial support.

Lage: A big part, probably.

Whinnery: Yes, certainly.

Lage: And that you were doing through these various research institutes, in part?

Whinnery: Yes, that's right.

Relations with UC Davis Engineering

Lage: You had mentioned also you wanted to talk about relations with departments on other UC campuses. The Davis campus?

Whinnery: Yes. What's interesting is that this was a period when engineering was being established on other campuses. Originally, it was only at Berkeley, then UCLA, and then other schools. Davis had had an agricultural engineering department for a long time--I suppose it was a division too, when there were divisions--a very distinguished program, one of the best in the country. But it was under the college at Berkeley.

When they decided they wanted to have a full engineering program--before I became dean--it was decided that they should still be under the college at Berkeley, even though they then were including electrical engineering, mechanical engineering, and other fields. So when I became dean, I was dean not only for Berkeley but for Davis engineering. But Roy Bainer, an internationally known agricultural engineer who had been head of that program, really planned and guided the new developments there. He was a very fine person to work with.

Lage: And what was his position?

Whinnery: He was appointed as an associate dean of the college at Berkeley. He really did the planning for their new programs. We had many discussions and all of the approvals had to go through the Berkeley committees. We helped with that. So he always appreciated the fact that this helped him rather than hindered him.

Lage: That must have grated a little bit, though, having to go through the Berkeley channels.

Whinnery: I don't think so, at least with Bainer. The chancellor, [Emil] Mrak, who was a very ambitious person and a very strong chancellor, probably wasn't very happy about it. When he later called me in and said, "We're going to go on our own," he was so surprised when I said, "Fine." I said that it looked like it was time for it. So that, I think, went quite smoothly.

Lage: Do you remember when it was that they went on their own? Sometime during those four years.

Whinnery: In 1962.

Lage: Then did a close connection continue?

Whinnery: Actually, yes. Probably not as close as before, but two or three of the faculty moved up there--Clyne Garland, and [Gerald T.] Orlob from civil engineering, and Warren Goedt. And because of Bainer's long years of working with Berkeley, he remained in close contact.

Relations with UC Santa Barbara Engineering

Whinnery: The experience at Santa Barbara was a little less pleasant. Normally, we would not have gotten involved with that at all. My understanding is that UCLA had opposed Santa Barbara's starting engineering, feeling that it would be competitive with them in southern California. I'm not sure whether that's correct or not, but that's what I was always told.

In any event, the first dean they appointed, [Albert G.] Conrad from Yale, wanted to bring about seven people from his faculty at Yale as a group, and the chancellor at Santa Barbara, [Samuel B.] Gould, approved this. But it came to Harry Wellman as acting president. He thought it not proper to bring people

in as a group, that one should look at them individually. All he had was the names. He asked Roy Bainer at Davis and me to see what we could find out about them. Later I realized how dumb I was, because it should have been the responsibility of Conrad to have supplied the biographies. But anyway, I spent a lot of time in the library--

Lage: Oh, my goodness, that would be quite a job.

Whinnery: And I didn't find out much about many of these, which I told him. Roy handled it much better; he said, "I couldn't appoint any of these with this information." [laughter]

I thought this report was confidential, but Conrad found out and for several years was very mad at me in particular and Berkeley in general. They did turn down his request to bring these persons as a group.

Lage: Did Yale have a good engineering program at that time?

Whinnery: It wasn't a terribly strong one.

Lage: I see. So just coming from Yale wasn't enough.

Whinnery: No. We later got to be friends, but for several years he was pretty annoyed with me.

Lage: What did he do after that? Did he go about in the traditional way to build the department?

Whinnery: Yes. I think by that time there was a new chancellor, one that wanted to follow the university rules. And they have a very distinguished college now. So it's interesting that maybe it didn't matter whether they started in a cooperative way or not, because both Davis and Santa Barbara have turned out to be very fine schools.

Lage: And developed in such a different way.

Whinnery: Yes.

Lage: Do the smaller--I'm assuming they're smaller schools--do they concentrate in certain areas, or do they have a full range of the program?

Whinnery: They have a pretty full program. They don't have every specialty that you would find here. But Davis is not a small school, really.

Lage: How about Santa Barbara?

Whinnery: Again, it's a good-sized school. In some fields, the fields of quantum electronics and solid-state, they're one of the tops in the country.

Relations with "Teller Tech," Livermore

Lage: Now, let's see. You also mentioned an intriguing thing: Teller Tech.

Whinnery: Oh, yes. Clark Kerr had encouraged some way of using the facilities at Livermore for education, and the first thing Edward Teller proposed was a full campus there. I don't know how far that got, but by the time I got into it, it was proposed as a graduate program.

Lage: And was it engineering?

Whinnery: No, it was engineering and science--physics, chemistry--

Lage: Oh, across the board.

Whinnery: I'm not sure how many departments it was proposed to have, but certainly chemistry, physics, and engineering. Mathematics, I presume. And it was quite controversial on this campus. First of all, Teller was controversial in his own right--the H-bomb and the Oppenheimer matter. But others felt that the program that he was proposing was much too ambitious. Anyway, there was a committee set up with Carl Helmholz as chairperson to look at the proposal, and the committee did recommend approval with some provisos. The main one was that the students in that program had to spend some time on the Berkeley campus, if it was to be under a Berkeley program. I always thought that that was not acceptable to Teller and he went to Davis and got it approved there. It turns out, in talking with Clark Kerr, that that was not the case, that it was the Educational Policy Committee [of the Academic Senate] in Berkeley that turned it down.

Lage: Oh, after the Helmholz committee, they didn't accept it?

Whinnery: They didn't accept our committee report. And so it was set up under Davis in engineering. Bainer had put on the same condition that students had to spend some time at Davis, but as I understand it, that is not required now.

Lage: So the entire educational process can take place there?

Whinnery: That's my understanding. I don't know just when it changed. They obviously have some very good people and some excellent facilities. But if I were reviewing it again, I would say that if it's going to be under one of the campuses, that the students should have some tie to that campus, too.

Lage: Did that mean that the Davis professors moved out there?

Whinnery: Largely I think it's staffed with people from the Lawrence Livermore Laboratory, and they have some excellent people, of course. But I imagine some courses are given by Davis faculty.

Lage: Is Teller still associated with it?

Whinnery: Oh, I don't think so.

Lage: Is the name still in currency, Teller Tech? [laughter] I hadn't heard it called that.

Whinnery: Yes, informally. It's the Department of Applied Science under Davis.

Lage: Well, that's an interesting one. Did you get involved on any of the committees at all?

Whinnery: I was on the committee with Helmholz and talked with Teller several times individually. His first proposal for the engineering curriculum I didn't think very good. But he seemed to accept suggestions. In the end, the faculty is the key thing, and they would be the ones that would make the curriculum. The first proposal is significant in that that's where you start looking for persons in certain areas.

Lage: Was the engineering curriculum focused on, say, nuclear engineering?

Whinnery: Not particularly. Well, since part of the point was to use the facilities there, it had certainly a strong complement in nuclear. But other things such as laser research were proposed.

Lage: How was Teller to deal with on a one-to-one basis?

Whinnery: He was very enthusiastic about whatever he was doing. And he seemed to take suggestions. Some people would warn me and say, "This is just maneuvering. He'll appear to take suggestions but won't carry them through." Well, since I didn't have the

opportunity to see how it was carried through, I don't know. But I think some of the points got across.

Lage: He's such an intriguing figure.

Whinnery: Yes, he certainly is.

International Programs

Lage: Now, what have we missed?

Whinnery: Well, somewhere along the line, I think the international programs are worth discussing.

Lage: That's right. You mentioned them in your list, and I hadn't been aware of them, so tell me.

Whinnery: Yes. This was a period when the U.S. government, the Ford Foundation, and other agencies were trying to encourage cooperation between American universities and, I guess you'd call it the Third World institutions--programs to try to build them up. There was an agency in the U.S. government, I believe AID, Agency for International Development. And the Ford Foundation was very active and had a tremendous program. We were getting requests from all sorts of schools from all over the world for cooperative programs.

But one thing we had decided fairly early was that it wasn't going to be useful to go into schools unless there was some intellectual match. There had to be a certain level, or there couldn't be communication. The second thing is that we couldn't do everything; we could expend a reasonable amount of our resources on such programs, but if more than 10 percent of the faculty became involved, it wouldn't be fair to obligations at home.

The individual faculty, incidentally, took part in many other international programs where we were not official sponsors, in addition to the two programs that we sponsored. One was in Chile with the Catholic University of Chile, sponsored by the Ford Foundation. The very strong dean, Raul Deves, was trying to convince us to go in with them on a program supported by the Ford Foundation. At first, we were not all that impressed with what we heard long-distance, but the Ford Foundation convinced me to visit Chile, and McGauhey, the

director of the Sanitary Engineering Research Laboratory, went with me. When we got there, we were very much more impressed.

Lage: This was before you had actually signed on?

Whinnery: Yes. And we did establish an official program. The primary part of the program was sending Chilean students abroad for education, not just to Berkeley, but to Germany, France, England, and schools all over the U.S.

Lage: Rather than building up an institution there?

Whinnery: They were to get Ph.D. degrees and then presumably return and enrich their native countries. In addition, we had some of our faculty go there. We had some very good people: [Harry D.] Huskey in computers; [Theodore] Van Duzer; Orlob, whom I mentioned eventually going to Davis.

Lage: How long would they stay?

Whinnery: Typically one to two years.

Lage: And teach, or build the program?

Whinnery: Teach, and work with them in building up curriculum and research programs. It probably was one of the most successful of the international programs, until the revolutions in Chile. I was back once on a Ford Foundation evaluation of it some years later, and haven't been back since, but I am told by people there that influences of the program remain, even though they had some very rough times through the political upheavals. First, when [Salvador] Allende was elected, there was a very politically-oriented period, and persons could be thrown out for their politics--

Lage: Out of the university?

Whinnery: Yes, out of the university. And then when [Augusto] Pinochet came in, that was really a revolution. But I am told that some of the remnants of the program still live. I've forgotten the number, but we had certainly in the twenties of these Chilean persons who got Ph.D.s and returned, becoming heads of departments, heads of computer centers, just exactly the way the model was supposed to work.

Lage: Well, that sounds very encouraging.

Whinnery: Then the second program was one in which we were just one of a consortium. There were eight schools--MIT, Caltech, Michigan,

Purdue, Ohio State, Case, Princeton, and Berkeley. That was at Kanpur in India. They were building an institute of technology at Kanpur, and our main contribution was providing some very good people. Art Bergen was one who went, Huskey on the computer side, John Kelly from math, Arthur Gill, Wayne Brown, and McGauhey.

Lage: Did you visit there?

Whinnery: No, I didn't ever visit there.

Lage: Who was the lead person from this? There must have been somebody who organized it.

Whinnery: At the beginning, this was something that I did, with the help of Frances Eberhart in working with the administration on legal aspects, which I didn't understand very well. In the trip to Chile, McGauhey was extremely helpful. First of all, he spoke Spanish, which I did not, but also he was just a very wonderful personality, and very astute, so that he could assess the situation very well.

Anyway, eventually we had Alex [Alexander C.] Scordelis appointed associate dean to really follow the programs. I guess we saw this as something that was going to grow and grow, which as a matter of fact sort of tapered off shortly after that.

Lage: Was the India one as successful, do you know?

Whinnery: I think it was a success. We get many good graduates from Kanpur. In fact, I've heard it described as the top technical university of India.

Lage: That sounds like a gratifying part of your deanship.

Whinnery: Yes, I think it was.

Lage: How did you like Chile?

Whinnery: Oh, wonderfully. Of course, the trouble is it's just California upside-down.

Lage: Yes, the reverse! And very cosmopolitan, I hear.

Whinnery: Yes. The Europeans came from all over--you see red-haired persons. It looked so funny to see what looked like a typical Irishman speaking Spanish. And the vegetation has been transported back and forth so often from being the same

latitudes that it looks just like California, especially with the ocean, the mountains, and the coastal plain.

Relations with UCLA Engineering

Lage: We didn't mention UCLA when you were talking about the various UC campuses. Did you have a formal relationship there, or problems?

Whinnery: I don't think we had problems. First of all, there was an Engineering Advisory Council, which worked to coordinate all the engineering programs. At first, it worked with UCLA and Berkeley, and then as newer schools came in, they were included. So we had relations that way. But we also had quite a few other relations with [L. M. K.] Boelter. UCLA had a part of the Institute of Transportation and Traffic Engineering; also water resources was set up as a statewide project. So we had meetings about those projects regularly.

Lage: But it was smooth? You didn't sense a competition?

Whinnery: No. It was quite a different program. Boelter had a concept of unity of engineering. He had one department of engineering, and much more interaction among the parts than we did.

Lage: Oh, so he kept one department as O'Brien had?

Whinnery: But without the divisions.

Lage: Was it as big a college?

Whinnery: It wasn't as large as ours then. I think it must be comparable now.

Lage: Do you know if it's still organized that way?

Whinnery: No. It was a very idealistic idea, and it had some good parts, but it was really unworkable as it became large.

Lage: We still have a few things to go on the college. Do you feel like we'd do better starting afresh?

Whinnery: I think so.

A Status Report on the College During Whinnery's Deanship

[Interview 5: March 2, 1994] ##

Lage: We were saying before we turned the tape on that sometimes we forget the overall picture, which was a very healthy one. You were going to start today by giving a status report on the college at the time of your deanship.

Whinnery: Yes. I thought that since we've talked about some of the problems, many of them not all that important, that it was desirable to point out the status of the college. It was in very good shape, thanks to Mike O'Brien's building of it for so many years. The faculty committees were working on the curriculum. We probably will want to discuss the curriculum later. The staff in the office was excellent. We've already talked about Frances Eberhart and Don Horning, but also in the student offices, Vi [Violetta] Lane with the undergraduates, and Esther Robertson in the graduate office, and their staffs, were excellent. The associate and assistant deans were tremendously dedicated and helpful.

Lage: Did you have the same associate and assistants over your period of time?

Whinnery: I didn't change them at the beginning, and in general not until they wished to change. Clyne Garland was the associate dean, very hardworking, a very fine person. He stayed until he decided to go to Davis with Bainer when Davis became a separate college. [Leonard] Black was in charge of the graduate office. Ralph Hultgren and Herbert Scott were in the undergraduate office--all of them very effective.

Lage: Did they get some relief from teaching duties for this kind of office?

Whinnery: Yes. I think it was typically a half-time position, but it depended on the assignment.

Lage: So were these people you could leave with an area to take care of and be confident that it was taken care of?

Whinnery: Yes. The work-study program, the co-op program, Lysle Shaffer was assistant dean in charge of that, and that was very successful and ran smoothly.

Lage: Would you want to just say a few words about that? I don't believe we've discussed it, have we?

Whinnery: No, I don't think we've mentioned it before. This was something that O'Brien started in 1948. There were other models of co-op programs around the country at that time. MIT had one, and there were others. In these programs students typically take five years to graduate, but they have two or three work periods during those five years. In general, they do better. I would frequently get calls from parents who would be concerned about students going into this--wouldn't it interfere with their scholarship--but usually their scholarship improved, I guess because of motivation.

Lage: So they would take a semester off and work in an engineering firm, is that the way it works?

Whinnery: Yes. The pattern of work versus study has varied during the life of the program, but during the five years, they would have had more than a year of work experience.

Lage: Was that designed for people who weren't thinking of going on to graduate school, or did it matter?

Whinnery: No. I think because of motivation, it probably increased the chances of their going on, as they worked with people in the industries and realized the importance of additional study.

Lage: Is that something that continues?

Whinnery: Oh, yes, it continues, and it's still very successful. It ran smoothly, but it did take time because of the visits to companies. Not every job, of course, would be suitable for a work-study assignment.

Lage: So you had to have some review of the job assignment.

Whinnery: That's right. We tried to have faculty visit every one of them over a period of a few years, but probably couldn't achieve that ideal.

Also, the relations with the community colleges were very good. The Office of Relations with Schools had a person, Bonham Campbell, who concentrated on engineering, and we had a lot of the faculty visiting the junior colleges and the state colleges, later state universities, too.

Lage: Was this with an eye to preparing the transfer students?

Whinnery: That's right. In particular, whenever we would make a change in curriculum, we would set up visits to the community colleges to tell them about it. We also set up summer institutes on the new courses.

Lage: I can see that becoming very complex, as you're doing a curriculum revision.

Whinnery: Yes, that's right. Of course it was becoming more complicated during this period because of the new campuses. Originally, engineering students in the community colleges who wanted to go on largely transferred to Berkeley. Then of course, with UCLA, they had quite a different program. Transfer students had to choose, or work out a program that was somewhat of a compromise.

Lage: Yes, then you have Santa Barbara, and Davis--

Whinnery: Yes. At that stage it became almost impossible for the community colleges to have a program that would make it possible to transfer to any one of these without some makeup work.

Lage: As the curriculum became more sophisticated or more research-oriented, did your community college teachers have any difficulty in doing the revisions of their curricula?

Whinnery: Yes, I think the two courses that gave them some problems were the materials course in the lower division, and the electrical engineering course was probably the hardest of all.

Lage: But the summer institutes helped cover that?

Whinnery: They helped, certainly. And of course, some of these schools had people that were expert in electronics. If they did, it went fairly well. If they didn't, it was very hard for them.

Lage: Did they go so far as to adopt the books used here?

Whinnery: In some cases, yes. If most of their transfers did go to Berkeley, then they would try to pattern it after the Berkeley program. But if their transfers went to a variety of schools, it was harder. We had to set up adjustments, so if they came without a given course, there was a way of making it up without putting them too far behind.

Lage: Did the school continue to encourage that sort of a pattern of attending junior college and then transferring to the university?

Whinnery: Yes. As I understand it, there is more of a dichotomy in the transfer students now. There still are some very good ones that come from the community colleges, but there is much more unevenness than there used to be. We may have mentioned this before, but one thing that helped at that time was that we could use a differential. From the colleges that had the most transfers, a record was kept of how students did in comparison with the grade point that they came in with.

Lage: So you evaluated the school.

Whinnery: Evaluated the schools. As I understand it, that can't be done now.

Lage: I've always heard that private universities and colleges do that with high schools.

Whinnery: Yes. They used to do it with high schools here, but I'm not sure that they do now.

Lage: They might feel that it's unfair to the student who happens to be in a poor district.

Whinnery: Yes.

But coming back again to the status of the college. As I say, the reputation certainly was already high, even though I think the first of these many surveys that placed us in the second slot to MIT was somewhat later. Of course, the reputation had to have been built before the survey. In fact, the surveying, as I recall the dates on that, was probably going on at about that period. So the school, the college, did have a very fine reputation around the country. So there were a lot of--

Lage: A lot of good things.

Whinnery: A lot of very good things. The Institute of Engineering Research that O'Brien had set up with Paki [Henry] Schade as its first director ran very smoothly. Earl Parker took over from him, and George Maslach was, I believe, an associate director. They worked very hard to help the new young faculty find research support. That was their emphasis and it was very successful.

Lage: I see a lot of attention to detail and to the whole picture. Is this something engineers are particularly good at? [laughter]

Whinnery: Well, I don't know. It was a pretty complicated arrangement, but thanks to the many people that were working at it, it ran pretty smoothly for the most part. We talked about a few of the glitches, and that's why I wanted to get across the overall picture that things for the most part were going well.

Lage: I hope that comes across. That's certainly been my impression, that things were good, but I know when you start talking about problems--because sometimes they're the most interesting things to get into--you forget this larger picture.

Curriculum

Lage: Are there any other things along that line in terms of the status report that you had thought to mention?

Whinnery: I think we want to talk about curriculum in some detail.

Lage: Good. Why don't we start with curriculum and what kinds of changes were taking place?

Break-up of the Common Lower Division

Whinnery: I think the most important change was in the common lower division. It was somewhere in the early fifties that the common lower division that O'Brien had worked so hard for was effected. In addition to physics, math, and chemistry, and the humanities, there was to be one engineering course each term. He wanted all of the departments to be represented. The hardest one to work in was electrical engineering.

The old surveying course was made into a measurements course, which, in addition to physical measurements, was to include electrical measurements. But this was in the freshman year when students hadn't had the electrical physics course. So the measurement of electrical things just didn't work. There was some statistical approach to measurement, but the students didn't have background in statistics either, so that was probably the least successful of the courses.

Lage: Could that have been put to the second year, or it was necessary for something in the second year?

Whinnery: Even if it had been put in the second year--and of course, there were other things that it had to compete with--the students still would not have really had a very strong background for measurement. I think the mix of the two things was artificial.

Probably the most successful of the new courses was the materials science course. That is still going on, with, of course, obvious revisions over the period of years. Of the other two, the graphics course was changing somewhat already from the old mechanical drawing course, beginning to use new techniques, although not yet the sophisticated computer techniques we have now. [Alexander] Levens was considered one of the top people in the country in graphics, and tried to keep it up-to-date. So that went quite well. And then the mechanics course, which is standard. [James L.] Meriam was a leader in that.

Lage: Were these courses that are standard also undergoing revision?

Whinnery: Yes. Sort of a continual revision, but I think at the time that the--I'll call it the O'Brien lower division--was put in, there was a purposeful rethinking of each course with a major revision at that time.

Lage: Even though the course is thought of as one professor's course--that's the way you seem to talk about it--do others feed into them?

Whinnery: Oh, yes. Certainly when I mentioned Meriam and Levens, there were others working with them. But in those two courses, they were the leaders.

The problem still was that electrical engineering felt left out of all of this. If the point of a common lower division was so that students could see the various fields and then choose their major, it wasn't working for electrical engineering. So in the curriculum discussions that occurred in the late fifties and into the sixties, the emphasis was on getting something in electrical engineering. We also thought it important that all engineers have at least an introduction to electrical and electronics engineering.

The course we started was called Introduction to Electrical Circuit Systems and Devices. It was sort of an overview, but it did try to have some depth.

Lage: Now, when you say you wanted it to be of value to others, do you mean to people who weren't going into electrical engineering?

Whinnery: Yes. But it turns out that other departments didn't want it that much. I think mechanical engineering required it for a while. Certainly not the whole college. So that, I guess, triggered the breakup of the common lower division, for better or worse.

Lage: Has it broken up more now?

Whinnery: Yes. And now students are admitted to their majors when they apply as freshmen. Which is too bad, in a way.

Lage: They get more depth in their field, I guess.

Whinnery: Some, but a case can be made for a need of breadth at that level. But part of it is the relative demand for the different fields. In recent years, electrical engineering has had far more students who are admissible to Berkeley who wanted electrical engineering than could possibly be handled. So the department has a separate quota. I don't know the status of some of the other departments, but there is a difference in demand between the different departments.

Lage: So it's harder to get into electrical engineering than, say, mechanical engineering?

Whinnery: I believe so. Engineering science and electrical engineering have the highest ratio of applicants to admits. It's interesting that the exams for entrance to freshman and junior level that O'Brien started were stopped eventually by the Academic Senate under the grounds that anyone admitted to the university should have free choice in curriculum. But when it was discovered that we couldn't possibly take care of all of these applicants, why, then the quotas were again put in. I don't remember when the quotas were put in; this was after the period I was dean.

Lage: Not based on your special exams, but just on your evaluation of record?

Whinnery: Just on records, the SATs, and the essay.

Lage: During the time when you were dean, what was the situation?

Whinnery: We still had the exams for the freshman and junior year. I believe they were stopped around 1964.

Lage: Did you have to deal with the Academic Senate on that?

Whinnery: No. There may have been some preliminary discussion on the issue. I think the faculty didn't really argue about it too much, because the exams had pretty much served their purpose and there were other ways of evaluating students. It was a tremendous operation, giving the exams throughout the state.

Lage: Who read the exams?

Whinnery: Some of the faculty were involved in it, but most of it was such that the exams could be read by the staff. Although a lot of work, it ran pretty smoothly.

Lage: What an operation. I hadn't really thought of it administratively, what it would involve.

Specialization in the Upper Division Curriculum

Lage: Were there changes in the upper division curriculum that you were involved in?

Whinnery: Yes. The upper division, for the most part, is set by the individual departments. But changes do have to be approved by the college and there would be argument in the college meetings about some changes. The main change which was starting then and has continued even more since, is the cutting back of courses in common. When I was in school, for example, even in the upper division most of my courses were in mechanical and civil engineering, more so than in electrical. Now, of course, all that's required is, I think, six units in some other department or some other parts of the college. There was a required course in engineering economics. There was a course called Introduction to the Profession, which in part was an emphasis on giving oral and written reports. I thought it a useful course, but eventually it was given up as a required course. Electrical engineers used to have to take mechanics in the upper division, heat power, and strength of materials. I think those were cut back one at a time.

Lage: Were they required previously because there was a closer connection between the fields, or just a sense that you should know what else is going on?

Whinnery: Part of it is historical. Originally there was only civil engineering. Mechanical engineering became a specialty of that, and then electrical engineering grew out of mechanical engineering. Also, many people believe that an engineer should

not be too narrow, that an electrical engineer should be able to handle the thermal and stress problems of a design as well as the electrical problems. And ideally, I think there's very little argument about it. The problem is time, of course.

Lage: In acquiring the specialized knowledge.

Whinnery: So the education has become more and more specialized. And this is true not just of electrical engineering. Civil engineers used to have a course in electrical engineering, and they gave that up.

Lage: And it's happening outside engineering, as other fields become more and more specialized.

Whinnery: Right.

The Social Science Requirement

Whinnery: Now, the other curriculum matter I wanted to talk about is the humanistic, social part of the program. The accrediting agency, which was then the Engineering Council for Professional Development and is now ABET, Accrediting Board for Engineering and Technology, requires about one-eighth of the program to be in humanistic, social studies. That's the equivalent of about one semester. I believe this requirement was put in sometime after World War II.

Lage: And previous to that had there not been a requirement along those lines?

Whinnery: I believe not. Certainly when I was in school, I believe there was no such requirement.

Lage: You didn't have to take an English course?

Whinnery: I had several in junior college. I don't know if the lower division students here had such a requirement. In any event, when the requirement was first instituted, students chose courses more or less at random. O'Brien was concerned about how to use this requirement more effectively. A number of constraints were put in. The trouble is there were so few units, but even so, there was supposed to be some concentration in about half of the program, and then also some breadth.

Lage: How many courses were involved here?

Whinnery: Well, if we're talking twenty units or so, five or six courses.

Lage: Five or six courses over the four years?

Whinnery: Yes. Anyway, O'Brien brought in a number of people to advise him on this. Burchard was a dean of humanities at MIT; Le Corbeiller was in the general education program at Harvard; and some others. Also, in talking with people on the other side of the campus, he established Social Sciences 1A/B. Lewis Feuer, Van Dusen Kennedy, and others started a very interesting course which used original sources, including Freud and Karl Marx. It originally had mostly engineering students, but began to be popular for others around the campus. This course was very successful for a number of years.

Lage: And it was designed to fill this engineering need?

Whinnery: Yes, that's right.

Lage: But was offered to everyone.

Whinnery: Others did take it. Not everybody liked it, but we would hear more discussion about this from the students than anything that we'd had before. But after a period of years it became difficult to get good instructors for it. It was considered a service course, and the instructors didn't get respect from their departments for teaching it. It's fairly typical that innovations have a limited lifetime. But nevertheless, it was quite successful for a number of years.

Anyway, as we began to realize the end of this was coming, and the social science course was given up somewhere during the period when I was dean, we still continued trying to get people in to advise us. We had C. P. Snow of *The Two Cultures*[1] and a former president of Harvard, [James Bryant] Conant, and others. In particular, they talked with engineering and L & S faculty and helped us make a list of courses that would be acceptable. I guess that's still more or less the plan that's being used. But it's very difficult with the small number of units to believe that you're making an educated person--

Lage: Yes, make a meaningful group of courses. But it's certainly a noble effort that you were making, it sounds like to me. You took it very seriously.

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[1]C. P. Snow, *The Two Cultures: And A Second Look*, Cambridge, University Press, 1963.

Whinnery: Yes. It should be a meaningful part of the education, and not just courses selected by students just because the courses are easy for them.

Lage: That's very interesting. Did C. P. Snow have an interesting take on it?

Whinnery: His public lectures were disappointing.

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Whinnery: Do you know the book, *The Two Cultures*?

Lage: Yes.

Whinnery: Well, those lectures were a rehash of that, but he was tired of it, and they didn't come across well. But when we got him in a room with a case of cabernet and twenty or thirty people, we had a wonderful dialogue--or multilogue, I guess it would be. He used the Socratic method; if you asked him a question, he would ask one back.

Lage: Did he come for a period of time?

Whinnery: Yes. He was here several weeks.

Lage: So you set up some situations like you've described.

Whinnery: That's right. Also, he and his wife invited students in for tea. They had a place up on Euclid not too far away from campus. Students got a lot out of that; again the same Socratic method, I guess.

Lage: That's really interesting. And when you arranged the seminar-like settings, were these with people from the humanities and social sciences as well?

Whinnery: Some were. The meeting I mentioned with the case of cabernet was at the Faculty Club with the Dean's Coordinating Advisory Council--DCAC. But his visit was partly sponsored by the English Department because of his novels, so we had some joint meetings.

Lage: Well, that must have brought new perspective, and kind of stimulated that effort to bridge the two cultures.

Whinnery: Yes. Of course he was interested in having humanists learn about science and technology as well as the reverse.

Lage: Any other things on curriculum that we should talk about?

Whinnery: I think those are probably the major matters.

Lage: It sounds like sort of a general evolution with no strong breaks at any point.

Whinnery: Yes.

Engineering Science Program, and the Three-Two Program

Whinnery: Oh, there are two things I might mention. The engineering science program, which was started after the war, first with engineering physics and engineering geophysics, was a very successful program, and still is. During the period we're discussing, it was broadened to other fields, including for a while materials science and operations research. Both of these fields were developed first under that program before operations research became a part of the industrial engineering department and materials science became a major part of what was then the mineral technology department.

Lage: You mean these two fields grew out of the engineering science program?

Whinnery: Their first development as curricula. Then they became major parts of their department programs. Then engineering mathematics and engineering mathematical statistics were added as parts of the engineering science programs.

Lage: Are these basically majors that are parts of the engineering science major?

Whinnery: Yes. Let's take engineering physics. The goal of the program is that a student who graduates in that major is prepared to go to graduate work either in physics or in the field of engineering selected by his electives--typically either electrical, mechanical, nuclear, or material science. The same thing is presumably true in the engineering mathematics program. It is a very successful program and has some of the highest scholarship students applying for it. And a very high percentage continue for graduate work, some in engineering and some in science.

Lage: Sounds like a very good background.

Whinnery: So the development of that, adding the two or three specialties to the engineering physics and engineering geophysics was a contribution. All of these curriculum things, you understand, come from the faculty.

Lage: Someone would bring forth the idea?

Whinnery: Yes. There are faculty curriculum committees. Some of the ideas would come from those committees, and others would be from an individual making suggestions to the committee. Of course the dean can make such suggestions.

Lage: Would the thrust for the engineering science programs usually come from engineering, or from physics or math or geology?

Whinnery: I don't know the details, but proposals for joint programs typically start with informal discussions between persons who are already cooperating on some project. And once it was found that the engineering-physics program was working well, it was natural to think of other extensions.

There was one other program that we spent some time with that didn't pan out. A number of schools have what they call two-three or three-two programs. Students after two or three years in a liberal arts college may transfer to three or two years of engineering, often in another university. We were trying to work out something similar here. There was a very good committee. I don't remember all the members, but I know that Tom Everhart, who had come from Harvard, was very enthusiastic about it.

It turned out the problem was that if they'd had the math and science in their first two years, there was no particular problem, but also there was no particular problem without having such a program. They could come in and make up the missing one or two engineering courses. On the other hand, if they hadn't had the math and science, they couldn't finish in three more years anyway.

Lage: It's like starting over.

Whinnery: It's like starting over again. Also, the engineering science programs were providing some of the flexibility we were looking for. So I don't know, maybe we could have found a solution--certainly these programs exist around the country, and some of them seem to be quite successful.

Lage: What is the goal of a program like that?

Whinnery: I think it's to get people into engineering that are a little broader--it's the same goal as the humanistic, social requirement, but carried a step further.

Lage: C. P. Snow's types.

Whinnery: Yes.

Engineering Advisory Council

Whinnery: Sometime you wanted to ask, you said, about the Engineering Advisory Council.

Lage: Yes. What they were, and what their role was.

Whinnery: Yes. This was a group, started by O'Brien, of very distinguished people, selected to give advice on major policy issues. Most, but not all, were alumni. Of course, O'Brien also used them to support programs that he was trying to sell at that time to Sproul. Sproul knew many of these people personally, and I think probably the biggest success they had was in the Engineering Field Station. They certainly played a major role in convincing the university that that made sense, and I think even perhaps in helping locate the site. That's all described in O'Brien's oral history.

Lage: It had a bit of a political purpose, you could say.

Whinnery: Yes. Anyway, they were a group of very dedicated, very distinguished people, and continued to support the university in many ways. During the period I was dean, I appreciated their support very much. With the new campuses, they had worked with Boelter in building up UCLA as they had here. In fact, one of the major issues was that of an engineering field station for UCLA, and they were helpful in that.

Lage: Was this Engineering Advisory Council a statewide group, then?

Whinnery: At that point it was. In fact, as the newer campuses proposed engineering programs it tried to play a major role in deciding whether engineering should be on all campuses.

Lage: This is quite an important role for basically an outside committee.

Whinnery: Yes. But as I recall, they were not in favor of the Santa Barbara program, and it went ahead anyway. Of course, no advisory group expects its advice to be taken absolutely. I think it became less influential in major decisions like that, but the support was certainly valuable.

Lage: Was the influence also related to Sproul's leaving and Kerr being in, and others?

Whinnery: It may have been partly that. I think the biggest influence was the multi-campus growth of engineering. For a while it tried to operate with a subcommittee for each campus. Finally it evolved to advisory groups individually for the different campuses, as we have for Berkeley now.

Lage: Did you have regular meetings of this group?

Whinnery: Yes. About twice a year, as I recall.

Lage: I'm just wondering how you used the meetings, or what you saw as the role? Were you informing them about what went on, or were you seeking their advice?

Whinnery: Since it was then statewide, all of the deans would suggest items for the agenda, and the committee members would of course be polled to see if they had items, too.

Lage: Was it more than a window-dressing kind of thing?

Whinnery: It's a little hard to know how much you get out of any given meeting. But the discussion, even when the advice is not taken in detail, can be very valuable. Often the preparation for presentation of problems and goals to a savvy group of persons who are going to listen to what you have to say is the most valuable part.

Lage: Were there any particular outstanding members of the group that you relied on?

Whinnery: One of the most interesting was Doolittle.

Lage: Is this Jimmy Doolittle?

Whinnery: Jimmy Doolittle. He was a very dedicated, very thoughtful, very nice person. Perry Yates, a vice president of Bechtel, was very helpful. George Tenney of McGraw-Hill was the chairman of the group, and very effective in getting the agenda together and running the meeting. John Kemper, then of Marchant, later became a faculty member at Davis and was dean of engineering

there. Lou Oppenheim, of Kaiser, is still active in fund raising for the university. There were others who were helpful but this gives some feeling for the level.

Lage: Would they ever feed into curriculum discussion, or anything that specific?

Whinnery: I don't think they tried to get into details of curriculum, but did discuss general issues such as the importance of humanities and social sciences, and general engineering versus specialization. Things of that nature. They would give advice on new programs proposed by any of the deans.

Engineering Alumni Society

Lage: You also mentioned the Engineering Alumni Society, and the changing roles of that.

Whinnery: Yes. This had been started by O'Brien and was growing and becoming increasingly important. Now it's tremendously important to the college.

Lage: In what way?

Whinnery: First of all, fund raising. Well, I shouldn't say first, although that's important, but they have many other activities. One is a program of networking with students.

Lage: Like a mentorship group?

Whinnery: Yes. They call it the Blue Network. They sponsor the graduation ceremony for the mid-year graduates, and also offer career advice to students. It's a very active group, and very supportive of the college.

Lage: Was it as active during your term as dean?

Whinnery: It was growing. I think it was not as strong as it is now.

Lage: Did you have a newsletter at that time, a means of communicating with them?

Whinnery: Yes. But it wasn't as formal as it is now.

Lage: And did you have someone on your staff who took care of alumni affairs?

Whinnery: Yes. There wasn't a full-time person as there is now. Frances Eberhart or her assistants handled the matters.

Lage: The ubiquitous Frances Eberhart.

Whinnery: Yes.

Community Relations, and Fund Raising

Lage: You did a lot of community relations, too. When I was just leafing quickly through your papers, I saw all kinds of talks at the Berkeley Women's City Club, and things of that nature.

Whinnery: Yes. I think most deans are asked to do things like that.

Lage: There's an interest in the community about the school.

Whinnery: Yes, that's right.

Lage: How did you interpret what was going on to people who were not engineers? What would have been their interest?

Whinnery: Many people recognized that engineering was having an impact on their lives. One of the problems is to keep these talks from getting into a "Gee, whiz," talk, telling them all the wonderful things that are going to happen next year. Sometimes, I'm afraid that they did end up a little bit that way. Right now, for instance, all this talk in the papers about the communication superhighway. Well, people are interested in it, but some aspects get exaggerated.

Lage: As dean, did you have to get into fund raising?

Whinnery: No. I'm glad you raised that question, because that is something that has developed very much since. I don't know what we got at that stage, but probably at most a few thousand dollars a year, and even that was almost by chance. There may have been larger amounts left in wills for scholarships or other specific purposes, but very little discretionary money.

Lage: Most of the money came through the regular budgeting process?

Whinnery: That's right. Fund raising developed over a period of years, and was growing during Dean Maslach's period, but I think the major breakthrough was in getting the funding of the Bechtel Center when Ernie Kuh was dean.

Lage: So at some point there evolved the sense that, at least for buildings, the college had to go out on its own?

Whinnery: Yes. And following that, realizing that there are other essential programs that the university doesn't have the budget to support.

Lage: Are these research programs or curriculum programs?

Whinnery: Well, special programs, for minorities, for example. There is government money for such programs, of course, but it takes seed money to get them started. Money is also needed to get new faculty started. The university has some money for new faculty, but in comparison to some of the places that we're bidding against, it's very small. The Berkeley Engineering Fund is quite a big operation now, and very successful. Its report gives other examples of help to the college.

Lage: That will be interesting when we get on to talking with future deans, to see the evolution of that trend.

Whinnery: Yes.

Lage: But after you were dean, haven't you been called upon to take part in some of this fund raising?

Whinnery: I've been on fund-raising committees, yes. I'm a lousy fund raiser. I hate to ask people for money, and if people say no to me, I take it as no. The really successful fund raisers don't.

Lage: No. They come at it from a different angle. Oh, that's hard. So that was something you didn't have to do.

Whinnery: No. Probably should have done more, but I didn't. I think it was not common for deans at that stage.

Lage: Yes. Now every division seems to have its own newsletter and its own outreach to alumni.

Whinnery: Yes.

The College's Self-Study Program, and Retreat at Tahoe

Lage: You had mentioned the college's self-study project, that led up to a retreat at Tahoe. That came towards the end, did it not?

Whinnery: Oh, yes. I can't remember exactly when this started, but I think it was about the time that I realized that I was not going to continue, but before I had announced it. I guess I was somewhat dissatisfied in seeing all of the things that O'Brien had accomplished, and I didn't feel I had done anything that constructive.

Lage: Of course, he'd been here a bit longer.

Whinnery: Yes. But anyway, feeling a bit frustrated, and not knowing exactly what directions we should take, it seemed time for a self-study program. I appointed a committee; the first committee didn't accomplish very much.

Then, George Maslach took it over and did a very fine job. I believe that had something to do with his being asked to be acting dean first and then dean. Of course, he also had done a very good job in working with Earl Parker in the Institute of Engineering Research, and as chairman of the aeroscience division of mechanical engineering. At that time, there were all-university meetings every year that Sproul started and Kerr carried on. A topic would be chosen and subcommittees appointed to write up papers on specific issues. Then these papers would be distributed to the hundred or so invitees, and they'd spend--I think it was typically--two days arguing about them, and then make certain resolutions, which the president took quite seriously. In fact, the first thing he did each year was to report on what had been done about the resolutions that had been passed the year before.

Lage: That's a nice way to begin.

Whinnery: So anyway, George used this pattern, set up some study committees, and did a very effective job.

Lage: Were you looking at things like we've been talking about, the curriculum and faculty hiring and--?

Whinnery: Yes. We should get out the report, I guess, and look at it. But there were discussions on curriculum, facilities, and hiring, organization.

Lage: Sort of looking at what's been done and what was coming.

Whinnery: That's right. The meeting was held at Tahoe in the year that he was acting dean.

Lage: Were you here, or were you on sabbatical?

Whinnery: I was in New Jersey, but they invited me back, and I was present at the meeting.

Lage: Was that a good occasion?

Whinnery: Yes, it was a fine occasion. I guess we'd have to look at the report to see whether it really changed direction of the college in any way. It was certainly useful, among other things, in getting people in different departments together, which doesn't happen often enough.

Lage: The other thing that strikes me about it is that it was a real change from O'Brien's style, kind of the one-man style, versus all of this involvement of the faculty.

Whinnery: Of course, again, in fairness to O'Brien, he was a very strong person, and he injected ideas. But he worked through the faculty committees.

Lage: So is it an exaggeration to say that it was a one-man operation?

Whinnery: Yes. It was a lot more than one, and particularly as he began to get a strong faculty. He was much more autocratic in the early stages when he didn't have much confidence in the faculty, but as the faculty developed, more and more decision making was done through the faculty committees.

Lage: I'm glad we've had a chance to talk about O'Brien, because I think it's good to get your reflections on him. I know you've written about him, but it's coming out more in this interview, his contributions and style.

Whinnery: Well, he certainly is responsible for the major growth of the college. He was a very strong dean, but not an absolutely autocratic dean.

Lage: That kind of leadership seems not to be the style of leadership we have now.

Whinnery: No, nor do I think it would work right now. Once you have a strong and effective faculty, I don't think that would work as well. You asked once before why he left, and I think part of it was his recognition that with the kind of leadership that he had, he'd accomplished what he wanted to do, and the college was turning over to more of a collegiate operation.

Engineering Programs within UC Extension

Lage: Did you have anything to do with UC Extension engineering programs, or would you have anything to say about that?

Whinnery: Oh, yes, that's something that we should talk about. One of our assistant deans, Joe [W.] Kelly, was the person that was the liaison with Engineering Extension, and it was a very good program. We had to review course proposals and qualifications of the various instructors that took part in it. The major related issue that came up during my period was that the electronics industry on the peninsula wanted a master's degree program centered there. There was a lot of debate about it. That was one of the things the Academic Senate had to approve, and there were a number of restrictions that they put on it. One of the major ones, and one we agreed with, was that no student would be able to get a degree from Berkeley without spending at least a term on the campus.

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Whinnery: The industry association that requested this program, Western Electronics Manufacturer's Association, WEMA, wasn't too happy with that restriction. But anyway, we decided to start on that basis. We started with good instructors from our own faculty, but it was difficult service because of the travel. So the program didn't survive in that form.

One problem was that we were competing with Stanford on its home ground. By that time, Stanford was moving into the television program in a big way, so the students could take many of their courses by television at their own industrial site, and the instructors could teach from their home campus.

Lage: So that was the way Stanford designed their extension program?

Whinnery: Yes, for their M.S. program with industry. Our television program came somewhat later. George Maslach pioneered that.

Lage: Apparently, there was some conflict with Santa Cruz also.

Whinnery: That came later. Santa Cruz was established in 1961.

Lage: That was a later time. Did this kind of program benefit the college in some way, or was it as you said, more of a service?

Whinnery: We thought of it as service. Of course we wanted to cooperate with the industries, but it was not clear that this was the best

way. It was extra work for a very hard-working faculty, particularly with commute time involved--

Lage: And curriculum development, I'm sure, was involved.

Whinnery: Yes. And another issue concerned the number of courses that could be given. If there aren't enough, there's not enough breadth for persons with different interests. In contrast to this type of degree program, I think extension is set up to give a broad range of courses.

Lage: Today I'm presenting [former UC Extension dean] Milton Stern with his oral history interview. He discussed this same program. I think extension had to move up the peninsula to leave Santa Cruz its territory, so they offer courses from Menlo Park or thereabouts.

Selection of Lotfi Zadeh as Chair of Electrical Engineering

Whinnery: One of the things I thought we should talk about was the choice of the chair of electrical engineering near the end of the time I was dean. Bob Saunders was the chair at that point, and I thought he had done a very good job in continuing the building of the department. As you know, he went on to initiate the engineering program at UC Irvine. But as the time for selection of the next chair approached, there was an unusual amount of political activity with discussion concerning directions of the department, some of it pretty intense.

Lage: Were the disagreements in the area of faculty hiring?

Whinnery: No. I don't recall any major disagreements on hiring. Certainly some very good people were appointed during that period. The emphasis seemed to be on the curriculum. We reviewed the curriculum in department meetings every spring, and often made changes, but there were arguments for a much more radical restructuring. In view of the fact that there were major changes a few years later, resulting in a curriculum with more free electives than in any other EE program we know of, this preliminary discussion may have been useful.

The two leading candidates were Lotfi Zadeh and Vic [Victor] Rumsey, both outstanding people in their fields.

Lage: What were their fields?

Whinnery: Lotfi was systems theory, and one who saw the increasing importance of computers. We've talked a bit about the early

build-up of computers through Paul Morton, and the difficulties of keeping this strong. But Lotfi saw pretty clearly the role of electrical engineering in this trend.

Vic Rumsey was an expert in electromagnetic theory in general, and antennas in particular. He went on from here to San Diego, and was head of one of the colleges at UC San Diego. So they were both very fine persons. In the vote it was nearly equal, with an edge toward Lotfi. Lotfi had complicated things by saying he didn't want to be chairman, so I talked with a number of people as to what to do about this. They felt that he should at least be asked.

He did accept. It turned out that he also was a somewhat controversial chair. He had very strong opinions on the way things should go, and he wouldn't take no for an answer. If you didn't agree with him, he would come back and argue with you for hours. But I think the important thing was his view of the key role of computers, and the fact that electrical engineering had to be a part of this. I wasn't in on it when computer science left electrical engineering to go to the College of Letters and Science and then eventually came back, but even during the period when there was a separate department, he had effected the name change to Electrical Engineering and Computer Sciences, just to show that we still had to be active in that area.

Lage: Even when the program had transferred over to Letters and Science?

Whinnery: Yes. No one thought he would be successful in this, but he's a very expert politician and was able to obtain the name change.

Lage: Was the name change controversial within the department?

Whinnery: Yes, it was controversial within the department and without, but I think it was very important in the end.

Lage: When the computer sciences program went to L & S, was it an action of the group of professors, or was it an action from higher up?

Whinnery: It was probably a combination. In addition to the people from this department that formed the department in Letters and Science, there were people from mathematics and some hired from the outside, so it wasn't just made up of persons leaving electrical engineering. I don't know the details on who made the proposal to the administration for the separate department.

Lage: You mentioned the vote for the chairman. How does this take place? Is there preparation before the vote?

Whinnery: As I recall, the directive at the time I was dean only said, "The faculty should be consulted." As I mentioned, my first consultation was carried out individually, which provided more chance for discussion of the choices, but was also subject to misinterpretation. So later surveys were carried out in written form, and still are.

Lage: But I'm assuming that there's no formal process where a candidate expresses their view of where the department should go.

Whinnery: Some of the people wrote memos along with their vote, and they were helpful.

Lage: How carefully do you look, when you're choosing somebody, at their personality or their political abilities?

Whinnery: I think personality, in the sense of getting along with people, is terribly important. When you say political abilities, I think it was a surprise to most people to find Lotfi as political as he was. I'm not putting this in a negative context. He was very effective in getting things done. So I would say it's more administrative capabilities that you look for, but some of that is political.

Lage: One thing I have heard from talking to various people is what a good feeling there is in the Department of Electrical Engineering, what a sense of collegiality. Has that continued through all the different chairmen?

Whinnery: Yes. There have been disagreements, and some of the discussions of these became rather tense, but the long-term collegiality and respect for each other's opinions seems to me to have continued.

Lage: Which really must make it a nice place to work.

Whinnery: Yes, it does.

Building Up Other Campuses with Berkeley Professors

Lage: You mentioned just in passing several professors that went to other campuses: one to Irvine, one to San Diego. In the

building up of the new campuses, did this college ever feel sort of robbed?

Whinnery: No, I don't think so. I think, in general, for persons who go on to more effective positions, you may miss them, but at the same time it's part of the contribution to education in general. That includes not only the ones to other campuses of UC, but persons like Everhart going on to Cornell, Illinois, and Caltech; and Henry [C.] Bourne [Jr.] was another who was at Georgia Tech and later NSF.

Lage: So it's part of the pattern.

Whinnery: Part of the process.

Lage: I have heard in other fields some feeling that the new campuses were a drain on the talent pool.

Whinnery: No, I don't think so.

Lage: Maybe you had a big enough talent pool.

Whinnery: That helped. Of course, if you get an exodus of everybody in one field, or departures because they're really unhappy with the situation, that's something else again. But if they see this as an opportunity to contribute more, why, more power to them.

Lage: Right. And then you still have some connection, I would think, with their roots at Berkeley.

Whinnery: Sure.

Leaving the Deanship

Lage: Tell a little bit about how you left the deanship. It sounded like you had trouble getting out of it.

Whinnery: I think Ed Strong was not very happy when I told him of my decision. He didn't know about the agreement with Seaborg until I showed him the letter. As I think I mentioned before, one of the smartest things I did was to get it written down when Seaborg asked me to serve for two or three years, and by that time I'd been dean for four. But Strong didn't put any pressure on me to stay.

Lage: Didn't it take a while, though, to get your successor appointed?

Whinnery: George was made acting dean at first. But I believe I left at the time I requested. The thing that I had realized is that if I stayed very much longer, I could never go back to technical work, and it was even chancy at that stage. Counting ERL, service as chair of the department, and the demanding four years as dean, I had been in administration for ten years.

Lage: Were you able to keep up any research and teaching during the deanship?

Whinnery: Don Pederson and I developed and taught the new electronics course that I mentioned, Engineering 17.

Lage: The lower division course.

Whinnery: And I think I did some other teaching, which, looking back on it, may have been a mistake. It may have been more important to do what some of the other deans have done, to save some time to keep up with their research. I had some graduate students finishing. One in particular, Marty Pollack, now at Bell Laboratories, head of a department and very successful, was doing most of his work during that period. The difficulties in setting up meetings to discuss matters with him was part of the reason that I realized this pattern wasn't working. There are some deans in other schools that claim they save half of their time for research, but I don't see how they do it.

I also realized that I couldn't really get back to research without a break of some sort, and that prompted the decision to go to Bell Laboratories. I'd had an open invitation to go there for years.

Lage: So this was the way to immerse yourself again.

Whinnery: Yes.

Lage: We'll get to that later [Chapter IX].

Whinnery: I don't remember anyone giving me any difficulty over the decision to leave. I think some were surprised. And I wouldn't blame them for thinking it a little unfair to the college, that they had to go through this [laughs] painful business of setting up a search committee so soon again. But no one gave me a hard time over it.

Lage: Well, I should hope not. Four years of your life seems like plenty for such an all-encompassing task as that.

Whinnery: As I said once before, I certainly enjoyed many aspects of it, particularly the people I got to know in other departments, and realizing what a fine faculty we had across the board. And then the opportunities outside. This prestigious position opened up avenues all over the country. A lot of those were very interesting.

Commission on Engineering Education

Lage: Now, we haven't talked about that much.

Whinnery: Yes. I think we could make it brief, but you said you wanted to talk about some of the committees. I don't think there's a lot to be said about many of them; two or three are probably the most important. I would like to say some things about the Commission on Engineering Education, and its educational experiments.

Lage: And that was with other university deans of engineering?

Whinnery: They weren't necessarily deans. It started with a National Science Foundation [NSF] conference in Boulder, Colorado, a week-long conference on, "Where is engineering education going?" These go on regularly--there must be half a dozen of them this year--but that was a rather special one. I was not on the planning committee, but it was a very good one. Very stimulating and exciting ideas were presented to us.

I think the NSF members were as surprised as anyone when, at the end, the attendees asked NSF to set up a permanent body to carry out some of the suggested experiments. Again, I wasn't involved in that, but the negotiations went on, and the Commission on Engineering Education was set up. Eventually, I became one of the chairpersons of it. It had a whole lot of educational experiments going on.

Lage: It would support experimental programs on different campuses?

Whinnery: It was very wide-ranging. It was concerned with computer-assisted instruction, televised instruction. The programs in the high schools, the so-called Man-Made World project. Ed David and John Truxal were the leaders for that. There were inter-university cooperative programs; the one between Colorado and Illinois was the most successful of these, the so-called Build program. Educational films--just dozens of projects, some successful and some not.

Even the programs which were successful at the time did not necessarily survive in their original forms but did provide excitement and an opportunity for critical examination, which played a part in the continuing evolution of engineering programs. For that reason I think such experiments need to be done regularly.

Lage: When you were chairperson, did you bring any particular point of view or ideas in, do you remember? Did you have a pet project?

Whinnery: I didn't revolutionize anything. The commission had been going on for several years by that time and had a fairly full agenda. One of the big problems was fund raising. In addition to the continuing NSF support, we had support from the [Alfred P.] Sloan Foundation, [Charles F.] Kettering Foundation, and others for specific projects. But each new idea required a new source of funds.

Lage: Was there a staff for the commission?

Whinnery: Yes, and a very good executive director, Newman Hall. So it was more like a university committee in which everybody put in ideas and then decided what to do next. The staff kept things moving.

Lage: It's impressive that so many engineers are committed to improving engineering education.

Whinnery: Well, they still are. But every so often in my talks about engineering education, I bring up this model and try to get people to look at what was done, but nobody seems to be that interested in past history. I think there are some lessons that could be learned. In particular, the desire to still do more with the high schools, motivating students toward science and technical careers. I think the success for several years of the Man-Made World project was tremendous, but most people who want to work with the high schools don't even know about it.

Lage: So they reinvent the wheel. That happens a lot.

Whinnery: Another project was concerned with CAI, Computer-Assisted Instruction. That has gone far beyond what we were trying to do at the time. Computers were primitive, especially in their storage and display capabilities. But the early experiments were important in getting things started. Similarly with instructional television. Our role was primarily in conducting a technology assessment of the medium, with only a small part in its development. But it was pretty exciting at the time.

The Course of the College Since 1963

Lage: I hate broad questions like, "Do you have any reflections on the course of the college since your deanship?", but is there anything that you'd want to say about leadership or changes in direction since that time?

Whinnery: Oh, I think it's continued to develop. I certainly don't have any criticism. I think each of the deans has carried on the development. One of the things I do admire is their ability to raise funds. But it's not just fund raising; it is the improved interactions with the community. The important industrial liaison program will take place next week--

Lage: Here on campus?

Whinnery: Yes. The whole college takes part and there will be hundreds of visitors from industries all over the world.

Lage: For seminars and the like?

Whinnery: Yes. The main points will be to present research of the college. Somewhere I had the program for the departments, but here is the research summary for EECS. [pulls out summary]

Lage: Oh, my, this is an impressive volume here. We're looking at "Research Summary, 1994." An inch and a half thick, just for the department?

Whinnery: Yes. EECS and ERL. The Industrial Liaison Program is for the whole college. It starts off with a plenary session in the student union, and then breaks up into departmental programs. There are luncheon speakers; they used to have a dinner, literally filling the Pauley Ballroom, but it's not scheduled this year.

Lage: Is this a yearly event?

Whinnery: Yes. Part of the purpose is fund raising. But even more than the money is the interaction, the participation of our students, the cooperative research programs that often come out of this, and the knowledge of the prestige of the college. Ernie Kuh started the first of these.

So I think that each of the deans has done a tremendous job, and the college has continued to develop. Of course, Dave Hodges has to face difficult budget cuts but still has plans for new programs--especially in the interdisciplinary area.

VIII POST-1963 UNIVERSITY SERVICE

Chairman, University Four-Letter Word Committee

Lage: Our next topic is some of your university service during the sixties and seventies. I don't think we need a lot of detail. I'm particularly interested in your coming back to all the student unrest and turbulence on campus after your leave at Bell Labs, and how it struck you, and what role you played.

Whinnery: Yes. One of the most difficult assignments I had was that of chairman of the four-letter word committee.

Lage: Oh, is that what you were chairman of? [laughing] I ran across a quote from a letter--I think maybe you were writing to Seaborg--"That was a horrible experience and one impossible to handle really well, but it's over."[1] That must have been what you were referring to, because it was in the spring of '65.

Whinnery: Yes.

Lage: So you chaired the committee that dealt with four-letter words?

Whinnery: Yes. Which sounds so silly now: you can go to any movie and hear all of them. But it really was a crisis for the university. It was impossible to handle it well, because here we were, a fine faculty committee, and fortunately, we had two persons from the law school on it, Ron Degnan and Sho Sato. These were needed because the students wouldn't talk to us. We could only deal with their lawyer. The whole idea of a faculty committee was to try to understand the students' motives. And it was also difficult to find exactly what happened in spite of

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[1]In Whinnery papers, Bancroft Library.

the fact that thousands of people were in Sproul Plaza when this happened.

Lage: I'm trying to think of what the actual incident was. It was using four-letter words over the loudspeaker?

Whinnery: Yes, [Arthur] Goldberg in particular. There was no question about what he said over the loudspeaker. He also had a number of other people leading a cheer, and another young student--the one I felt sorriest for--holding a placard with the famous word on it. The fourth incident was reading *Lady Chatterley's Lover* to the staff in Sproul Hall, who were asking the reader to quit.

The sad part about it was that the students wouldn't talk to us about their motivation. Most of the actions we took were not terribly severe, but they claimed afterwards that they lost scholarships. If that was an issue, we would have hoped they would have discussed it with us. But here we were, dealing with lawyers, and the university's lawyer was just as bad as their lawyer. He would say, "Why don't you throw the so-and-so's out?" [laughter] He would say, "There's no presumption of innocence here." We would say, "Wait a minute, look at the catalogue. It says under student conduct that the student is assumed to be in good conduct until shown otherwise."

Lage: Were there clear rules? Had there actually been rules--time, place, and manner rules?

Whinnery: The rules were somewhat vague in that they talked about good conduct, and the issue was whether this was good conduct or not. It has to be seen in the period in which it occurred, and the public's very negative reaction. But the sad part was that it was not the way a student-faculty discussion of conduct should have been carried on.

Lage: Do you remember what kind of penalties there were? Were they suspended for a time?

Whinnery: Mostly probation for various periods. With the case of Goldberg, it was a dismissal. Even there, he had an opportunity to appeal it, which as far as I know he didn't. He went on, I think, to Howard University.

So for the most part they weren't, in the eyes of the committee at least, very severe. Fortunately for the university, the public thought they were, and they'd been dealt with, and that got the crisis out of the way.

Lage: Did you have any campus administrators feeding in their points of view to you, or was this really an independent committee?

Whinnery: No. The administration was very, very concerned. And the hearings took quite a while because of the problems of scheduling and the difficulties with the lawyers. But the acting chancellor--

Lage: [Martin] Meyerson.

Whinnery: Meyerson. He was very anxious to get our report, but didn't put any pressure on us on how we handled the hearings.

The Continuing Turbulence of the Late Sixties and Seventies

Lage: Was it kind of a shock to you, to come back to--you left a relatively quiet campus and came back to one that was very disrupted.

Whinnery: Certainly, quite apart from this personal experience, it was a disturbing time because the Academic Senate was holding meetings almost weekly--

Lage: And a lot of division on the campus.

Whinnery: And a lot of division among the faculty. I must say, the FSM [Free Speech Movement] kept things under control in large part, and tried to have their people be peaceful, even when they would have sit-ins to disrupt things, but there were individuals that were threatening when you went to these meetings.

Lage: Did it affect the engineering side of campus as much as the rest of the campus?

Whinnery: It didn't affect things until much later in the bombing of Cambodia. The engineers, I think quite properly, thought that was terrible, and became involved. But I was very proud of them in that they worked through legal channels. Professor [Pravin P.] Varaiya in the department was advising them, and everything they did was by the rules, handing out leaflets, writing letters, and things of that nature.

Lage: Because there were student strikes and a number of incidents related to that.

Whinnery: Yes.

Lage: Do you remember the Hart Committee on Senate Effectiveness? You served on it in '65.

Whinnery: Yes.

Lage: What did that deal with?

Whinnery: It changed the leadership of the senate and established a system of state-of-the-campus messages. I'm not sure in the end that it had a major effect in the way the senate operated, but at the time, it seemed an advance.

Lage: I'm sure the senate was drawn on in ways that it usually hadn't been, during these times of crisis, like the loyalty oath and FSM. Overall, do you think the senate functions well in dealing with crises like this?

Whinnery: I think that even though that was very cumbersome and painful, it was a necessary way of effecting change. Even though Berkeley had the national headlines, many other campuses had much worse experiences than we did, with more disruption to classes and more physical damage.

Lage: Well, it wasn't just FSM, but that whole period, the Vietnam Day thing and third world students strike--

Whinnery: That's right.

Lage: Chancellor [Roger] Heyns came in, '65 to '71. Did you have an opportunity to work with him?

Whinnery: Not terribly closely, but I admired him very much.

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Whinnery: He had a lot of educational vision and creative ideas, but much of his time had to be spent in this putting out fires. I saw him just the other day, and he looks fine. He said that he's enjoying his retirement very much.

Lage: To come from off the campus, completely foreign to the campus, and to be plunked down in the middle of this crisis situation--you have to admire him.

Whinnery: Yes.

Lage: Did he do a good job of building bridges with, say, the College of Engineering, do you remember?

Whinnery: I think so. Of course, George Maslach was the dean at that time. But certainly my impression was that he had a high respect for engineering. He actually tried to talk me into coming back into the administration at one stage.

Lage: In what capacity?

Whinnery: I don't know. This was after I had returned from Bell and felt I was hanging on by my fingernails, getting back to technical work. So I didn't really explore the offer. I suppose it would have been an assistant chancellor or vice chancellor or something like that.

Lage: Well, that was a road not taken.

Whinnery: That's right.

Lage: Shall we end on that note?

Whinnery: Yes.

Appointment to UC Santa Cruz Applied Technology Program, 1968

[Interview 6: March 16, 1994] ##

Lage: You took some time and went to UC Santa Cruz in 1968. What was that arrangement?

Whinnery: Actually, I was going to transfer there. Lotfi Zadeh, the chairman, instead talked me into just going on a year's leave to see how it was. I guess it turned out to be very fortunate. When I was asked to go, it was to help build up the new School of Engineering there.

Lage: How were you asked, and by whom?

Whinnery: By Francis Clauser. He had been brought in from Caltech to build up engineering and was then made a vice chancellor, so he was looking for someone else to be dean of engineering. Well, I didn't want to be dean--

Lage: You'd done that.

Whinnery: --but he still asked me to come and help him in building engineering.

Lage: What attracted you initially? I'm surprised that you would consider a permanent transfer.

Whinnery: It was the Santa Cruz model of the colleges, which were supposed to be mixing zones, interdisciplinary, between different fields. I think in the end it didn't quite turn out all the way that [Dean E.] McHenry had in mind. But it was a very exciting idea. And of course, Santa Cruz is a beautiful place.

Howard Eberhart from civil engineering, and then Don Peterson from EE had helped in the initial planning for the school. But the year I was there, we accepted students in engineering and started some classes and also looked for staff.

Lage: At just the undergraduate level, is that right?

Whinnery: At that stage, yes, with the hope that it would eventually be graduate.

During that year, Fred Terman was asked to make a study of engineering for the state of California. He concluded that there were too many engineering schools and recommended the closure of both Riverside, which was also starting up, and Santa Cruz, also a couple--I've forgotten which they were--in the state college system. And they did.

Lage: When you say "they did," was this the legislature or the university administration?

Whinnery: The university administration, of course, for the university. And I guess the board for the state colleges and universities closed at least one of their programs.

Lage: Did you agree with that assessment, having read Terman's report?

Whinnery: No. First of all, you have to have a longer-term view. I think at the time he probably was correct in saying that there was an oversupply of engineering graduates. The economy seems to go up and down and that was a down period. But in the long term, we've always found that there was a need for them. The other philosophical point is that a general campus should have some professional schools. That certainly was McHenry's view.

But the other thing that was a little maddening is that some of Terman's figures were a little bent--the way he handled the federal support, for example. He made it look like Stanford was the most economically-run school, by excluding federal support.

Incidentally, Terman was a great person and deserves credit for the buildup of electronics in this area. I think I mentioned earlier that when I was dean he came to congratulate me and give me some very good advice, which I very much appreciated.

Lage: Yes, I think you did mention that.

Whinnery: In any event, I didn't agree with the report, but since it was carried out, it was well that I was on leave and came back to Berkeley. The year I was at Santa Cruz, the system really worked beautifully. I was in Crown College, and its theme was science and engineering. The college course was a course on history and impact of technology in America. It involved physical scientists and social scientists. I was the only engineer.

Lage: It was team-taught?

Whinnery: Yes. One person who was an expert in the Industrial Revolution gave most of the main lectures. Each of us gave one or two main lectures, but then we handled discussion sections. The students were excited about it, and it was a lot of fun working with the people in economics and chemistry and other disciplines.

Lage: The buildings were in place by then, the Crown College dormitories?

Whinnery: That was the newest college. They were trying to open one a year. They were then building the fourth college.

Lage: Did you move?

Whinnery: No, actually. We put our house up for sale and we were looking for a place to move to, but I guess it was again fortunate first that I was on leave, and secondly that the house didn't sell.

Lage: That would have made it more difficult, wouldn't it?

Whinnery: Yes.

Lage: That's something I hadn't known, that you were actually thinking of transferring. Did you like the atmosphere at Santa Cruz when you spent time there?

Whinnery: I liked very much the role of Crown College. In addition to the college course, I gave one course in electronics very much like the one Pederson and I had developed here. That was for engineering majors and went quite well. A young Ph.D. from

Berkeley, Sing Lee, worked with me on that. He is now on the faculty at UC San Diego. But another course was a complete failure. I tried to use the Man-Made World concept to try to give a technological view to non-majors. The first time I wrote the simplest three-term equation on the board--and remember, everybody had had algebra--half the class got up and walked out. [laughter] The ones that remained were engineering or science students and the material was probably too simple for them.

Lage: Was that a time where there was a fair amount of student unrest down at Santa Cruz?

Whinnery: No. It was new, and everybody was very eager. It was a lot of fun to work with the students.

Lage: It's an exciting time, when there's something new and with so much vision. Did you have a good relationship with Dean McHenry?

Whinnery: Oh, sure. I didn't see him a lot, but he's a marvelous person to work with. Of course, he had this vision. At that time, it was working very well.

One of the other great things, the provost of Crown College was Kenneth Thimann. I'm sure he's retired now, but he was a marvelous person. I couldn't imagine a more ideal person for that position.

Lage: I know they have a building named after him now. In that one year the program was stopped?

Whinnery: Yes, the engineering program.

Lage: Did the majors transfer elsewhere?

Whinnery: The fortunate thing was that the people that Clauser had hired were computer people. Harry Huskey had come from Berkeley, and then they'd hired a couple of very young, bright people, one from MIT, one from Stanford. They remained and the program continued as information sciences.

Lage: Because that would be sad, to hire people away from other jobs and then not be able to continue the program.

Whinnery: Yes.

Return to Berkeley; University Professorship

Whinnery: Another sequel to that is interesting. When I came back here, Ernie Kuh was chairman. He asked me to give the course which I had been so excited about in Santa Cruz, the impact of technology in America. It was not a success. I don't know how much was the Santa Cruz atmosphere. Of course, I was trying to do it on my own, whereas there we'd had a team of people, including people who knew a lot more than I about sociology.

Lage: Was that given by the engineering college, but offered to other students as well?

Whinnery: Yes, it was offered to others. Again, we had somewhat the same problem, that the engineers really wanted to dig in to some one issue, like energy, or the computer effect on society, and the others didn't want any technical talk at all.

Lage: So the two cultures maybe are more divided than Snow thought?

Whinnery: There have been a number of people who have had very good successes with courses such as these. What seems to work is to choose a topic like energy, and then bring in the social aspects of that. Or the effect of computers on society.

Lage: Something that people can relate to.

Whinnery: Yes. So I think that is probably a model that works. I don't think the course I described survived many years at Santa Cruz either.

Lage: The other question I had was about your university professorship. What does that involve? I know it's a tremendous honor.

Whinnery: Yes, it certainly is. Like a lot of my honors, this is work of a lot of friends making the nomination. What it originally was intended to be was a program in which a professor would go from campus to campus and be available to all of the campuses. But first of all, it's very difficult, particularly if you have a laboratory that you have to have in some center. But even otherwise, it is difficult to have graduate students all over the state. So mostly it has come down to shorter-term visits on other campuses, and to be honest, some of the university professors don't bother with traveling at all.

I discovered this when I was named and talked to quite a few to see what the expectations were. It's interesting; there

were two letters. One said we were "expected" to spend time on other campuses, and the other one said we were "encouraged." [laughter] It turns out that "encouraged" is the operative word. I learned that some would say, "Well, sure, I'd give a lecture on another campus." That was something I would do anyway, so it really hasn't made a difference. Others took it very seriously. Josephine Miles was one. Neil Smelser was another.

Lage: Would these people and yourself initiate ideas for other campuses, or would you just wait to be invited?

Whinnery: A little of both. I think in my case, I had invitations from all the campuses that had engineering. The typical request was for a one-week stay to give a series of lectures. For San Diego, I took a sabbatical for one term. You'd also be asked to be on either appointment or review committees of other campuses. You might have been asked on those anyway, but some certainly came from the university professorship.

But it's bothered me that the university, if serious about it, could do more to encourage these activities. They have a small fund to help with travel but don't seem to encourage use of that fund. One of the problems is that, if you go away for long, your home department has to worry about covering the teaching.

Lage: There isn't automatic university-wide funding for the university professorship?

Whinnery: Only the small fund for travel. I guess it still exists. I haven't used it for several years. But the budget committee several times has made a recommendation that the home department should have a fund for replacement to encourage this. I guess right now there are more important issues. There is a review going on now about possible changes. There was one proposal that it only be honorary, but the last I heard they were going to leave in some word of encouragement for time on other campuses.

Lage: Does it relieve you of any duties within your home department?

Whinnery: Not automatically. But my department was very cooperative in making arrangements to cover courses when I was invited to other campuses.

Lage: So you must have a really good fix on engineering throughout the university system?

Whinnery: When I was active I had a pretty good overview and was impressed by most of the programs. When Dave Saxon was president, he asked that we write him a memo and give our impressions of the programs that we saw on these visits.

Lage: I always like to see those programs be real and not just titles. It's sort of unfortunate that they are often merely honorary.

Whinnery: Yes, but I believe it would take only a little time and money to make more use of this group.

Lage: How many are there?

Whinnery: There are presently sixteen, and nine are emeritus.

Lage: Are there any functions for them as a group? Did you get to know Josephine Miles, for instance?

Whinnery: Some of the presidents had annual dinners for them, but I don't think there's been one for quite a few years. Yes, Josephine Miles, when they did have functions, was always there. Marvelous person.

Lage: Had you known her before?

Whinnery: Not personally. I went to some of her lectures and readings and have some of her books.

Lage: We have an oral history with her, a very nice one.

Service on University Committees

Lage: I got your bio-bib, as you probably know. It's about three inches thick, and filled with lists of committees.

Whinnery: We certainly don't want to talk about all of them. Some took a lot of time but didn't accomplish much. The senate committees generally had specific functions and good people on them, so worked well. The advisory committees, as that to the Lawrence Hall of Science, were interesting in that we got to see their excellent programs. Many people think of the Hall as just a science museum, but its main function is in science education with both students and their teachers. Their staff was very good so that was pleasant duty.

More difficult were the advisory committees for the computer center when it was being established. There were both financial and personnel problems. And I'm a computer ignoramus, so that may have been part of the problem.

Lage: Study of Technological Aids to Education [1967]. Was that a university-wide committee?

Whinnery: At the university level, there were proposals for microwave relay links between campuses, primarily for TV. I don't think these were ever built. It's interesting that there was much more use of TV for on-campus instruction than there is now.

Lage: Is that something you think is useful, the use of television as an instructional tool?

Whinnery: Yes. It was used to tape a series of lectures for use in another term, or to expand the audience for a lecture by showing it in other rooms. Studies have shown that both of these techniques work, but don't seem to be a substitute for the live lecturer when that's available. It's interesting that the Crown College course at Santa Cruz, which I mentioned, was televised to an overflow audience, and I made the point of attending the overflow room at times. The students were relaxed, even taking off their shoes at times, but still attentive. Nevertheless, as the term went on and there was room in the auditorium with the original lecturer, more and more of them drifted back to the live event.

Lage: There was a President's Committee on Innovation [1969-1970].

Whinnery: That was a university-wide committee reporting to Vice President Fretter. It had many meetings with emphasis on the rights to intellectual property. There was a thick report but I'm not sure it changed anything. More effective was a campus committee on intellectual property, set up by Chang-Lin Tien when he was vice chancellor. It largely concentrated on computer software, the degree to which it should be protected, and who should have the rights to it.

Lage: What were the issues, if we can sort of define them?

Whinnery: Many groups on the campus develop valuable software for their specialties. Some have distributed it at cost. Others have hoped to recover some of the costs of development by charging a royalty. Should there be a uniform policy? Under what conditions can the software be protected by copyright or even patents? If there are royalties, what is the proper distribution between the developer and the university? Most

universities were struggling with these issues at the time we met and we tried to find what others were doing, to the extent we could. It was gratifying to find that the report was read. A software center was set up and the director followed many of our recommendations.

Lage: Those are all really important issues, at least to point out that they're there and that you were involved in them. Is there anything else along these lines?

Whinnery: That's probably enough to give a feel for the university committees. Most everyone agrees that there are too many committees, but I've often thought that I wouldn't know anyone outside of our college if it weren't for the committee assignments.

IX RESEARCH AND TEACHING

Electromagnetic Fields and Waves: Approach to Problems

Lage: It seems from what you've told me and others that your research falls into two areas.

Whinnery: Microwaves and optics, yes.

Lage: Maybe we could start with microwaves to just give an idea of what your major contributions have been.

Whinnery: We've already discussed some of the microwave work done at GE. The work on transmission lines and waveguide discontinuities, using Hahn's method, is some of my best-known work. In spite of the more general work of Schwinger and Marcuvitz, which we talked about, I still receive requests for reprints of our papers on this subject.

Lage: So some of the value is that you wrote it up in such a way, or continued the research until it was more accessible?

Whinnery: Yes, I think presentation had something to do with it. The other work that started there was on the microwave tubes. We were trying to extend the very highest frequencies they would work at. The difficulty is, if it takes too long for electrons to get across compared with the period of the wave, the devices don't work. We were trying to get around these "transit-time" effects.

Lage: Let's just look at that for a moment. Were you working on your own, or was this a team approach?

Whinnery: The problems came out of the team. Although I was not in Ramo's group formally, I worked closely with people in that group. The problems arose from their experiments on new proposals, and we

would discuss them as a group. The analysis I did at that time was pretty much on my own.

Lage: Do the solutions come through your working with pen and paper, or do they come through discussion with colleagues?

Whinnery: Both. My analysis at that stage was based on a lot of physical pictures. Ramo had very strong physical pictures, and I learned much of that approach from him.

Lage: Tell me what physical pictures are.

Whinnery: Instead of just seeing things as terms in an equation, you try to visualize what was happening in a physical sense. Once you see what you think is important in the physical sense, you can often make approximations.

Lage: I looked over the [Charles] Townes interview to see if it could help me with the questions for you. I was very taken with the description that he gave of having a picture in his mind of the electrons, and how they moved. Then he would think, "What would they do if--?" He said, "It's like thinking about a friend, and what he would do if--."[1] [laughter] Does that strike a bell?

Whinnery: Well, the first part of it is the physical picture, exactly what I was trying to say. I hadn't thought of the anthropomorphic aspect of it particularly.

Lage: He seemed to feel so familiar with electrons. I think that's what he was getting at, more than the anthropomorphic aspect. And how they would operate; he could just imagine these things.

Whinnery: Yes. I guess that by the time we'd thought about the electrons going across a high-frequency tube, we were pretty familiar with them, too.

Lage: [laughs] That's true. So you're not thinking just in mathematical terms?

Whinnery: No, it's a combination of things. My work is nowhere near the level of Townes'.

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[1]Charles Hard Townes, *A Life in Physics: Bell Telephone Laboratories and WWII, Columbia University and the Laser, MIT and Government Service; California and Research in Astrophysics*. Regional Oral History Office, University of California, Berkeley, 1994.

Lage: Now, when you say "nowhere near the level," how is it different? You're very prominent in your field.

Whinnery: He created a whole new field, through first the maser and then the laser. Nothing that I did, did that. I worked on extending fields.

Lage: In terms of the difference between engineering and physics, could you describe where one stops and the other starts? Or is it a continuum?

Whinnery: I think it is a continuum. But if you take the extremes, in physics, you're trying to understand the laws of how things interact. In the purest sense, you don't care whether they're applicable to anything or not. In engineering, you're trying to get something done, and you bring in whatever laws you need to figure out how to get it done. But there is a continuum in between. The physicists proved they could be very good engineers during World War II in many projects--radar, the atomic bomb, so on. Some persons with engineering training develop some very important principles.

Lage: Where would you put yourself on that continuum?

Whinnery: In thinking about the problems where I feel I have done the most, I think I was inspired by a problem in the engineering sense. So I guess I'd lean toward application. And then, on the other hand, very few things I've carried far enough to sell.

Lage: [laughs] You're not that practical.

Whinnery: No.

Lage: But things that intrigue you are things that are going to work. Am I interpreting it correctly?

Whinnery: Yes.

Lage: But wouldn't a physicist say he had picked a problem, also?

Whinnery: Yes. I described the two extremes, but many physicists are really inspired by practical problems, too.

Lage: When you come to picking a research problem, does your research just lead you from one problem to another, or do you actually have a little list in your pocket or on your index cards about something you want to work on at some point?

Whinnery: Ideas may come in a variety of ways, but the work at GE on microwaves was largely a matter of evolution--new ideas growing out of the preceding work.

Lage: And when you came here, how did you extend that, or did you make a break when you came here?

Whinnery: No, I was very much building upon that. And later, the work at Hughes on microwave traveling-wave tubes set a new direction, which I then carried on here for several years.

Associate Research Engineer George Becker

Whinnery: One thing we should emphasize: a very key person in the microwave tube research when I came back, and then later in the lasers when I returned from Bell Laboratories, was George Becker [associate research engineer]. If you talk to any of the graduate students who worked with him, I'm sure they'd say they learned as much or more from George Becker than from any faculty member in the department.

Lage: Tell me about George Becker, who he was.

Whinnery: George has worked on high-power tubes at Eitel-McCullough [Eimac]. He worked with Dave Sloan when he first came to the university, and then with our project on traveling-wave tubes. His degree, I think, was from Heald College, an unaccredited program, which gave us some problem in getting the right job title. But he had a great breadth of knowledge of chemistry, materials, and processes, and skills in glassblowing, mechanics, and photography. He could build anything and had the reputation of being able to solve any problem.

Lage: How would you work with him?

Whinnery: It was primarily the graduate students who worked with him. One of the weaknesses of the program, if you like, is that they came out thinking that you can get anything built. [laughter] When they went to other places, they discovered that wasn't always the case. They designed some fairly crazy things sometimes.

Lage: They would design, and he would create? Is that how it worked?

Whinnery: Well, again, there would be interaction. They would tell him what they wanted, and then he might say, "Wait a minute, you

can't do that, but you can do this." Then it would evolve into something tangible.

Lage: Would he build things for you and other professors? Or mainly just for the graduate students?

Whinnery: There were other professors, Everhart, Susskind, [Theodore] Van Duzer--well, Van Duzer was first a graduate student and then a faculty member. Then for the laser field, Steve Schwarz and Ken Gustafson. But graduate students were involved with all of them. Later he worked with the integrated circuits program when it was getting started.

Lage: I'm glad you mentioned him, because that kind of person is often the unsung hero.

Whinnery: Dick Cruse, Don Roger, Bob Hamilton, Wil Zeilinger, and Sam Higenbotham were also key persons in making tubes, lasers, and instruments for us.

Work on Backward-Wave Turnable Amplifier, and Noise Aspects

Lage: Any other areas in microwaves?

Whinnery: Following my work at Hughes, the work was so much with the graduate students that it's a little hard to say whether I contributed anything.

Lage: [laughs] Go on.

Whinnery: One thing that seemed like it was going to be terribly important was a tunable amplifier developed by Mal [M. R.] Currie and me. Currie was one of our very outstanding graduate students and later went on to be chief executive at Hughes. The amplifier used backward waves and was tunable over a wide range just by changing the voltage.

Lage: Why backward?

Whinnery: In most traveling-wave tubes, the wave and the electrons go together. In the backward-wave oscillator that had already been invented, the electrons go in one direction and the wave goes in the other. That's where the backward aspect comes in. In any event, it was fairly obvious you could make an amplifier, once you knew you could make an oscillator, but the original ones were unstable. The developments that Currie and I made appeared to make it into a useful device.

But, as in so many other cases, the function was taken over by a solid-state device, the tunable Yig filter, which could be used with a broad-band amplifier for the same function.

I also worked on noise aspects, particularly as affected by the potential minimum, the cathode region.

Lage: What is a noise aspect?

Whinnery: Statistical fluctuations. You've heard on your radio background crackling, and that's noise from some source. The most basic part comes from statistical variations in the electron flow.

Lage: Is that where we get the word static?

Whinnery: No, static is typically from lightning or some interfering event. The noise of concern here is from statistical variations in electron flow. At first it was thought you couldn't do anything about it, that if you have a certain number of electrons in a stream, there's going to be so much variation. But it turns out that there are things you can do near the cathode--the source of the electrons--to smooth out this noise. Noise is an interference and determines the smallest signal that you can detect. So I did quite a lot of work in that area with several graduate students.

Other Researchers, and Publication

Lage: Was this a general problem that many people were working on, how to reduce the noise?

Whinnery: Yes. MIT, Stanford, and Hughes were especially active in this area.

Lage: How does research proceed when there are many people? I assume it varies in various locations.

Whinnery: First of all, there are conferences. You present a paper at the conference, and argue with the people that either say they've done the same thing, or that you're all wet. Sometimes you are wrong, and you start over. And then, of course, you keep up with the journal publications, too, and contribute your own papers.

Lage: Has there been a change over time in how cooperative different researchers are, or how competitive, would you say?

Whinnery: In one sense, it seems to have got more competitive, but the effect has been almost more publication and more hurried publication. "I've got to get this out before somebody else gets it in print."

Lage: So maybe something that's not fully considered comes out?

Whinnery: I think some things would have been better to have waited. There also seems to be a lot of duplicate publication. There are a dozen journals you can publish in, and people will present the same material with only minor variations in several of them.

Lage: Is this to get your list of publications increased?

Whinnery: That's certainly one of the pressures. And sometimes, editors of the journal invite you: "You've done work in this field, please write us an article on it." Some of those invited papers are very useful, but I think the total effect is that there is too much duplication.

Lage: You mentioned that that was an area where you worked on your own, rather than with graduate students.

Whinnery: There were more of my own ideas in the noise work than in some other areas, but there were also contributions from graduate students Bill [William B.] Bridges, Marty [Martin A.] Pollack, and Ted Van Duzer.

Lage: And did your ideas end up in a practical application?

Whinnery: I think they were part of an evolution of understanding. One of the papers is reprinted in one of the series where they reprint so-called classics, but I don't think it changed the nature of traveling-wave tubes as much as work of Dean Watkins in his Stanford thesis, or Hermann Haus of MIT, or Mal Currie in his later work at Hughes.

Teaching and Guiding Graduate Students

Lage: Should we discuss teaching now as we discuss research, how you work with your graduate students?

Whinnery: Yes, I think so, because really, my research at the university has been through, with, and by the graduate students.

Lage: Maybe you can describe how a graduate student selects a problem.

Whinnery: Yes. First of all, there are several extremes. There are people who are told, "You are assigned to do this; when you get this done, you get your Ph.D." And the other extreme is, "Your problem is to find a problem, and when you get a good one, come back to me and I'll see if it's okay."

Lage: And that depends on the professor?

Whinnery: That depends on the professor. These are the extremes that you find. A lot of people are in between, and I'm certainly one of those. In general, I had a list of suggested problems. Quite often these were evolutionary, that had grown out of what we had done before, but looked like the next interesting step. On the other hand, sometimes a student came in saying, "Why don't we do so-and-so, I'd like to do this." Sometimes it would be completely impractical, either because we didn't have the facilities or didn't think it a good idea, but often I'd say, "Yes, that's a really nice problem. We'll see if we can work it out."

But even when they started a problem I suggested and worked for about a year they would often come back and have a newer or better idea.

Lage: A redefinition of that problem?

Whinnery: Yes, or sometimes it would be quite different. They would be reading the literature and get excited about something they saw, or go to a conference and hear something, and say, "Hey, why don't we work on that for a while?" At that time, we had quite a lot of flexibility with the Joint Services program and even the NSF support. As long as we kept the project managers informed, they encouraged--not just random jumping around--but evolution into new areas.

Lage: Would you have to justify why one thing was being dropped and another taken up?

Whinnery: Yes. But it was pretty easy for a while, just very informal. Now there is more and more the feeling, "You made this proposal, why didn't you do step seven that you proposed?"

Lage: Even if it doesn't sound reasonable to continue?

Whinnery: Yes. If it's research, you don't know necessarily that step seven will make any sense after you've done some of the other steps. But most of the agencies seem to have gotten more nervous about defending the fact that they're getting what they paid for.

Lage: That seems short-sighted. Was there, by way of illustration, a particular graduate student that combined all the good qualities that--

Whinnery: Oh, I had so many.

Lage: Or can you discuss how you worked with them?

Whinnery: I had so many great ones that it's a little hard to single any one out. One example of an extreme change of direction is Amnon Yariv, who's now a very famous professor at Caltech. He had done his master's project on a problem with microwave tubes, measuring velocity distribution of the electron stream after interaction. He went to a conference in Boulder where the maser was described, and came back and asked, couldn't we work on the maser.

I didn't know enough about it to feel confident to supervise him, but we got help from Alan [M.] Portis in physics, and then George Feher, who was a former student here but was then at Bell Laboratories, and Jay Singer, of our department. This was supported by the Air Force Office of Scientific Research and had to be cleared with them. So that was an extreme case but was successful in that Amnon went on to become one of the world leaders in quantum electronics.

Lage: It sounds like you were open to these new ideas.

Whinnery: I tried to be.

Lage: Is that across the board with professors, or is there a continuum there too?

Whinnery: I think there's a continuum. The extreme is to assign a specific problem.

Lage: In those cases, is that usually a problem that contributes to the professor's research very strongly?

Whinnery: Yes. And to defend that point of view, it may be the best way to make a strong contribution to a research field. The argument against the other approach is that if you jump around all the time to a smattering of things, you don't make a major contribution to any one of them. But educationally, I think it's marvelous to allow some flexibility.

Lage: You do seem to have a strong grounding in being an educator. That comes across very clearly.

Whinnery: I hope so.

Lage: I'm sure that must vary a lot, too, among the professors, how committed they are to education.

Whinnery: I think most of them here are very committed. They may have different styles, but it's really the point of being here.

Lage: They could be other places if they wanted.

Whinnery: Yes.

Lage: Were there any dead ends in your microwave research?

Whinnery: Oh, yes. Certainly some of these projects didn't accomplish what I hoped they would when I started.

Lage: Is that hard, when you've invested a great deal of your time and thought and see it's not going anywhere?

Whinnery: Well, it's not as much fun as getting an exciting, positive result, that's for sure. [laughter] But it is part of the process.

Quantum and Optical Electronics

Lage: What about when you reoriented your research after the deanship? Why did you take that step?

Whinnery: I realized that I had to do something more than just take a year's sabbatical here or in some other university, and I had an opportunity at Bell Laboratories. I had a lot of friends at Bell, and an open invitation to go there. Of course, I realized that the group that I knew who had worked on microwave tubes had largely changed to lasers at that point. But it wasn't so much choosing to go into the laser field as it was a chance to work with an exciting group.

Lage: So that was a common transition?

Whinnery: It was very common at that time.

At first, it was pretty tough. Because of the time in administration, I was even behind in microwaves, and now I was trying to move into something new. But since these were mostly

people who had also changed from microwaves to lasers, they knew the transition that I was going through and were very helpful.

Lage: Is there a common thread, then, between the concepts?

Whinnery: Yes. The part which is different is called quantum electronics and requires a good knowledge of quantum mechanics. But 90 percent, maybe more, of laser work is just classical, and the electromagnetics is the same, just a different optical frequency. So there is a lot in common, particularly with the part that I worked on.

Lage: Tell me about your contributions in the area of quantum electronics. What major things did you work on?

Whinnery: Much of my work was on periodic systems for guiding light. Fibers at that time were too lossy to be of use, though now, of course, are the dominant means of optical guiding. Probably the most important work was that on the thermal lens effect. Sergio Porto had observed some strange effects when he placed cells of organic liquids in a laser cavity. They appeared to be thermal effects from the absorbed light, but these were very transparent liquids, so the first calculations seemed to rule out this explanation. After considering many alternate explanations, Jim Gordon and I made a detailed analysis and found even the small absorption enough to explain the effect. It turned out to be quite important, sometimes as an undesirable effect, but also useful for measuring very small absorptions. It is a simple effect, and I guess should have been obvious as a thermal effect from the beginning.

Lage: That must be true of a lot of things, when you look back on them.

Whinnery: So a number of the things, after I came back here, were built around that. We also began to get a group of graduate students that were so imaginative that they were almost setting the program. People like Erich Ippen, who's at MIT, and Bill [William M.] Clark, now at Hughes, and Marvin Klein, also at Hughes, and later Dave Auston, now dean at Columbia, and Ron Schmidt, now at Synoptics. So their ideas were building the program as much as mine.

Developing Group Research with Graduate Students and Other Professors

Lage: How do you tie up with graduate students? How did you get such a great group of them?

Whinnery: [laughs] I've often wondered. Jay [Jerome] Singer had started the program with Shyh Wang, first with masers, and then leading into lasers. I mentioned Amnon Yariv, who was really the first student in that field. Jay had some very good students, too, and had built up the laboratory.

Lage: When were they active?

Whinnery: It was largely during the period I was dean. When I came back, Jay wanted to move more into the bioengineering area, and Shyh Wang at that time was pretty much working on the ferrimagnetic materials. So there was a beginning of a facility, and Singer was very gracious in letting us use it. The students that he had finishing up at that time were very helpful to us in getting started.

There was then a reservoir of students who saw this as an exciting area, but found nobody to work with. So when I came back from Bell and had some ideas, there were interested students. Then once you get some good students, by word of mouth you get more.

Lage: Do they come to you and ask if they can work with you?

Whinnery: It works both ways. There may be applicants for research assistantships, and if you have a research assistantship available, you may, on the basis of the student's record, offer it. But quite often, it's somebody who has a fellowship who hasn't made a commitment to anyone. Usually they will talk to three or four faculty members before making a decision.

Lage: How often do you say, "No, I don't think that will work"?

Whinnery: One of the embarrassing things--Chuck [Charles V.] Shank, the LBL director, claims that I turned him down. What we did do at that time was try to divide up students somewhat. Steve Schwarz and I would look at students together, and Steve wanted to work with him. Later, when Ken Gustafson came, we continued to work very closely as a group.

Lage: How do you work as a group with other professors? Are you in the lab together, or you confer on problems, or--?

Whinnery: We certainly confer. I don't know whether you noticed, but of the Ph.D. students I've had in the last couple of decades, quite a number of them are jointly supervised. Most of mine have been with Andrew Dienes, who contributed a great deal to our program. He is a faculty member at Davis, but came here first from Bell Laboratories on a visiting year. We worked very well together, so after he went to Davis, he continued to come in regularly. I also had students jointly supervised with Shyh Wang, Ken Gustafson, and Steve Smith.

In general, when you meet with students, you do it in one of two ways. Either individually, each student comes in, typically once a week for an hour, and then you set up other times if there's something that needs it. Or, you have a group meeting, and then again, set up individual meetings as they're needed. When you're working with other faculty members, the group meeting tends to be the most efficient way. The last several years, I mostly have worked with Dienes and then with Steve Smith, using group meetings.

Lage: Is that a trend, towards more group team research?

Whinnery: I haven't observed it. I think we probably do it more in our group than is typical of the department or in other universities. But there are certainly other groups with close cooperation.

Lage: Not being in a field like this, I hadn't realized what key roles the graduate students had in advancing the research. Are they appreciated uniformly by all the professors?

Whinnery: Oh, I think so. I think it's well understood by most people that without good graduate students, you aren't going to have a first-class research program.

Lage: If you had to describe what role you took with your graduate students, what is your function, or is each one different?

Whinnery: I described it to one of them once as like a fight manager. [laughter]

Lage: Oh, that's intriguing! Tell me more. A fight manager?

Whinnery: Well, you have to keep them in training, and when it's time for them to present papers, that's their bout, and so on.

Lage: Do you help them with the presentation aspect of it?

Whinnery: Oh, yes. First of all, we go over the written paper, and then usually the student will rehearse the presentation once or sometimes many times.

Lage: Is it on delivery or on content?

Whinnery: Both.

Lage: The things you describe come after they've done their work. How do you help shape the process of doing the work itself?

Whinnery: Quite typically, and part of it is related to the early publication that I mentioned before, a Ph.D. student, by the time he or she gets the degree, may have anywhere from two or three to two dozen publications. Even though they haven't finished the whole of the project, publications may be on parts of the project. It typically doesn't start in the first year; may not even in the second. But by the third or fourth year, quite often they have results that are worth presenting.

Lage: How do you help them along in their search for these results as they're working through their research problems? Do you leave them on their own?

Whinnery: This is where the meetings come in, whether you have a group meeting or individual one. If you do it as a group with all of the graduate students together, the other students do as much of the guidance as you do, or sometimes more. They'll argue with each other and shoot down some of the false ideas. It's a continuous process.

Lage: It shows a lot of respect. You treat them as a fellow researcher, I'm gathering.

Whinnery: Yes.

Lage: And you're somebody that they can get feedback from.

Whinnery: That's right. For the first couple of years, you hope you're teaching them, and the next couple of years, they're teaching you.

Lage: No wonder it's exciting. With all these graduate students that you had, and so many successful ones, are there common qualities about their minds or their styles that you would say make a successful research engineer?

Whinnery: Of course, there are obvious differences in personality, and even approach to problems. But yes, they certainly have to be

curious and excited by what they're doing, and willing to work very hard. That isn't to say they have to work twenty-four hours a day every day--most of them have hobbies, skiing, or something equivalent--but I guess the curiosity is the key thing that's common to most of them.

Lage: A devotion to the field as well, perhaps?

Whinnery: Yes. It has been an exciting field during this period.

Lage: Have you had any notable failures among your graduate students?

Whinnery: There certainly were a couple--maybe more than a couple--who started and didn't finish for various reasons. And there were some that we considered marginal, but even these did useful work afterwards.

Lage: After you bring your graduate students along, do you take a role in launching them into a job?

Whinnery: You try to help them find their first job. Quite often, if that doesn't work out, you're involved in advising them and certainly writing letters of reference if they want to change. Sometimes that goes on for years and years. But most of the discussion is about the first job. Right now, they aren't getting as many offers as they once did, but I think most of them are finding something. Typically, when they have more than one offer, they want your views on the relative values to them. They don't always take the advice. I never tell anyone which job to take but try to tell them the pros and cons of the various alternatives.

Lage: Do they usually have a pretty clear idea whether they want to go into industry or the academic world by that time?

Whinnery: Yes. There are exceptions. In our field, most people agree that it's well to go into industry for a few years, even if a university is the end goal. There are some other cases where a university job will be offered right away, and there may be reasons to take it.

Funding for Research

Lage: We've talked about government grants. In the sixties and seventies there was a lot of mistrust of government directing research, war-related research and all. Do you think there is a

danger of having so much either federally-financed or industrial-financed research? Does it skew the direction of the field?

Whinnery: Most of the government agencies that we work with, NSF, Office of Naval Research, Air Force Office of Scientific Research, and the Army Research Office, have had a pretty broad view of what they want from university research. The Mansfield amendment, at the time of the Vietnam War, required that research supported by the Department of Defense be applicable to the military. But nearly everything in electrical engineering--lasers, integrated circuits, or computer software--has potential for either civilian or defense uses, so that didn't change things much. Now there is more emphasis on directed research. Even NSF has had pressure from Congress for more "strategic" research.

On the industrial research, there are certain cases of companies coming in and wanting to support something with too rigid a definition, a product that doesn't make sense to try to do in a university. But most of the industries that contribute do so on a much broader basis than that.

Lage: Is that a significant source of research money?

Whinnery: Oh, yes, it is now. It didn't used to be. I told you about the industrial liaison program that was held last week. Dean Hodges gave the breakdown of industrial support. I think it's about a third of the support now.

Lage: And that's significantly higher than it used to be? Industries are stepping into the void of reduced federal funds?

Whinnery: Somewhat, yes.

Lage: Somewhat. Is research money tighter now than it was?

Whinnery: Federal research budgets have continued to increase but competition for those funds seems to be more severe all the time.

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Lage: It strikes me that during this time period we're talking about, probably when people look at it from a distance, the really significant thing in the growth of the engineering school, and maybe the university as a whole, is all the federal research money.

Whinnery: Oh, yes. Clark Kerr called the major universities "federal grant universities" in his book on the multiversity.[1]

Lage: And as that drops off--maybe it won't drop off. Maybe I'm being pessimistic.

Whinnery: It would certainly change things a lot if support stopped completely. I don't think it will stop completely. It not only may get tighter, but it does seem to be changing character, becoming more specific on the work to be supported.

Lage: I see, less basic research.

Whinnery: Yes.

Lage: For instance, what happened at Stanford--scandal relating to research and overhead costs and everything--did that have an impact?

Whinnery: Oh, that affects everybody, yes. There's more attention to overhead rates and new rules. Since I don't have a grant right now, I'm not up on the details, but it certainly is affecting everybody.

Lage: You were in at the right time, I would say.

Whinnery: I guess so. That's right.

Lage: Do you think we've covered things that you want to see covered in terms of research and teaching?

Whinnery: I think so. If I think of anything else, we can fill it in.

Lage: I like starting up the next session with your thoughts from the week before, because you think things through and think of what we missed. You always come up with something useful.

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[1]Clark Kerr, *The Uses of the University*, Harvard University Press, 1963.

Optics and Laser Research

[Interview 7: March 23, 1994] ##

Lage: I know we haven't discussed in depth any of the technical aspects of your research, I suppose because I feel at a loss to even talk to you about them.

Whinnery: We have talked about the microwave work in about as much detail as makes sense to do here, and also the laser work at Bell. Maybe a little more can be said about the laser and optoelectronics work at UC. I don't think any of this is earthshaking, but we have had some interesting things to work on.

After returning from Bell, there was some continuation of the thermal lens work we talked about. This is a fairly simple effect; it is surprising how little absorption there has to be to make the effect significant. Sometimes it's useful, and sometimes not.

Lage: I don't want to divert you with naive questions, but what do you mean by so little absorption? Is there a framework to help me understand it?

Whinnery: When light goes through a glass or material we think of as transparent, most of it goes through, but some of it is absorbed. So materials that we normally think of as having very little absorption may nevertheless have enough so that the heating from it changes the character of the path for the laser beam, and either causes focusing or defocusing.

Lage: I see. So that effect is what you were studying.

Whinnery: Yes, we continued some of that work. In addition, in starting the new program, we looked at a number of different laser mechanisms--ion lasers, and microwave discharges for excitation of helium-neon lasers.

Then there was some very interesting work with Erich Ippen and Ron Schmidt on acousto-optic interactions, particularly the laser beams interacting with surface acoustic waves. Then I had suggested to Dave Auston, one of our excellent graduate students, the possibility of making patterns by combining transverse modes, and he realized you could lock them to make very rapidly scanning patterns. This technique of transverse mode locking was carried on by a couple of students after that.

There was some interesting work with liquid crystals for optical modulation, suggested by Chenming Hu after learning of the basic work of Y. Ron Shen in physics.

There was a great deal of work, largely started when Andrew Dienes came here from Bell Laboratories, on short optical pulses. This was first with dye lasers and then with other materials. In addition to the generation of those, we studied their switching aspects. This was particularly interesting because the photoconductive switches were developed by Dave Auston, whom we've just mentioned, after he went to the Bell Laboratories.

Lage: There seems to be a lot of back and forth between researchers.

Whinnery: Yes. In the last few years, the concentration has been on semiconductor lasers, particularly laser arrays and the surface emitting semiconductor lasers. Most of the standard semiconductor lasers emit through an edge, but for some purposes it's a lot simpler if you can get it to emit normally to the surface. That has been an active field in a number of places during the last few years.

One interesting area of work relates to doping superlattices, popularly known as nipis, because there's an N region, an intrinsic region, and a positive region, forming a kind of a sandwich. The way in which we started that work is interesting. One of our students, Ghulam Hasnain, took a summer job at Hewlett-Packard. A very interesting person, Gottfried Döhler, was working there on nipi devices, and convinced him this would be something exciting to work on. So we had a cooperative program with Hewlett-Packard while he was there, and in fact, that still continues, even though Döhler has gone to Germany as a professor at Erlangen. These are interesting devices because they're electrically tunable. Both Ghulam and his wife Connie [Chang-Hasnain] did some very nice work on those devices.

Lage: Are they a husband-wife team?

Whinnery: Yes. They met as graduate students and were married while they were students here. They worked on different aspects of the nipis. Ghulam made some broadly tunable light-emitting diodes and Connie modulators. Connie also did some excellent work on laser arrays.

Lage: Were they both your students?

Whinnery: Yes, jointly with Andrew Dienes. I mentioned before that we did a lot of joint supervision.

Lage: Was this idea that came from Hewlett-Packard something that was needed for them to move forward in an industrial use?

Whinnery: They hoped it would be. I'm sorry to say that it hasn't got into commercial use yet, so far as I know. The attractiveness is the electrical tunability, but it would be especially useful if you could make a voltage-tunable laser. And though other tunable devices were made, I don't think anyone has accomplished the tunable nipi laser.

Lage: Would that be something that you would encourage another graduate student to pursue?

Whinnery: We did have one more after that, Xin Wu, who worked in that field. If I were still taking graduate students, I'd have to feel that we had a new approach before encouraging anyone else to attack the laser problem. There is other interesting nipi work to be done, and Professor Döhler's group in Germany is still very active in the field.

Lage: What do you consider when you're thinking about whether to continue? Do you consider how large a risk is involved?

Whinnery: There should be interesting problems to solve, and, yes, there should be some chance of success. And of course there should be a source of funds for the project.

Lage: Did this cooperative Hewlett-Packard program mean that Hewlett-Packard gave funds for the graduates to do research?

Whinnery: During Ghulam's summer work period, they of course paid him. After that it was mostly use of special equipment there to supplement what we had here. Then, of course, we exchanged ideas.

Lage: I think those are good illustrations of many things we wanted to get at.

I had a question that may or may not be fruitful. I noticed in your papers that a former student of yours was quoted as saying that you "...imparted a point of view and an approach which have influenced everything I have done over the years." Could you describe what kind of point of view and approach you would hope to impart? We'd have to ask him what he meant by that, but do you have a thought about what kind of approach you're trying to impart to your students?

Whinnery: You try to get them to think of new ideas and to be very critical in analyzing them. Theoretical analysis and carefully planned experiments are used to test the ideas. But most everyone I know does somewhat the same.

Lage: From what I understand about the loyalty of your former students, you must do it very well. But maybe it isn't different from others.

Whinnery: Well, everybody has a different style, but I think the principles are very much the same.

Lage: Okay. We'll leave that at that point.

X SERVICE TO GOVERNMENTAL AND SCIENTIFIC AGENCIES

Lage: Shall we look now at the different governmental and scientific agencies that you've served with?

Whinnery: Yes, but not in a lot of detail. There are obviously too many committees. I should have said "No" more often.

Lage: [laughter] Of course, I didn't list all of them.

Advisory Group on Electronic Devices, Department of Defense, 1957 to 1966

Whinnery: The first one listed is the Advisory Group on Electronic Devices [AGED]. This was a Department of Defense [DOD] committee made up of project engineers from army, navy, or air force labs plus several members from universities or industry. The purpose was to coordinate work of the different agencies on new electron devices. So the project engineers would present their proposals for new research or development grants for discussion and approval. Sometimes they would already have in mind the place to do the work, and if so, the committee would discuss whether or not that was the best place for it.

So there was a tremendous amount of work, and I developed a lot of respect for these very hard-working and largely unappreciated engineers at the DOD agencies who were managing these programs.

Lage: I think that's an important point, your attitude about what we might call bureaucrats. Were they scientifically sophisticated, would you say?

Whinnery: A few had Ph.D. degrees, but usually only bachelor's or master's degrees. But they knew their field of responsibility very well.

Lage: Who were the other civilians? What type of people? I wouldn't expect you to remember their names.

Whinnery: Let's see. Art Samuel of IBM was the chairperson for a long time. When he left, I was asked to be the chair, but I didn't accept. Ed Harold of RCA and Gerry [William G.] Shephard of the University of Minnesota were especially strong members.

Lage: That was a long-time commitment, it seems. Almost ten years. I have '57 to '66.

Whinnery: Yes, that sounds about right.

Classified Consultant on the ICBM, 1957

Whinnery: Then you mentioned the committees and the consulting work on the ICBM, the intercontinental ballistic missile. I was on several committees concerned with these and also did consulting at the Ramo-Wooldridge Corporation, before it was TRW, on the system. I wish such things didn't exist and have often wondered if it was right to work on them. But at the time, with the cold war and the Soviet work on these weapons, it seemed necessary.

Lage: What kinds of things did that committee do?

Whinnery: As you may remember, the first part of the U.S. rocket program was not very successful. We had many failures, so the committees looked at the problems and considered different designs. One of the assignments I had, in my consulting, was the propagation of radio waves through the rocket flame. It turned out not to be a problem but there was worry for a while that guidance might be lost because of this.

Lage: I see. But you mentioned that you wish those devices weren't needed. Was this a conflict that you had at the time?

Whinnery: I was pretty well convinced at the time that it had to be done, and in view of the Soviet work, I still think so. But I have wished many times that no one had made these things.

NASA Science and Technology Advisory Committee for the Apollo Program, 1964 to 1969

Whinnery: Another committee on the list is the NASA [National Aeronautics and Space Administration] STAC, Science and Technology Advisory Committee for the Apollo Program. That was certainly one of the most interesting assignments. First of all, I had tremendous respect for Charlie Townes as chairman of that committee. He asked good questions, always supportive to the program, and always let everybody on the committee have their say. He just respected everybody, both on the committee and the people that we were advising, and had good questions of his own.

Lage: Did the committee include people opposed to the Apollo program?

Whinnery: No.

Lage: I understand there was a lot of negative feeling among scientists.

Whinnery: I think there were many who thought that the science that would be done wasn't worth the cost of the Apollo program. You have to admit that the program was largely a political program. Our prestige had fallen so low that Kennedy and his advisors felt we had to do something to show that we still could carry out a major program.

Lage: There's even a quote by Kennedy, that somehow by having this program it would make a difference to those countries that were deciding between freedom and tyranny. They would pick based on who got to the moon.

Whinnery: Sure.

Lage: But the committee itself had no dissenters?

Whinnery: No. The committee accepted the goal of the program and tried to advise on how to accomplish it. It had quite a few medical people on it, because of concerns for radiation in space and weightlessness and so on. It was a very strong committee.

The other person that I admired very much is George Mueller, the director of the whole Apollo program. First of all, he paid attention to every suggestion and question that was asked, and, secondly, he had an overall grasp of this complicated program that you just couldn't believe. Sometimes he knew more about the latest changes in subsystems than the persons in charge of those parts. He took every question very,

very seriously, and had somebody analyze it if the answer was not clear.

Lage: So the committee was sort of a sounding board for him?

Whinnery: Yes. Jerry Shepard and I were the two engineers on the committee. Of course we commented on many issues, but one assignment was to follow the GE program on reliability analysis. There were literally millions of parts in the system, many of which would have to have "five nines" reliability (99,999 successes out of 100,000 tries) for the system to have even a 50 percent chance of success. Normal approaches to reliability would require testing of thousands of each component and there was no way of doing this with many of the specialized units. NASA's approach was to emphasize and reemphasize care through a "zero-defect" program. People not involved can simply not imagine the complexity of the system. It seems almost a miracle that it worked.

Lage: It seems almost impossible.

National Science Foundation Committee on Research Applied to National Needs [RANN]

Whinnery: Well, let's see. There were several NSF committees, but the most important was one on applied research.

Lage: Research Applied to National Needs?

Whinnery: Research Applied to National Needs was a program in the NSF, and the NSF director, [Richard C.] Atkinson, was convinced that there had to be some changes in this. So he set up a high-level committee to advise on what NSF should be doing, if anything, in applied research. We had meetings for two or three years. We submitted a report, and they made some changes. Not all of our suggestions worked well, but it did constitute a change in direction for NSF.

Lage: Could you describe what kind of a change it was?

Whinnery: Rather than have a separate directorate for applied research, we recommended that applied research be integrated with each of the programs and grow more naturally out of the basic work. I think that still remains the philosophy as I understand it, but the particular office that was set up to encourage the integration didn't quite work.

RANN actually had some very good programs. One of the problems was that the very fact that it was supposed to help get congressional support, because Congress could see something useful, meant that the Congress tried to micromanage it. You'd report on a program, and they'd say, "Well, why don't you do this instead?"

Lage: "And in my state."

Whinnery: "And in my state," of course. [laughter]

National Academy of Sciences Committee on Science and Public Policy [COSPUP], 1970s

Lage: What about the Committee on Science and Public Policy? We talked about it very briefly.

Whinnery: At the time it was a committee of the National Academy of Sciences [NAS]. Its successor, I believe, reports to NAS, NAE [National Academy of Engineering], and the Institute of Medicine. Its studies may be assigned from one of the boards of directors, or may be self-generated, but are supposed to be concerned with major issues of science and technology relating to public policy. Melvin Calvin, of our Chemistry Department, chaired the committee for many years, followed by Israel Singer, a distinguished mathematician from MIT. One of the studies had to do with safety issues related to nuclear energy. There had been many studies of that issue, with different conclusions, and it was hoped to have something more definitive.

Lage: Did you come up with a report recommending changes in public policy?

Whinnery: A tremendous amount of time was spent on this issue and many drafts of the report were written, but I don't think the report was submitted by the time I left the committee. I think it mainly showed us how difficult it was to obtain reliable estimates of risks.

Lage: That seems like a really controversial area.

Whinnery: Usually the issues were somewhat controversial.

Another study of this committee was that of peer review. There had been much criticism, particularly by Congress, of the peer review system of NSF and NIH [National Institutes of

Health], saying it was just an old boys' network. (Now they'd have to say boys' and girls' at least.) It turned out that the study seemed to show that this was not the case, that in fact some of the established persons had a harder time getting grants. We didn't think that was right either, but that was what the study seemed to show. It did seem to quiet the criticism of peer review for a while, but the issue still comes up from time to time.

Atomic Energy Commission Standing Committee on Controlled Thermonuclear Research, 1970-1973

Lage: Here's another one: the Standing Committee on Controlled Thermonuclear Research of the AEC.

Whinnery: Yes. That was probably my most miserable job as a committee member. Roy Gould of Caltech was then head of the CTR program, Controlled Thermonuclear Research. He asked me to be on his advisory committee, and I told him at first I didn't know enough about that field. He wanted somebody from the outside, but really, you needed to know quite a lot about the specifics of the fusion program to be of use. The other persons were expert in the plasma field.

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Whinnery: Sol Buchsbaum, the chair, was especially good. He was from the Bell Laboratories, and unfortunately died last year. But after Roy left, the next director promptly fired me--Bob Hirsch. [laughter] No, it was a mutual agreement that I resign. I didn't really feel I contributed what I should have.

IEEE Board of Directors

Whinnery: I mentioned to you last time the IEEE [Institute of Electrical and Electronics Engineers]. I was on the IRE [Institute of Radio Engineers] board of directors early on and then later the IEEE board of directors, and the IEEE board especially took a lot of time.

Lage: Did the IRE go on to become the IEEE?

Whinnery: The IRE and the American Institute of Electrical Engineers joined forces and became the IEEE in 1963.

Lage: On that board of directors, what would have been the purposes?

Whinnery: The board of directors, as in any organization, sets the policy and makes decisions. Some are routine operating decisions, but new directions, and the budgeting for those, must be considered. The main issue during this period was how much the institute should change from being just scholarly, running conferences and publishing, to getting into lobbying. I think many of us felt that it was a mistake to move in that direction, but as a matter of fact, the institute did, and I guess it's worked out all right.

One of the problems is that IEEE is an international organization, and most of the political issues are national. So they set up a separate assessment for U.S. members and a U.S. activities board, which does the lobbying.

Lage: What were the problems that needed lobbying about?

Whinnery: The main one, and I think most of us agreed that was a serious problem, was the question of portable pensions. The electronics industry is so mobile that many people, if not most, move from one company to another, and they may end up at retirement time with either no pension or a trivial one. I don't believe the problem is solved, but maybe it has improved with the IEEE action. In other issues, as that of nuclear power, there is a strong difference of opinion within the institute between power engineers and environmentalists. So it would be difficult to take an IEEE position on this issue.

Lage: Is lobbying a direction that a lot of professional organizations have taken?

Whinnery: I think so, yes. There are many members who can't read the highly technical journals. [laughing] In fact, I'm getting so I can't. So the increasing emphasis for education and service to the average working member does make sense.

I'm not sure how effective the U.S. activities board programs have been, but the important thing is that they have not ruined the technical information exchange aspect of the institute, as many of us feared.

NAS Reports Review Committee, 1970s-1980s

Whinnery: One very well organized but time-consuming committee was the NAS Reports Review Committee, concerned with NRC [National Research Council] reports. All major NRC reports, and there are hundreds per year, must be reviewed. A report is first reviewed by experts in the field, and the authoring committee makes revisions, trying to meet the reviewers' criticisms or suggestions. A member of the reports review committee acts as a monitor, deciding if the revisions meet all the valid criticisms. The process is time consuming because you must read the reports, the reviews, and then carry on correspondence if more revisions are necessary.

Lage: Who was generating the original reports?

Whinnery: The various boards and committees of the National Research Council. Most of the studies are at government request, but some are initiated within the academies.

Lage: Why was this needed instead of a usual, say, scholarly review of published articles? Couldn't it have been done in the same way?

Whinnery: The first stage with peer reviewers is very much the same. I suppose the reports review monitors are acting much like the editor of a journal, in deciding if the authors have met reviewers' criticisms. Although the Academy Press has editors, I suppose they need help because of the huge volume of reports and the diverse subject matter.

Lage: An incredible amount of demand on your time.

Whinnery: Yes, it took a lot of time. Although no longer on the committee, I still get some requests to monitor reports, but as an active member I received three or four a year. Some were very extensive, as this series of reports on engineering. [takes group of reports from shelf and reads:] Engineering Employment Characteristics, Engineering Graduate Education and Research, Engineering and Society, Engineering Undergraduate Education. That series took a lot of time. Here's quite a different one: Twin Trailer Trucks.

Lage: Twin trailer trucks? Did you ever think you'd get into reviewing twin trailer trucks?

Whinnery: This largely had to do with safety issues and the interpretation of statistics, so it wasn't highly specialized. But of course,

of the twenty or so committee members, there weren't enough to have experts in every subject.

NRC Committee on Photonics

Whinnery: Another NRC assignment was as chair of a committee to make recommendations concerning the rapidly growing field of photonics, which is the use of optical devices to replace or complement electronic devices. It was an excellent and hard-working committee, with Venky Narayanamurti (now dean at UC Santa Barbara) as vice chair and such persons as Tom Giallorenzo, Stuart Personick, and Fred Leonberger on the committee. It was only a one-year study, so we had to limit the scope, but the report was widely read and quoted. Not all the recommendations were adopted, but I think it had a useful effect.

Department of Defense: Ramo Task Force of the Defense Science Board, 1966-1968

Lage: Here's one I want to talk about: the Ramo Task Force of the Defense Science Board to Study the U.S. Technical-Military Posture for Limited Warfare circa 1980. Is that an important one?

Whinnery: Well, it was an interesting one. It had, in addition to Ramo as chair, Edward Teller and other interesting people. Ramo's approach was to take a limited topic and discuss it at one or two meetings, and then write a short paper to the DOD director with recommendations.

Lage: Was there concern that there was not being enough done to prepare for limited warfare?

Whinnery: Yes. I don't know exactly who proposed the study other than it came out of the Defense Science Board. I presume it was felt that too much emphasis had gone into the large-scale threat of atomic war. We looked at new technology and its usefulness for more limited engagements.

Lage: Somehow I always think of Edward Teller as thinking of this big picture, the large-scale war. Was he active in this committee?

Whinnery: Oh, yes. The interaction we had was on lasers. I was more interested in them for communication and surveillance purposes, and he for high-power weaponry. I suppose he was thinking ahead to the Star Wars concept.

Lage: How was Ramo as the chair of a committee like this?

Whinnery: He's very competent. There's quite a different style than that of Townes, but he certainly let everyone have their say. He liked to wrap things up after a reasonable discussion and get on to something else.

Lage: Would you have written up something having to do with lasers and communication?

Whinnery: Yes, I wrote something. It was mostly concerned with the thermal lens effect in the atmosphere and its effects on propagation of laser beams. It is a limitation for some applications.

University-Visiting Committees

Lage: Any others that you want to mention?

Whinnery: The visiting committees to universities are slightly different. One of the advantages of those is that you get a view of what other universities are doing.

Lage: For whom did you do this?

Whinnery: I was on the visiting committee for electrical engineering at MIT, and for engineering in general at Caltech, Stanford, Yale, USC, Harvard, and in the University [of California] itself, Davis and San Diego.

Lage: Is this by request of the institution?

Whinnery: Yes, for those I mentioned. The other kind of visiting committees are for accreditation. University of Hawaii, Cornell, Utah were the ones where I was part of an accrediting team.

Lage: Do you take a different approach depending on which type of assignment you're on?

Whinnery: Yes. For those where you're invited by the institution, the institution sets the agenda. For the accrediting committees, you try to dig into the whole program and decide if they should be accredited or not. You may make some recommendations of things to change and give a limited accreditation.

Lage: Did that happen on any of the ones you were involved in?

Whinnery: Yes. The University of Hawaii, and that was not a surprise to them. It was their first attempt to be accredited, and I think they appreciated the suggestions. In some cases, the deans want strong criticism so they can take it to their chancellor or president and say, "Look, we have got to have more resources."

Lage: You certainly went to some of the top schools to look at their programs. What reaction did you have?

Whinnery: Certainly for MIT, Caltech, Stanford, I was very much impressed with the programs. In many cases, they had specific issues that they wanted advice on. I think, in all those cases, they tried to take the advice seriously.

Lage: Is there a lot of sense of cooperation between the various universities? Or is there sort of a competitive underpinning?

Whinnery: Well, it's friendly competition. But there certainly is a lot of cooperation.

Lage: How about a program like USC? Is that a very well-regarded engineering school?

Whinnery: It has been built up and was rated within the top twenty in recent *U.S. News and World Report* rankings. They do feel the competition from publicly supported schools but do have some top programs--the optics program, for example. They have strong part-time and evening programs.

Lage: So they serve some of the working engineers.

Whinnery: Yes.

Lage: Okay. Any other comments along those lines?

Whinnery: Harvard and Yale were different in that they were basically applied science programs. Both had some excellent people but one of the issues at the time was whether they should even keep their engineering accreditation. The president of Yale, Kingman Brewster, had written articles questioning whether engineering

belonged in a major university. So there was a severe morale problem at Yale. There is now a strong effort to build the program up.

Lage: Did you notice differences in university governance at these various schools?

Whinnery: Oh, yes. Harvard in particular is almost unique. They have a saying, "Every tub on its own bottom," meaning that each school is supposed to raise its money and have a lot of independence with the money that it raises. I don't know exactly how the finances work when they participate in general education, but I think it has to do with student credit-hours. They've got some marvelous people in individual slots, but there are very few programs that would belong with the top half dozen. I guess applied mechanics would be one, solid state maybe another.

More on NASA and Apollo

Lage: I've wondered if there was more to say about your NASA experience, specifically about the aftermath of the fire on the launching pad. Was the committee involved in reviewing mistakes?

Whinnery: Yes. The main mistake was in having so much flammable material inside the capsule, with a concentrated oxygen atmosphere. Certainly the management recognized and corrected that immediately.

Lage: That was one you might have wished you'd gotten to before.

Whinnery: Yes. In fact, I remember their telling us how great it was that they had discovered the usefulness of Velcro. They could use Velcro to fix things that would otherwise float around in the zero-gravity environment. But I guess no one realized the flammability of Velcro.

Lage: Oh, I didn't realize that.

Whinnery: A related issue was the escape mechanism for the astronauts in case of emergency. For Gemini there had been a slide cable from the capsule to the ground but the huge Titan rocket seemed too tall for this so that there was only the elevator. I think a cable was later installed but never used. In any event, it wouldn't have been helpful for this accident since the astronauts never got out of the capsule.

Lage: It seemed like there was lots of criticism of, in quotes, "NASA engineers." Did you feel it was a well-run program?

Whinnery: Yes, I think the success of this incredibly complex program answers that. Of course we had some worries along the way. I think the one which bothered us most was the moon lander, when we saw it at Grumman. It was built to withstand lunar gravity and not earth gravity, so it looked like a very flimsy thing. Of course, it had to be of low weight in order to be carried in the rockets, but we looked at it and said, "Gee, is that really going to hold the astronauts?"

Lage: Did you review the decision to make the landing? Weren't there questions about, should we make the landing now or should we do some more circumlunar flights, or do you remember any of that?

Whinnery: I don't remember any special controversy in the committee about that. By that time we had a lot of confidence in the NASA team. One of the big worries was the characteristic of the ground on the moon. There was something strange about the reflections from the moon, so Tommy Gold of Cornell believed that there might be a huge layer of dust, and that the landers would sink down in the dust. So there were orbiters taking close-up pictures of the moon, and eventually unmanned landers to settle that issue.

One of my worries was the period of about an hour and a half when the lunar orbiter was behind the moon and out of communication. I proposed a relay satellite to eliminate this blackout period but it was decided not to be necessary. So far as I know, that didn't prove to be a problem. George Mueller took all committee questions seriously, and often had a Bell Labs group (Bellcore) supplement the NASA analyses on these proposals.

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Lage: It sounds like a very good use of an outside committee, as you're describing it. Did you get to go and watch the launchings?

Whinnery: The committee did go to some of them, but I left the committee before the completion of the Apollo program, and did not go. The committee had moved on to the next phase after Apollo, concerned with manned flights to Mars, which is still an issue, and a manned grand tour to several planets. So the work of the committee for Apollo was really finished.

Lage: Before the actual landing on the moon?

Whinnery: Yes.

Lage: But still, it must have made you feel so involved in that.

Whinnery: Oh, yes. And nervous, particularly after being involved in the reliability study.

Lage: Yes, I would think so. I know there were a lot of questions about whether so much research money and government funding should go into this one purpose. Did you feel that it advanced the science in your field at all, or detracted from it?

Whinnery: The science was primarily lunar science. For persons interested in the moon, it was a tremendous, unique experience.

Lage: But what about communication?

Whinnery: I think in terms of communications and systems work, it certainly was sophisticated enough that it advanced that field. Whether it was cost-effective or not is another question. As we said before, it was really a political program and in that sense, it was successful.

National Research Council Telecommunications Committee, 1974-1976

Lage: I'd like you to comment on a committee that was worthless. [laughs] You mentioned there were several.

Whinnery: Okay. I'll tell you one that I think was nearly worthless--the Telecommunications Committee of the National Research Council. I say nearly, because the useful part was in getting together persons from different government agencies concerned with communications. In that way they could exchange ideas, coordinate programs, and avoid duplication much as in the Advisory Group on Electron Devices we discussed previously. But the industrial people on the committee didn't want to tell their future plans with their competitors on the committee.

Lage: So that just didn't work.

Whinnery: That made it very difficult to have a clear view of future trends. The other problem was that the chairman, a distinguished and charming person, didn't like controversy. So when a strong disagreement arose between members of the

committee, he tried to show that there wasn't really a difference of opinion when in fact there was.

Lage: So is the quality of the chairman important?

Whinnery: Yes, tremendously important.

Lage: It seems like it, from what you've described as a successful committee. How do you bring it all together, when you're chairing a committee and you have these divisive points of view?

Whinnery: You certainly let the views be expressed and hope that the discussion brings some agreement, or if not, at least a clarification of the issues. But it often gets repetitious, and sometimes heated, so that you have to think of some mechanism to stop that particular interchange. If it's an important issue, you may appoint a subcommittee, and if not, time may take care of it. One thing I found terribly important is summarizing at the end of each meeting the points of agreement, the issues remaining, and the work to be done before the next meeting.

Service on Industry Advisory Boards

Lage: Have you been on boards of directors for industry at all?

Whinnery: Yes. I was on a board of directors for Granger Associates, which is now Digital Switch Corporation. The most interesting board was a science advisory committee to Allied Corporation, which is now Allied Signal. Their research laboratories had some very interesting work, the work on tunable lasers, the first Alexandrite lasers, metallic glasses, conducting polymers --quite a number of things.

But probably the key to it was the nature of the committee. John Brauman from Stanford, Mildred Dresselhaus of MIT, Sir Sam Edwards of Cambridge University, Jim Krumhansl of Cornell, and Jeremy Knowles of Harvard were all outstanding people. As in other committees, the quality of the people you serve with makes the experience so valuable and enjoyable.

Lage: Is it different serving on an industry advisory board versus a government?

Whinnery: Not terribly. It's really the people you're dealing with that make the difference from one committee to another. Of course, the goals of industrial and governmental organizations are

different. The value of service on an industrial board for a university person is to have a better view of the goals and problems of industry.

Lage: Are there other committees you think we should talk about?

Whinnery: There are many others, but I think that's enough.

XI FAMILY LIFE AND LEISURE

Lage: I had the reaction, looking at your bio-bib and all you've done, how did you have a family life and any leisure life?

Whinnery: After I saw this on the list of things you wanted to talk about, I thought back and decided it may not have been fair to the family. With all the committees and professional conferences there were too many trips. And of course, the university job is more than a forty-hour week commitment. But I did try to save a part of each weekend, when I was home, to do something with the family. We have three daughters, and an arrangement we had for a while was for them to take turns picking what we should do. It might be a picnic, a trip to the ocean, the zoo, a restaurant, to Fairyland by Lake Merritt, or something like that.

Lage: Did you have dinner with the family usually?

Whinnery: There were of course quite a few dinner meetings in connection with my work, but I tried to get home for dinner whenever possible, and to have some time with the family before getting to work a few hours before bedtime. When the girls were little, I read them stories, some of which I made up. I do want to say how supportive my wife, Pat, was in all this. Sometimes she had to take care of a few crises while I was away. One was a big storm that brought mud all over our driveway and garage.

Lage: And she'd have to take care of that, plus all the children.

Whinnery: She had to take care of that. She was also supportive in all the moves that we made. We discussed them, but I don't remember any time where she argued against a particular decision.

Lage: Has she had a particular area of interest or activities in her own life? She didn't work, I'm assuming.

Whinnery: She worked at GE; that's where we met.

Lage: Right, but I mean after the family--

Whinnery: She has a farm in Iowa which she manages with the help of a local manager there. She has a number of hobbies. She used to play the violin, but she gave that up when she didn't practice enough, and couldn't stand the result. Golf and bridge are two of her favorites.

Lage: Those are very rewarding. Tell me about your daughters. They are grown?

Whinnery: Yes.

Lage: What directions have they gone in?

Whinnery: Carol, the eldest, works for Northrup in budgeting and scheduling. She was a psychology major, and she worked with emotionally disturbed kids for several years--very tough job, with autistic and schizophrenic kids. When the budget cuts came and a lot of these places had to let people go, she was out of a job. It turned out a nephew-in-law who was working at Northrup suggested she come in and apply for a job there, which she did. She's been there fifteen years or maybe more.

Lage: That was a big career change.

Whinnery: Yes.

The middle daughter, Cathy, is an M.D. She got her M.D. degree at Michigan State and practices in El Cerrito with two other doctors.

Lage: In what specialty?

Whinnery: Family practice. She has two girls, ten and fourteen.

Our youngest daughter, Barbara, is an actress. Her best role, financially anyway, was in "St. Elsewhere." For three years, she was on that pretty regularly. She was Dr. Cathy Martin, a pathologist. She has been on "Matlock," "Murder, She Wrote," "Jake and the Fatman," and just last week was on Dick Van Dyke's new program, "Diagnosis Murder." She loves the theater, but some of the plays she has been in are what they call "showcase"--no pay. It is a tough business.

Lage: Yes, but if you're really devoted, you're just happy to be working in the field. That's the impression I get.

Whinnery: That's right.

Lage: Anything else to say about family life? It sounds like you did very well managing, as much as possible.

Whinnery: I don't know. Of course I'm prejudiced, but I think them all wonderful people. The nice thing is that the girls are good friends and enjoy each other so much.

Lage: Do they have similar interests? Do they all enjoy similar activities?

Whinnery: There are many interests in common, but some differences. We used to take the family to plays and musical events, including the opera. When Carol left home, the other two pointed out, "You don't have to take us to opera any more, we don't really like that." [laughter] Why they didn't mention it before, I don't know.

Lage: What about outdoors? I know you did a lot of going to the beach and--?

Whinnery: Yes, they all love the ocean, hiking, and other outdoor activities. We did a lot of camping when the girls were home. We also went skiing several times each winter, and Cathy and Barbara still do. All play tennis a bit, and Carol likes golf but mostly plays just when she's visiting here.

Lage: Nobody followed along in the engineering field?

Whinnery: No. Both Carol and Cathy were interested in science when they were in junior high and the beginning of high school, but whether it was that they had some better teachers in other fields or something else, they both changed.

Lage: How old are the girls now? The women? [laughter]

Whinnery: Carol was born in '46, Cathy in '49, and Barbara in '53.

Lage: Well, I think we've done an admirable job covering all the many facets of your career and the College of Engineering.

Whinnery: I think we took too much time on me and not enough on the college, but--

Lage: Not at all. It has really been a pleasure for me to record this oral history with you.

Transcribed and Final Typed by Shannon Page

TAPE GUIDE--John R. Whinnery

APPENDICES--John R. Whinnery

Appendix A

GROWTH OF THE COLLEGE OF ENGINEERING[1]

This history will concentrate on the growth of engineering at Berkeley during the decade of the fifties, with emphasis on the period of Clark Kerr's chancellorship. It was a period of rapid growth, especially in reputation of the college, as will be seen. In order to place this period in context, it will be desirable to give some antecedents to this period, especially with respect to the immediate postwar period, and some sequel.

Engineering education in the U.S. before World War II was largely an undergraduate enterprise. It was that way at Berkeley, with a highly dedicated staff of teachers, several master's students, an occasional Ph.D., and only a few research projects which generally had to be carried out on a spare-time basis. MIT, Caltech, and a few other schools produced the majority of the engineering doctorates of the country. The average number of U.S. engineering doctorates over the period 1912 to 1951 was about seventy per year (1), as compared with 5424 for the year 1990 (2). The major change for engineering education came at the end of World War II when many ex-GIs, who had experienced high technology in their wartime assignments, decided to return, either to complete their undergraduate education or to undertake graduate study. At the same time, government agencies that had profited from high technology, with the Office of Naval Research as leader, began to make generous grants to universities for research. These two factors, occurring together, changed the character of engineering education dramatically.

Following World War II, Berkeley took part in the engineering enrollment crush and began to share in the federal research support. Its College of Engineering was considered of high quality, and some of its work (for example the civil engineering research on concrete) was known internationally. Yet it is unlikely that it would have been rated among the top ten engineering schools of the country at that time. (No formal rankings are available for that period.) In the American Council on Education rating of university programs in 1966, however, it was rated second only to that at MIT. This paper explores some of the ways in which this change came about. The major architect of the change was Morrough P. O'Brien, dean of the college from 1942 to 1958. So a major part of this history will be that of O'Brien during his tenure as dean of engineering at Berkeley, a story which has been told briefly in other tributes (3-5).

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[1]Draft essay prepared by John Whinnery for inclusion in Clark Kerr's in-process memoir, *The Gold and the Blue--A Personal Memoir of the University of California, Part I: First Chancellor at Berkeley, 1952-1958* (proposed title).

In reviewing O'Brien's accomplishments, one becomes especially impressed by his grasp of the overall nature of higher education and the necessity to improve all aspects in order to become first rate. Thus we will see his emphasis on improvement of faculty quality, student quality, revised curriculum, and on administrative arrangements necessary to bring about the needed changes. Lest this appear to be merely an exercise in hero worship, it should be made clear that many others played key roles in the evolution of the college, and that O'Brien made some mistakes. But no one who studies that period can doubt the importance of his imprint on the changes. The support and inspiration from President Sproul in the first part of his period as dean, and from Chancellor Kerr during the latter part of that period, were essential in the development of the college.

FACULTY IMPROVEMENT: In reading O'Brien's oral history (6), it seems clear that improvement of faculty quality was one of his first goals. Certainly a high quality faculty is essential for a high quality program. He describes his personal efforts in recruiting such persons as John Dorn, one of our outstanding materials scientists, Sam Schaaf, a mathematician who made major contributions to low-pressure aerodynamics, Earl Parker, who was later to receive the National Medal of Science, and Henry Schade, who would build the outstanding Naval Architecture program at Berkeley. Around 1950 he set up a confidential screening committee within the college to advise him on cases of appointment or promotion submitted by the departments. Persons of the quality of Dorn, Parker and Sam Silver, who would later head the Space Sciences Laboratory, were asked to serve on the committee. It set very high standards for appointment and promotion, and for the preparation of the case material to be submitted.

It will be noticed that many of the persons listed above came with backgrounds in science or mathematics. This was a surprise to many since O'Brien always emphasized the difference between engineering and the sciences, noting that the primary function of engineering is design, while that of science is discovery. But he also emphasized the importance of science in making new engineering approaches possible, and he recognized that this strength needed to be built up in the college. His goal was to have a mix of the two strengths.

STUDENT QUALITY: Student quality is also important for a first-rate program. Before the institution of the California Master Plan for Higher Education, many marginal students were admitted to the University, who had a rough time with the demanding engineering majors, as did other bright students who had little aptitude for the quantitative aspects of the program. Dropout and failure rates were high, and tremendous amounts of time were spent advising or working in office hours with students who would never graduate. O'Brien saw this as a major problem and somewhat surprisingly obtained permission and funds to institute screening

examinations for admission to the college at the freshman level, and for transfer to the college, or continuation in it, at the junior level.

The examinations were instituted early in his term as dean and continued until the early sixties when the Berkeley Academic Senate ruled them inconsistent with University policy on free choice of major by the student. (It should be noted that screening for individual majors is now allowed on the basis of program limitations.) The formulation of the examinations, their offering throughout the state, and their evaluation constituted a tremendous effort. According to studies made by the college, they did improve student quality as judged by grade-point averages and dropout rates but probably had achieved their major purpose by the time the program was ended.

With better students, a number of steps were taken to improve motivation and hence retention. Most of these steps will be reviewed in the section on curriculum, but one to be mentioned here is that of freshman advising. Freshmen were divided into groups of about fifteen, and faculty members who agreed to serve as advisors for one of these groups promised to meet with it several times during the year. Funds were provided so that at least one of these meetings could be in the advisor's home, or at the Faculty Club. Advising of all students was taken very seriously with essentially all faculty engaged in either undergraduate or graduate advising.

CURRICULUM: During the period of concern, freshmen were admitted to the college without declaration of major. The program for the first two years was common. Apart from the ideological argument that students should have some time to become acquainted with engineering before having to make the choice of major, there was the practical matter of junior transfers from the community colleges. These colleges typically had high quality programs for lower division science and engineering students but were small and could not possibly offer courses for a variety of engineering majors. The lower division program, set partly by tradition and partly by requirements of the accrediting agency (at that time, the Engineering Council for Professional Development) typically had two years of physics, a year of chemistry, two years of math, a course from the humanities or social sciences each term and an engineering course each term. The engineering courses were typically drafting, surveying, analytical mechanics, and an introduction to the profession.

O'Brien believed very much in the principle of the common lower division but did not think the specific engineering courses as they then existed very good for student motivation. He hoped to modernize the subject matter and also to involve more of the departments. (The list given above related primarily to civil and mechanical engineering.) After many hours of faculty meetings, four courses evolved, one for each semester of the lower division. The surveying course was replaced by a

general measurements course, with electrical engineering participating. The drafting course was expanded to emphasize graphical exposition and problem solution; the mechanics course was modernized and an entirely new course on engineering materials was introduced. This last course, organized by the excellent materials science faculty, was probably the most successful and is still required by most of our departments. The measurements course was the least successful, mainly because it was given before students had met the principles of the physical systems to be measured, or the statistical base for measurement theory. But at least there was change, and the sense of excitement that went with it.

The new engineering courses presented some problems to the community colleges but at that time there was a well-functioning liaison apparatus with all of these colleges that provided transfer students to Berkeley. They were kept informed, and summer institutes were given in Berkeley on the new course content. Clark Kerr, in praising O'Brien's relationship with the community colleges, stated, "While I had hoped that what engineering had done with the community colleges in the state might become the universitywide pattern in other fields, the record has been greatly disappointing. No one has ever come close to what was done by Mike in engineering." (5)

In addition to his concern with the engineering courses of the curriculum, O'Brien spent a great deal of time trying to improve the selection of courses in the humanities and social sciences taken by engineering students. Accredited engineering programs must have 20 to 25 percent of the courses in those fields, but they are all too often left to random selection by the students. Mike brought in consultants from other universities--such persons as John Burchard, then dean of humanities at MIT, and Phillipe LeCorbeiller, who gave courses in general education at Harvard. These persons spent much time talking with faculty members in Letters and Science and helped draw up some guidelines for selection and grouping of courses. Probably most innovative was a special course in the social sciences (Social Sciences 1A-B), originally started for engineering students by Lewis Feuer, Van Dusen Kennedy, and Eugene Burdick, but eventually popular with others. This course used original sources and greatly challenged the students. For the first time advisors found themselves engaged in arguments with students about the ideas of Freud, Karl Marx, and others. The course was required for engineering students from 1957 to 1964, but it became difficult to find teachers to replace the imaginative group that had designed the course. O'Brien, in his oral history (p. 143) blamed the termination on the general lack of respect for service courses.

Curricula were also begun in naval architecture and nuclear engineering, both later becoming distinguished departments. (Naval architecture operated for several years with only three faculty members, which seemed absurd organizationally to most outside persons, but it

became world-renowned and operated as smoothly as any department of the college.) A program of process engineering was less successful. O'Brien first tried to have chemical engineering brought into the college, as it is in many of the universities of the country. Members of that distinguished department were quite happy within the College of Chemistry and opposed the move. The program of process engineering was then set up within the college to cover some of the same processes, but was considered as duplicative or competitive by the chemical engineers and was terminated in 1961.

SPECIAL PROGRAMS: Two special programs are noteworthy. The engineering science major was instituted in 1947 with a program in engineering physics. It was an honors program and an interdisciplinary program, not assigned to a single department but with advisors in most of the engineering departments and in physics. It was assumed that most students in this major would continue for graduate work, and the program was designed so that they might continue either in an engineering department or in physics. The program was highly successful and has since been extended to engineering mathematics, engineering biology and engineering geosciences. There are currently 143 students in the engineering science programs, with many highly qualified applicants turned away.

A second important initiative was that of the Cooperative Work-Study Program. The idea of giving practical experience through work periods interleaved with study periods was not new. Antioch College required co-op experience of all students and among the engineering schools MIT was a leader. Because of the success of these, such a program was instituted at Berkeley. It was very successful and continues to be so. It is typical for the deans to receive calls or visits from worried parents of students who have elected the co-op program. They are concerned that it might interfere with the course work. Fortunately the data show that a student's GPA generally goes up, not down, after a period in the co-op program, presumably because of better motivation.

THE MAJOR INSTITUTES: Several important institutes were initiated in the decade following the war. Three of these, concerned with problems of importance to the state, were devoted to transportation and traffic, sanitary engineering, and water resources. (The Institute of Engineering Research was more of an administrative arm and will be discussed separately.) Before discussing the specifics of these, it is appropriate to say something about O'Brien's working style. He obviously had tremendous energy, and a continual search for better ways of doing things. He traveled a great deal (always with the proper leave forms filed, according to his oral history.) On his travels he engaged many persons in discussions concerning engineering in general and engineering education in particular. Gordon Brown of MIT, Harvey Brooks of Harvard, Ernst Weber of Brooklyn Polytechnic Institute, Thorndyke Saville of New

York University, George Hawkins of Purdue, and C. W. (Jim) LaPierre of the General Electric Company were ones he especially sought out and often quoted. Others, nearer to home, played a major role through the Engineering Advisory Council, to be described later. He also spent time with legislators in Sacramento and found Senator Randolph Collier especially concerned with problems of the state and anxious to enroll the university in help with these. This association appears to have been central to the formation of the transportation institute and possibly others.

The first of the three key institutes was that on Transportation and Traffic (now Institute of Transportation Studies), formed in 1947. O'Brien convinced Harmer Davis of civil engineering to direct the institute, and it became a leading center for long range research in transportation problems, but also a close-working and highly regarded resource for the traffic engineers and transportation system planners of the state.

A second major institute was the Sanitary Engineering Research Laboratory (now Sanitary Engineering and Environmental Health Research Laboratory), formed in 1950. Harold Gotaas, then chairman of civil engineering, played a major role in setting up this laboratory, recognizing the growing importance of the subject to the country and the need for bringing together engineers, biologists and chemists. Percy McGauhey followed Gotaas as director, and the outstanding faculty and research personnel rapidly made it one of the most innovative teaching and research centers for sanitary engineering in this country.

A third example is the Water Resources Center, set up by a grant of $100,000 in the Collier Bill of the 1956 California legislature. This is somewhat different in that it is a universitywide institution, and one including agricultural and legal aspects of water as well as engineering. Vice-President Harry Wellman played a major role in this and was head of the committee appointed by President Sproul to plan the program of the center. Berkeley engineering programs under the center included sea water conversion, headed by Everett Howe, aspects of the hydrology of underground reservoirs, and a unique archives for literature and unpublished material concerning water resources with emphasis on California (7).

FACILITIES: With the growth of the college and the special projects, space was a continuing problem. New engineering buildings included Cory Hall, completed in 1950, three additions to the mechanical engineering laboratories of Hesse Hall (the last of these emphasizing hydraulics and named after O'Brien), and planning for Etcheverry Hall, north of Hearst Avenue, housing mechanical, industrial and nuclear engineering. An example of forward-looking planning was in the decisions concerning Cory Hall. It was planned as a four-story building, but the appropriated

funds were found insufficient for this. Rather than cut to three stories, it was decided to build with four, but with the top floor unfinished. The space was quickly needed and the fourth floor completed in 1958. (Mezzanines were added later and a fifth floor with offices only in 1986.) The total addition of this on-campus space amounted to 262,000 assignable square feet.

Important additions were also made to the Richmond Field Station. This had been obtained from the former California Cap Company in 1950 for large-scale projects that could not be centered on the campus. Transportation projects, sanitary engineering, sea-water conversion, and earthquake engineering are examples of programs that could not have developed as they did without this facility. This property was obtained for $750,000 (an amount later recovered by sale of a portion to the Highway Department). Some groups resisted the separation from the campus, for example the low-pressure aerodynamics group that brought the wind tunnels back to the campus once space in Etcheverry was available, but those that had projects of even larger scope certainly welcomed it.

ADMINISTRATIVE STRUCTURE: Perhaps the most controversial of O'Brien's administrative arrangements was that of forming one Department of Engineering, with himself as chairperson. The former departments became divisions. This was done because budgets, faculty appointments and promotions, and many other critical matters originated in department offices, not in the colleges. It was first of all somewhat confusing. Colleagues have told of calling for an appointment with the dean, and when asked about the subject of concern, were told that this was a department matter and he would have to call that office for the appointment. More importantly, it became intolerable to the departments as they became strong, but it was an important arrangement during the building phase of the college. The arrangement was terminated in 1958.

When the divisions again became departments, O'Brien saw three of these, civil, mechanical, and electrical, as too big for ideal department size and convinced the first two to form divisions within the departments. The divisions of civil were structural engineering, transportation and traffic, and sanitary engineering, These worked well through most of their history. Mechanical divided into heat power, aero, applied mechanics, and engineering design. There was less harmony here, especially between the design-oriented and theoretically-oriented segments of the department, and in 1973 the separate divisions were abandoned. Even in civil engineering the divisions were felt to be somewhat artificial, as more and more interdisciplinary projects grew and somewhat duplicative in administrative matters, so were given up in 1986. Electrical engineering was invited to consider the matter of divisions also, and there did appear to be some advantages in this because of the matter of size, but the EE faculty was opposed. It now seems fortunate that there was not a division. So many of the innovations in EE have

come from work that at first seemed separate (communications and control, for example). This cooperation might have happened anyway, but probably not as easily.

The Institute of Engineering Research has already been mentioned. This was formed to help faculty make contact with potential support agencies, and to give help with budgets, writing of proposals, and other administrative matters. It was especially helpful in the early stages of sponsored research as all the faculty had to learn the interests of the growing number of support agencies and the ways to approach them. Henry Schade was its first distinguished director. Earl Parker and George Maslach followed and gave special emphasis to helping the young faculty members get started in research.

There was reorganization within the college offices, with very effective associate deans (Everett Howe and Clyne Garland among others) and assistant deans for graduate matters, undergraduate matters, and for the work-study program. The Engineering Advisory Council, consisting of eminent alumni and executives of major corporations of the area, was very effective in supporting the college programs both within the university and in Sacramento. There was also the beginnings of the Engineering Alumni Society, which is currently of invaluable help to the college in fundraising, working with students, and general support of the college. Finally one can't emphasize enough the importance and hard work of the senior staff, especially Frances Eberhart (then Woertendyke), Don Horning and Vi Lane. Clark Kerr, in his introduction to O'Brien's oral history (8), makes this point by the following statement: "A great secret of the administration of the University of California is that it is not really administered by the deans or the department chairmen or the chancellors or the president. It is run by an extremely good group of assistants like Fran Eberhart."

CONCLUSION: Although the decade of the fifties represented the most dramatic building period of the College of Engineering, important progress continued under the succeeding deans, J. R. Whinnery, G. J. Maslach, Ernest Kuh, Karl Pister, and (currently) David Hodges. Recent deans have been especially good in developing sources of funds from industry and individuals, with the Bechtel Center, the fifth floor of Cory Hall and the new Soda Hall all funded by such gifts. The Engineering Liaison Program, started by Dean Kuh, has been especially important in this process. The Berkeley engineering program remains one of the top two or three of the country and is highly respected internationally.

ELECTRICAL ENGINEERING: Electrical Engineering is chosen for a detailed look at one department because it is the largest of the engineering departments, and although all of the developments in the college affected the department, O'Brien played less of a direct role in its growth than

in departments such as mechanical engineering and materials science. (As explained earlier, all were divisions of a Department of Engineering during O'Brien's period as dean, but will be referred to as departments for simplicity.)

Electrical engineering was a sound but little known department in the prewar and immediate postwar period, but was ranked third after MIT and Stanford in the 1966 Carter Report and in the 1970 Roose and Anderson report. (Rankings were so close in the latter report that one might declare a tie for the first four, MIT, Stanford, Berkeley and Illinois.) The standing was maintained in a National Academy of Sciences ranking of graduate programs in 1982, with Berkeley tied with Stanford as close seconds to MIT. Clearly there was dramatic improvement in the two decades following the war, and the improvement was sound in that it has been maintained up to the present.

In 1946, at the end of World War II, the small faculty of eleven was swamped with the large number of returning GIs, as mentioned for engineering in general in the introduction. Many of the appointments made at that time were temporary ones required for the heavy teaching loads, but several important permanent appointments were made during Thomas McFarland's period as chair: O. J. M. Smith, R. M. Saunders, Sam Silver, D. J. Angelakos and D. H. Sloan. (The author's initial appointment was as a lecturer while completing work for his Ph.D., but was made permanent in 1948.) Saunders was a later department chair and still later, dean of engineering at UC Irvine. Silver was a later director of the Electronics Research Laboratory and still later director of the Space Sciences Laboratory. Sam played a major role in the building of the department. Angelakos was a later highly respected director of ERL.

The major sponsored research project in existence at the beginning of this period was an antenna project sponsored by the U.S. Navy's Bureau of Ships. (According to O'Brien's oral history, he was responsible for obtaining that grant.) The main focus of this project was the design and testing of shipboard antennas. Although a number of the measurements were routine, there was some excellent fundamental work, and several doctorates were obtained through work on the program. But around 1950 the navy decided to terminate the project. Silver, who had been concerned that much of the work didn't fit in a university environment, was successful in having the navy substitute a smaller, more fundamental program, sponsored by the Office of Naval Research. This remained one of the key programs of the department for years, finally being combined with other projects into a joint services program.

A second major program was concerned with high-power microwave tubes suitable for radar or radar countermeasures, set up by L. R. Marshall, who had returned from wartime assignments. This was sponsored by the

Wright Air Development Center and featured Sloan as the primary faculty researcher. Many excellent graduate students were educated in this laboratory, but there was a continuing problem in completing projects useful for the Air Force. The Air Force support was later channeled through the Air Force Office of Scientific Research with a more fundamental emphasis.

A third important program which was started in 1948 was one of the pioneering computer research programs of the country, started by Paul Morton with university and Office of Naval Research support. This project was extremely successful in educating students who became leaders in the new but rapidly growing computer industry and was the foundation on which the outstanding Berkeley computer program was eventually built.

Although there were some smaller sponsored programs, most of the graduate students were related to one of the three described above. But in the early fifties a number of problems arose because of different policies of the three laboratories, with some competition developing among them. Silver was appointed to head a committee to study the problem and this committee recommended formation of an Electronics Research Laboratory to coordinate policies and to help all faculty members in their search for research support. The recommendation was approved, and although Silver could have been its first director, he chose not to accept but convinced the author to return from a leave at the Hughes Research and Development Laboratories to take the position. (The title used was vice chairman of the division in charge of the Electronics Research Laboratory, with title of director used only for later appointees.) This laboratory, with a number of dedicated directors, has been critical to the development of the department.

Cory Hall was completed in 1950, bringing the faculty together from several different locations and providing space for expansion. Paul Morton became chair in 1953, a year after Clark Kerr became chancellor and the dramatic buildup of the department began. Morton was a very well-organized person and gave attention to all aspects of the department, including curricular improvements, facilities, and faculty recruitment. Important faculty appointments during his chairmanship included V. H. Rumsey, Albert English, A. M. Hopkin, Harry Huskey, Eli Jury, A. S. Hoagland, Charles Susskind and D. O. Pederson. The Pederson appointment turned out to be a key appointment because of his help in recruiting other key persons, his administrative positions in the department, and because of his pioneering work in initiating integrated circuits work in a university setting, and later developing the most-used computer program for electronic circuit design (SPICE).

Student enrollments were growing much more rapidly than the faculty during Morton's tenure as chair, so, dissatisfied with the rate at which appointments were made available to the department, Morton resigned his

chairmanship. He wrote an angry letter to O'Brien explaining his feelings concerning lack of support. Matters were tense for a while but O'Brien presented the case to Chancellor Kerr and several new positions were made available to the department, at which point the author was asked to be chair. With the open positions, the period 1956 to 1959 continued as a period of rapid growth. In department meetings, and in discussions with an executive committee consisting of Morton, Silver, Saunders, Pederson and the chair, priorities were set with goals to build in the areas of computers, solid-state electronics, and the newly developing field of information theory to supplement the strength in microwaves and electromagnetics that had grown most rapidly after the war. Pederson played a key role in convincing former colleagues at Bell Laboratories, Ernest Kuh and Charles Desoer, to join the university. We heard (perhaps erroneously) that Lotfi Zadeh was planning to leave Columbia and were successful in convincing him to come to Berkeley. (He has made many contributions but is best known for his innovative work in developing fuzzy logic.) Shyh Wang and J. R. Singer came with expertise in solid state. A. R. Bergen, Aram Thomasian, and Alan Lichtenberg were appointed and T. E. Everhart (now President of Caltech) and Alan Trivelpiece (now director of Oak Ridge National Laboratory) were recruited. With these postwar appointees we had the core of an outstanding systems group (broader than the information theory group we had set out to build). Pederson was leading the solid-state electronics group into what would become the pioneering integrated-circuits group of the world. Wang and Singer were laying the groundwork for our later program in quantum and optical electronics, and Saunders, Hopkin, Smith, Bergen and Bourne were modernizing the power program with emphasis on broader aspects of energy conversion and control. Morton and Huskey, with some of the outstanding graduates of the Berkeley program--Hoagland, Torben Meisling and Douglas Englebart--were continuing to build the program in computers, but some of the young faculty left for industry. The major development in this area came later.

Important contributions were made also by a number of outstanding visitors, made possible through the Mackay endowment. Some were from industrial laboratories including the Bell Laboratories, IBM and GE. Some were from MIT, Harvard, Illinois and other top universities of the country, and some were distinguished international persons including Dennis Gabor, Harold Barlow and Balth van der Pol. Some of these gave full courses, others special seminars, and all helped to shape the research programs of the department.

With Directors Silver and Pederson the Electronics Research Laboratory was increasingly effective during this period in helping all faculty obtain research support, and in administering it when obtained. Uniform policies were applied to all graduate students supported through the laboratory. Perhaps the most significant achievement of Silver and Pederson was the success in having Berkeley added to the Joint Services

Electronics Program. This program was started during the war with four universities, and only two others had been added before the Berkeley addition. It was at that time a very broad program, with most of the EE faculty receiving some help from it, and with a considerable degree of freedom in choosing projects. There was also increasing support from a variety of agencies with the ERL budget increasing from $270,000 in 1953 to $1.2 million ten years later.

Growth in both quantity and quality has continued with a succession of outstanding chairpersons: Saunders, Zadeh, Kuh, Everhart, David Sakrison, George Turin, Donald Pederson, Eugene Wong, David Hodges, Paul Gray and, currently, David Messerschmitt. Leadership of the Electronics Research Laboratory continued strong with Angelakos, Paul Gray, W. G. Oldham and, currently, M. A. Lieberman succeeding Pederson. Computer Science, after a period as a separate department, was returned as a division in the Department of Electrical Engineering and Computer Sciences and has become one of the top computer science programs of the world. (The name change to Electrical Engineering and Computer Sciences actually occurred before the recombination and is now common in many universities of the country.) By membership in the academies, number of major awards received by the faculty, and number of NSF Presidential Awards received by young faculty, it is clear that the department is of top stature. The overall reputation of the university and the attractiveness of the Bay Area helped greatly in the recruiting, both of faculty and top students. During this time good people were available, and support funds readily obtainable for sound projects. But the contributions of many persons in the department, and the support of the dean and chancellor, were the absolutely essential elements in the successes.

REFERENCES

1. H. H. Armsby, "The Growth of Graduate Studies in Engineering," J. Engin. Ed. 45. 220-226, Nov. 1954.

2. Engineering Manpower Commission of the American Association of Engineering Societies, "Engineering and Technology Degrees, 1990."

3. Clark Kerr, "Mike O'Brien -- A Master Builder at Berkeley," Shore and Beach, 55, 31-33, July-Oct. 1987.

4. Robert L. Wiegel, "Biographical Sketch of Morrough P.O'Brien," ibid, pp 6-11.

5. John R. Whinnery, "Morrough P. O'Brien's Impact on Engineering Education," ibid, pp 34-36.

6. "Morrough P. O'Brien: Dean of the College of Engineering, Pioneer in Coastal Engineering, and Consultant to General Electric," an oral history conducted in 1986-1988 by Marilyn Ziebarth, Regional Oral History Office, The Bancroft Library, University of California at Berkeley, 1988.

7. Gerold J. Giefer, "California Water Resources Center Archives," Shore and Beach, 52, 27-28, July 1984.

8. Clark Kerr, Introduction to oral history, Ref.6, pp x-xi.

8. Engineering Manpower Commission of the American Association of Engineering Societies, "Engineering and Technology Degrees, 1990."

Appendix B

Selected Poems by John Whinnery

The Colorado poems, written a decade or so ago, are self-explanatory. My cousin tells me that I was misinformed about the drowning of the Curicanta Needle in the Black Canyon, so it will have to stand as a symbol for all the special formations that were submerged in the formation of the great reservoir. I have also been asked what it means to "rush the growler" in the Hinsdale poem. My dad said it was the term they used to send out for a bucket of beer.

"My Mind Now is a City" is from the Schenectady era, circa 1942. The White Mountain poems were composed while on a 1943 backpack trip in the Presidential Range, shortly after meeting Pat. The 22½ year anniversary verse was inspired as the coincidence struck me, passing St. Patrick's Cathedral in the snow, March 17, 1966. The idea-- and the title -- came immediately but it took some time to complete.

"Ferry Story" is a reminiscence of the rare but exciting trips to San Francisco during my student days at Cal. The poems from "Ecclesiates" to "Cormorant Steps" are from the Orinda areas or the North Coast.

There are of course dozens of "non-fattening" verse in the files and two examples are included.

READ, COLORADO

I

READ

The cynic says there is no Read;
I have a photo
Showing clearly "Read"
Upon a crossroad sign.
I have a map
With Read indelibly imprinted.
There once was more:
A red-brick school,
Two stores,
A station
Where the train from Crawford
Stopped for mail;
A small, white church
Where murderers (or liars)
Told their sins on cue
(And where I bid and won
My first squash pie
With girl to match.)

The land was poor
And gave its share of grief
To those who tilled.
My father toiled
But seldom reaped,
Perhaps because of luck,
Perhaps because leukemic cells
Grew even then within his veins,
Perhaps because
He loved his gadgets more.

Bu there was beauty
With the grief of that small valley:
Mesas, rivers, canyons;
Let's talk about the beauty.

II

GUNNISON RIVER

Each spring,
The Gunnison took part of our small farm,
The mud-bergs calving
From the steep adobe banks
Into the wild stream.
A cottonwood or two,
From the grove which magpies claimed
In summer,
Joined broken spruce and aspen
In the brown flood.
When this receded,
We had for recompense
A few yards of gravel
On the north side.
We picnicked there one time,
My father musing
On how to use
This legacy of rocks.

The river froze in winter;
Skaters warmed their toes,
Their wursts, their mallows
By huge bonfires.
My sisters skated;
I fell down.

I hadn't known it then,
But this small stretch of river
Was unique.
Born in high mountains,
Reared in dark canyons,
Destined for the greatest canyon
Of the world,
The Gunnison had little taste of farms.
No wonder it devoured them,
Poor or no.

III

PAONIA

If you want to be mean to your kid,
Take him to Paonia at cherry time,
Tell him that he can eat the cherries,
Or (not and but or)
Ice cream for lunch.
When I was young,
They thought the mixture killed you.

A gloss:
No self-respecting picnic,
Holiday, or family occasion
In western Colorado
Was possible without ice cream --
Hand-cranked, cream-rich,
And topped with berries of the season.
(But not cherries.)

Another gloss:
The cherries hung in brilliant bunches
From the trees,
Rich Bings,
The blood-red ox-hearts,
Bright Queen Annes
And tart pie cherries --
Tempting as Eve's apple.

The mystery:
I well recall the agonies of choice
But can't remember how it ended.
I think I fought the serpent for awhile,
And then succumbed,
Angry at myself
And those with stronger wills
Who'd have my just dessert.

By noon,
With crisp-fried chicken,
Home-baked rolls and cakes,
It's likely I recovered.
And after that I listened.
Uncle puffed his mellow pipe
And told, in living color,
Of his bouts and near escapes
From every lynx or bobcat
Wolf or mountain lion,
That observed us from the walls.

If you want to be nice to your kid,
Take her to Paonia at cherry time,
Tell her that she can eat the cherries,
And ice cream for lunch
(Of course in moderation.).

IV

THE BLACK CANYON

We were having a beer at Carmichaels,
Discussing what we most regretted.
I might not always answer "The Black Canyon,"
But did that night.
I regret that though I walked a few miles
of its tracks,
I did not ever ride the narrow-gauge
through the dark gorge;
I regret that the Curicanta Needle,
Symbol of my sister's school,
Is now drowned.

We walked in from Cimarron;
I suppose Dad was fishing
Or comforting the Model-T.
The track into the canyon
Went a mile or so,
Then turned to follow the wild river.
I recall the river's roar,
And slate-dark walls, rising
To the thin, blue stream of sky.

Years later,
You and I, Patricia,
Stood upon the eastern ridge,
Heard muted roar,
Filtered by the canyon walls,
Looked down the slate-dark chasm
To the thin, brown stream below.
Then on to Sapinero
Where the canyon, with its arms,
Now forms a monstrous lake.

John Muir
Decried the drowning of Hetch Hetchy:
'Better flood Milan,
Or Rheims, or Chartres,
Than this unique cathedral!
What say you, John, to Curicanta?
Surely Cleo's obelisk could go.

(But giant trout swim 'round it;
Fisherpersons tell me
'Fishing's great below!')

V

LIGHT (AND CIDER) FOR AUSTIN

For reasons most quixotic
My father bought a lightplant
For the tiny town of Austin
(Two dozen houses, I suppose.)
We moved up to the mesa,
A stone's throw from this folly.
My love of things electric
Began those days and grew.

The dynamo, mysterious,
Was driven by a Pelton;
Water came by ditches
Across adobe hills.
We walked the ditch by daylight,
At nightime with a lantern,
To plug the leaky tunnels
Small prairie dogs called home.

Our lunch, sardines and crackers,
While father checked the belting --
A lunch I thought delicious;
I taste its richness still.

In autumn, trucks and wagons
From orchards on the mesa
Brought Jonathons and winesaps
And much sweet cider flowed.
The Pelton drove the presses,
All hands filled up the barrels
While some of us took samples;
I taste the freshness still.

Do orchards on the mesa
Grow such sweet apples still?

VI

GRAND MESA

The view to the south wasn't much:
A few cottonwood
With parched adobe hills beyond.
North was something else:
That noble silhouette,
A hundred lakes,
The largest flat-top mountain
Of the world.

Sometime,
Between the first and second haying,
Dad felt the need to fish.
The model-T was packed by midnight,
Cranked by starlight,
And -- between the first and second Kaiser --
Stalled by dawn.
(Now isn't that a funny thing,
To name sweet streams
For World War's hated king?)
With water, skill and patience,
We finally chugged on.

The half-way point brought aspen,
Its virgin bark
Despoiled by fool's initials.
Farther on, dark spruce.
The hardened sap of spruce,
Chewed long enough makes gum
(If you have strength
And stomach for the flavor.)

We made our camp at Eggleston --
Upper? Lower? I forget.
And now mixed fragments of the week:
Much talk of flies:
Grey hackle, royal coachman;
Some talk of fish:
Rainbow, eastern brook;
Woodland paths with columbine,
Log rafts and cold, pure water.

Wakeup scents were frying fish,
Wood smoke, campfire coffee,
Mingled with the esters
From the pine and spruce.

One trip, asleep and shoeless,
I was bundled in the car
And spent that week
On moccasins from inner tubes.

Grand mesa,
Flat-top mountain of a hundred lakes,
Its noble profile
Framed for Read.

VII

LITTLE HINSDALE

Sometime,
Between the first and second haying,
Dad felt the need to fish.
Some years we wandered south,
By Cimarron,
Through Sapinero,
Gunnison, Lake City,
Over dread Slumgullion,
To Creede and Hermit Lakes
Where mother's folks farmed fish
And sweet grass hay from mountain meadows.

Lake City was her home --
A town of mines,
Saloons and mines;
a church or two -- and mines;
A lightplant and some mines:
Uncompaghre, Golden Fleece,
Ute and Ulay,
And other mines.

You've seen that picture of my mother,
I suppose:
A lovely girl of ten or so;
Her face serene but firm in character
As she was, all her life.

She called herself young mountain goat,
And claimed, when mad,
She'd climb the hill behind Lake City,
Brood upon the town,
Until her anger passed.
(Angry? Brooding? Mad?
Has anyone who knew her
Seen her so?)

I know so little
Of that light plant for Lake City.
I know two friends --
Her brother and her future spouse --
Fine-tuned the Peltons,
Swapped stories in the night,
Rushed growler on occasion,
And listened for each dissonance
In music of the dynamos
And working water.

Her parents came for mines,
Lost gold and silver in the mines,
But stayed to help make law
For this young state
And little Hinsdale.

VIII A CHILD'S CHRISTMAS IN READ

All holidays are special.

When the alternative
Was thinning sugar beets
In baking summer,
Or milking cows
In cold wet snow,
All holidays were special,
Some more than others --
Take Christmas:

The mesa known as Cedaredge
Was dusted with light snow.
Dad had his twenty-two
And four-ten shotgun,
Stalking rabbits
And the perfect tree.
The cedars there were dwarfed
And poor in symmetry,
But had a lovely scent
And would look great
With candles, paper chains
And popcorn, strung on string.
(Lighted candles? Paper chains?
Do you recall, at church,
When Santa Claus caught fire?
Recovered though, I guess;
The presents came as planned.)

Woman's work
(Aside from household chores
And milking cows
In cold, wet snow)
Was centered on the stove:
Christmas cookies,
Necessary candies:
Fudge, divinity,
White fondant and penoche,
Pies and cakes
For Christmas dinner.

Christmas eve brought popcorn,
Songs and restlessness,
then banishment to sleep.
(Sleep? On Christmas eve?
Not likely. Bells sound.
Heavy footsteps in the parlor --
No kid would stay abed
Except that Santa would then leave
With naught behind.

But morning came.
   Fruit and candy in the socks.
(How come Santa's candies
   Looked all like mom's?)
Bright-wrapped presents
   On the tree
And that one special gift
   Unwrapped below.

The scene now blurs.
There's play with Christmas gifts,
Games with relatives.
These and the feast
Made this a wondrous day.
(Almost as wondrous
   As in anticipation.)

MY MIND NOW IS A CITY

My mind now is a city, without plan,
Chaotic as the drabbest web of steel
That hides the light from poor undreaming man,
And throbs with groaning rail and pounding wheel.
The thousand architectures of my brain
Lie all confused, mad mixtures of design;
The small green parks that wait for sun and rain,
The hopeful spires of churches that are mine,
Are shadowed by the towers of steel and stone,
My hard technology, or lie too near
The cheap and tangled tenements I own
With shame. It is too late to pray, I fear,
The little quiet thoughts again to find
At graze in smooth green pastures of the mind.

NOTES FROM THE WHITE MOUNTAINS TO ONE AT HOME

I

IN A FEW WORDS

Not alone because you are to me all color
Have I found you this day
In each flame maple, golden birch,
Or rich composite mountain-side of color
In these fair New England hills.
Not alone because you are to me all poetry
Have I tried to tell in a few words
The quiet beauty of your love.

II

LESSON IN MAPLE LEAVES

They came, three and a dog,
Across the fall-plowed fields,
The stolen maple flame piled high in their arms.
The boy, behind now, ran a moment to catch up,
Stumbling,
For he looked downward at the branches he carried.
The look on his face, I think, was a puzzled one;
I had felt the same,
Wondering why in no single leaf and no single branch,
Though carefully selected,
Is there the beauty or fair share of all the beauty
In the total tree.
We'd passed,
And I'll not know what arch between great rooms,
What space above the fire,
What food piled table,
These would help make gay,
So gay, perhaps, the boy would half forget his question.
The lesson, though, if learned,
Is one taught pleasantly by maple leaves:
The whole is sum of all its parts,
A rule of cold geometry,
Has little application to its complex sisters,
Life, the hard one,
Or the soft one, beauty.

III

CHOCORUA

All day we had watched the sunset colors of fall leaves,
And though I love the sunsets,
I was thinking these more fair,
As if this were the sunset of a year
And so required a richer beauty
Than the sunset of a single day.
Now, at the lake backed by the horn-topped mountain,
The setting sun,
Amused, not angry at my fickleness,
Breathed colors second to no others
Through the long frail clouds.
And in the lake these pictures:
Tinted strata, tall tree-banks of color,
Image of the mountain,
Soft on the lake as on the tongue the name,
Chocorua, Chocorua,
The lake and mountain.
Having once seen these together,
You may not again think of the two apart.

IV

SCENE WITH MOON-SHADOWS

In the wood there were moon-shadows.
On the lake,
The smallest of lakes,
The water was so roughened by the wind
That it bore no single image of the moon,
Only a spattered pathway of light,
A thousand dancing mirrors;
And this spread and thinned,
Or raced its edge across the lake
With each new gust of wind.
The arc of sky,
Still darkly blue above the great ravine;
Now lighted leisurely some stars,
Not all familiar
For we'd lived too long in cities.
Near the lake,
A shadow's length above the water,
Flame points crackled,
Smoke threads rose in ordered patterns,
Changed, then lashed out fiercely
At the eddy-ends of wind.
Those who sat, or crouched,
Or moved about behind the shelter of the rock,
Cut birch in lengths to suit the flames,
Or talked,
Or watched these silent pictures:
Smoke and fire-fly sparks,
Stars and blown reflections,
Moon above the Bootspur,
And the woods with shadows.

Il y a Vingt-deux Ans

Twenty-two years ago today,
We in New York,
Our six-month anniversary;
You in green for Patrick,
With your blue eyes
And your Irish-fresh complexion
Set off by the flowers you loved:
Camellias.
(Camellias? Weeds in California,
But how special
In the east
In winter,
Pinned with love.)
I know I watched you
More than squirrels in Central Park,
More than all the long parade.

Il y a vingt-deux ans.
I in New York,
This time alone,
Snow falls along the Avenue;
The great cathedral's spires
Are white.
It was just here
I bought you that small pin,
And there you squeezed my hand,
And on that corner
That we stood to watch the scene.
There's no parade this year --
They say because of snows
But I,m the one that knows
The reason's you're not here.

FERRY STORY

244

In those days,
We took the K-train from College,
Down Alcatraz to the Bay.
The festive Sunday crowd
Watched ferries
Warp into their slips;
Names upon the land:
Klamath, Shasta,
Mendocino.
"You can't imagine the excitement
Of coming to The City
By the ferries of the Bay."

And what did we do in The City?
What does each provincial?
The zoo, the wharf
(Prawn to eat like peanuts
As we watched the North Beach fleet.)
Playland-at-the-Beach,
The great map in the Ferry Building,
Where are they now?
(Where are they now?)

For twenty cents
We rode the Sunday trolleys,
Buses, cable cars
From Here to There,
From To to Fro.

At evening, Lucca's;
Dark Sicilian grotto,
Lighted by the candles
In their wax-encrusted bottles:
Scents of bay and garlic,
Tarragon, oregano;
Tastes of strong-spiced pasta,
Antipasta, crusted breads
And soup in huge tureens.
The entrees, veal and fowl and ham
Etcetera;
(You could have all
At that one price:
Three-quarters of the dollar --
It was Depression.)
Wine and huge desserts.
(A few of that strong class
Survives.)

The ferries home
Passed lighted towers
That would, one day,
Be bridges;
The ferries would be restaurants
Or mud-encrusted skeletons
Beneath the Bay.

ECCLESIASTES 11:7
(Come 7:11)

"Truly the light is sweet
And a pleasant thing it is
For the eyes to behold the sun."
This lovely valley lies at our feet,
Slowly unfolding
As the night is done.
Light filtered through oak leaves
Is soft to the touch;
That falling on Roundtop
Has a quality such
We remember it all through the day.
The clouds near Diablo
Have started to burn;
By watching them closely
We silently learn
How the light brings new color to gray.
In this light, in this color,
Is truth understood
That by night was enveloped in dun.
Truly the "wisdom is good ...
And by it there is profit
To them that see the sun."

AKEBONO

"Loveliest of trees."

I shall miss most the trees
When climates change
Or when wild atoms
Blast our landscape
To a moonscape
Or a Texas plain.
But for the present
Look out from your window
To our trees.

You first sight redwoods,
Tall, symmetrical and dark --
A frame to all we see.
(Is this our finest tree?)
Then notice the madrone
With shy, light flowers
Among two shades of green
(As lovely as we've seen.)
Or oak with small crisp leaves,
Growing, falling, through the year.
(Live oak were always here.)
The native buckeye has its day,
Burnt in August, bright in May,
And pine and plum and apricot,
Each perfect in its way.
But for this week in April,
As with Housman I must go,
To watch each petal of the cherry
As it slowly melts its snow.

TYPHA LATIFOLIA

Cattails!
That's a funny name.
"Sausages-on-stick,"
I'd say.
We had enough when I was young --
The marsh along the railroad
Had cattails to our eyeballs!
Blackbirds in them sang:
"O-ka-lee; karak-la-ray."

En route to school
We pulled a few;
(Knights of the brandished
Sausage -- yeh!)
We liked them best when ripe --
Not dandelion ripe,
But whacks along the tracks
Made sure they flew.

Cattails!
Our little lake in Lafayette
Has some.
(But where are all the redwing
Blackbirds, singing
"O-ka-lee; karak-la-ray"?
And where are all the children
Sending winged seeds on their way?)

WHALE-WATCH AT SALT POINT

Not all geysers are faithful --
These geysers-of-the-sea least of all.
We see five in a minute,
Then none for awhile.
This sign explains:
The giant beasts blow several times
Along the surface,
Get their bellies full of air
And then dive deep.

And what shall we do
While the whales browse the depths?
There is really nothing to look at
But the wind-blown waves
Pounding the rocks,
The foaming rivulets
Working back to the sea,
The spume blown southward,
And gliding sea birds
Between the spray
And quiet sky.

CORMORANT STEPS

See that rock?
Not the far one --
The tall one nearer shore:
Notice how the North side's
Cut in steps.
I cannot tell if they were carved,
Or worn,
Or cast with molding of the rock;
I do not think the present users made them.

In some seasons
There's a cormorant on every step,
Watching mother sea.

The cormorant's an awkward bird
At times,
But not in flight
And not these sentinels on steps.

THE PEPPER WHEN HE PLEASES

At the kennel near the tunnel
She poured fennel through a funnel,
Added marjoram and thyme
(The latter just to rhyme)
And then with rare acumen
Put in just a touch of cumin,
Bay and sage and coriander --
All these fit for goose or gander --
But then careless in her hurry
Dumped in lots and lots of curry

Spice is nice; good spice entices,
But the merest pinch suffices.
Too much spice in rice or ices
In a trice brings on a crisis
(Even more at current prices).
As Osiris said to Isis,
"Hold the garlic on the pisces;
We Gods gotta watch such vices!"

Expressing Distress

Upon Learning that the Scallop,

Botticelli's Symbol for Aphrodite,

Is often a Hermaphrodite!

Some mollusks have gender
And others do not.
(Or to be more precise,
They have quite a lot,
With a he-cell
And she-cell
Right there in one sea shell,
So each single is really a pair.)
Thus we make this deduction:
When it comes to seduction,
It's a purely internal affair.

Curriculum Vitae

Appendix C

JOHN R. WHINNERY

University Professor Emeritus
Electrical Engineering and Computer Sciences

Specialization Field

Communications applications of lasers with emphasis on short-pulse phenomena.

Experience

John R. Whinnery was born in Read, Colorado, on July 26, 1916. He received the B.S. degree in Electrical Engineering from the University of California, Berkeley, in 1937, and the Ph.D. from the same institution in 1948. From 1937 to 1946 he was with the General Electric Company, Schenectady, New York, working on problems in waveguide discontinuities, microwave tubes, and applications to radar. During that period he was active in war training classes, and in 1945-46 held a part-time lectureship at Union College, Schenectady. Dr. Whinnery has been on the faculty of the University of California, Berkeley, since 1946, holding appointments as Lecturer, Associate Professor, and Professor. In 1980 he was appointed University Professor at the University of California. From 1952 to 1956 he directed the Electronics Research Laboratory; from 1956 to 1959 he was Chairman of the Electrical Engineering Department; from 1959 to 1963 he was Dean of the College of Engineering at Berkeley. On leaves from the University, he acted as head of the Microwave Tube Research Section of the Hughes Aircraft Company in 1951-52, and engaged in research in quantum electronics at the Bell Laboratories, Inc., Murray Hill, New Jersey, in 1963-64. He has held Visiting Professorship at the University of California, Santa Cruz and at the Stanford University. In 1959 he held a John Simon Guggenheim Fellowship at ETH, Zurich, Switzerland; in 1973-74 he held a Research Professorship in the Miller Institute of Basic Research in Science at UC Berkeley; in 1986 he had an appointment at California Institute of Technology on a Sherman Fairfield Distinguished Scholarship; and in May 1986 he was invited as Honorary Professor of Chengdu Institute of Radio Engineering, People's Republic of China.

Professional Services

John R.Whinnery has been on numerous government advisory committees, principal of which were the Advisory Group on Electron Devices DoD, the Science and Technology Advisory Committee to NASA for the Apollo program, the Standing Committee on Controlled Thermonuclear Research of the former Atomic Energy Commission, and several advisory committes for the National Science Foundation. He was on the Telecommunications Committee of NAE-NRC and Committee on Science and Public Policy (COSPUP) of NAS. He has been on visiting or advisory committees to the engineering schools of California Institute of Technology, Harvard University, Massachusetts Institute of Technology, Stanford University, Worcester Polytechnic Institute, Yale University as well as the other University of California campuses.

Awards and Honors

IEEE Fellow (1952)
John Simon Guggenheim Fellowship (1959)
National Academy of Engineering Member (1965)
IEEE Education Medal (1967)
National Academy of Sciences Member (1972)
ASEE Lamme Medal (1974)
Named as Outstanding Educator of America (1974)
IEEE MTTS Microwave Career Award (1976)
Optical Society of America Fellow (1978)
University Professor (1980)
American Academy of Arts and Sciences Fellow (1980)
UC Berkeley Engineering Alumni Society's Distinguished Alumni Award (1980)
IEEE Life Member (1982)
Member, Modesto (California) High School Hall of Fame (1983)
IEEE MTTS Centennial Medal Award (1984)
IEEE Medal of Honor (1985)
University Anniversary Commorative Medal of Chile's Catholic University (1986)
NAE Founders Award (1986)
The Berkeley Citation (1987)
American Association for the Advancement of Sciences Life Member (1988)
The Berkeley Fellows, UC Berkeley (1989)
IEEE MTT-S Distinguished Lecturer for the U.S. (1990)

Publications

See attached listing.

Society Memberships

American Association for the Advancement of Sciences
American Physical Society
IEEE
Optical Society of America
Sigma Xi
American Society of Engineering Education

PUBLICATION LIST

1. J. R. Whinnery, "Summary of Wave Types and Propagation Characteristics for Simple Wave Guides," General Electric Report, D. F. 26648, November 3, 1941.

2. J. R. Whinnery, "Skin Effect Formulas," Electronics, February 1942.

3. J. R. Whinnery, "Radial Transmission Lines," General Electric Report, D. F. 26659, April 25, 1948.

4. J. R. Whinnery, "Transmit Time Quantities Applicable to Grid-Separation Circuits," Part I, General Electric Report, D. F. 46210, July 28, 1942.

5. J. R. Whinnery, "Transmit Time Quantities Applicable to Grid-Separation Circuits," Part II, General Electric Report, D. F. 46218, October 22, 1942.

6. J. R. Whinnery, "Penetration of Pulse Fields into Conductors," General Electric Report, D. F. 46217, October 20, 1942.

7. J. R. Whinnery, "Study of Magnetron Equivalent Circuit by Network Analyzer," General Electric Report, D. F. 45246, April 5, 1943.

8. H. W. Jamieson, T. E. Robbins and J. R. Whinnery, "Equivalent Circuits for Capacitive Type Discontinuities in Rectangular Wave Guides," General Electric Report, D. F. 46252, July 5, 1943.

9. J. R. Whinnery, "Wave Guides of Foreshortened Cross Section," General Electric Report, D. F. 46253, July 8, 1943.

10. J. R. Whinnery, "Preliminary Report on Re-entrant Oscillator Theory," General Electric Report, D. F. 46256, August 2, 1943.

11. C. Concordia, W. Ridgeway, G. Kron and J. R. Whinnery, "Network Analyzer Studies of Electromagnetic Cavity Resonators," General Electric Report, D. F. 63060, August 31, 1943.

12. T. E. Robbins and J. R. Whinnery, "Cut-off for Circumferential Modes in Coaxial Lines," General Electric Report, D. F. 56260, September 24, 1943.

13. J. R. Whinnery, "Graphical Construction for Studying Impedience Transforming by Quadrupoles," General Electric Report, D. F. 46285, February 3, 1944.

14. J. R. Whinnery, "Cut-off in Guides Partially Filled with Dielectric," General Electric Report, D. F. 46288, April 12, 1944.

15. T. E. Robbins, "Equivalent Half-Wavelength and Quarter-Wavelength in Radial Lines," General Electric Report, D. F. 46289, April 13, 1944.

16. T. E. Robbins and J. R. Whinnery, "Equivalent T and Pi Networks for Radial Lines," General Electric Report, D. F. 46290, April 17, 1944.

17. J. R. Whinnery, "Basis for General Study of Microwave Triode Oscillators," General Electric Report, D. F. 46291, April 22, 1944.

18. T. E. Robbins and J. R. Whinnery, "Radial Line Discontinuities," General Electric Report, D. F. 46293, June 22, 1944.

19. J. R. Whinnery, "Resonant Line Shortened by Re-entrant Sections," General Electric Report, D. F. 78003, November 20, 1944.

20. J. R. Whinnery, "Power Loss in Linear Four Poles," General Electric Report, D. F. 78004, November 21, 1944.

21. H. W. Jamieson and J. R. Whinnery, "Equivalent Circuits for Discontinuities in Transmission Lines," Proc. IRE, Vol 32, pp 98-114, February 1944.

22. S. Ramo and J. R. Whinnery, "A New Approach to the Solution of High-Frequency Field Problems," Proc. IRE, Vol 32, pp 284-288, May 1944.

23. C. Concordia, W. Ridgeway, G. Kron and J. R. Whinnery, "Network Analyzer Studies of Electromagnetic Cavity Resonators," Proc. IRE, Vol 32, pp 360-367, June 1944.

24. H. W. Jamieson, T. E. Robbins, and J. R. Whinnery, "Coaxial Line Discontinuities," Proc. IRE, Vol 32, pp 695-709, November 1944.

25. S. Ramo and J. R. Whinnery, "Fields and Waves in Modern Radio," John Wiley & Sons, N. Y. Vii, 502 pages, 1944.

26. J. R. Whinnery, "Equations Useful in the Study of Microwave Networks by Equivalent Ideal Transformers," General Electric Report, D. F. 78007, January 2, 1945.

27. J. R. Whinnery, "Some Thermal Radiation Problems with Thin Wires," General Electric Report, D. F. 78009, February 6, 1945.

28. J. R. Whinnery, Review of "Tables of Associate Legendre Polynomials," Mathematical Tables Project by Columbia University Press, Proc. IRE, Vol 34, p 280, May 1945.

29. J. R. Whinnery, Review of "Electromagnetic Engineering," by Ronald W. P. King, McGraw-Hill, Waves and Electrons, Vol 1, No. 104, February 1946.

30. J. R. Whinnery, Review of "Tables of Arosin X: by Mathematical Tables, Project," by Columbia University Press, 1945, Waves and Electrons, Vol 1, No. 160, 1946.

31. J. R. Whinnery, "Coupling Between Parallel Wire Grids," General Electric Report, D. F. 78020, March 1946.

32. H. W. Jamieson and J. R. Whinnery, "Power Amplifiers with Disk-Seal Tubes," Proc. IRE, Vol 34, July 1946.

33. A. M. Gurewitsch and J. R. Whinnery, "Microwave Oscillators Using Disk-Seal Tubes," Proc. IRE, Vol 35, No. 5, May 1947.

34. J. R. Whinnery, Review of "Klystron Tubes," Proc. IRE, Vol 35, November 1947.

35. H. W. Jamieson and J. R. Whinnery, "Study of Transit-Time Effects in Disk Seal Power Amplifier Triodes," Proc. IRE, Vol 36, No. 1, January 1948.

36. J. R. Whinnery, "The Effect of Input Configuration Antenna Impedance," Journ. of Appl. Phys., Vol 21, October 1950.

37. T. T. Taylor and J. R. Whinnery, "Applications of Potential Theory to the Design of Linear Arrays," Journ. of Applied Physics, Vol 22, No. 1, 19-29, January 1951.

38. J. R. Whinnery, "Design of Microwave Filters," presented at Symposium on Modern Network Sunthesis, sponsored by Polytechnic Institute of Brooklyn, N. Y. April 1952.

39. J. R. Whinnery, "Some Notes on Oscillators Using Wave-Type Tubes," Hughes Technical Report No. 279, February 1952.

40. S. Ramo and J. R. Whinnery, "Fields and Waves in Modern Radio," John Wiley & Sons, 2nd edition, 1953.

41. H. R. Johnston and J. R. Whinnery, "Traveling Wave Tube Oscillators," Trans. of IRE, PGED-2, January 1953.

42. C. K. Birdsall and J. R. Whinnery, "Waves in an Electron Stream with General Admittance Walls," Journ. of Applied Physics, Vol 24, No. 3, pp 314-323, March 1953.

43. H. R. Johnston and J. R. Whinnery, "Traveling Wave Oscillator Tunes Electronically," Electronics, Vol 26, No. 8, August 1953.

44. J. R. Whinnery, "Noise Phenomena in the Region of the Potential Minimum," Trans. of IRE Elec. Dev., Vol ED-1, No. 4, December 1954.

45. D. C. Stinson and J. R. Whinnery, "Radial Line Discontinuities," Proc. IRE, Vol 43, No. 1, January 1955.

46. V. C. A. Ferraro and J. R. Whinnery, "Electromagnetic Theory," Proc. IRE, Vol 43, No. 4, April 1955.

47. W. H. Watson and J. R. Whinnery, "Study of a Plane Short on a Shielded Helix," Trans. of IRE Elec. Dev., Vol ED-2, No. 4, October 1955.

48. M. R. Currie and J. R. Whinnery, "The Cascade Backward-Wave Amplifier: A High-Gain Voltage-Tuned Filter for Microwaves," Proc. of IRE, Vol 43, No. 11, November 1955.

49. J. R. Whinnery, Review of "Principle of Electromagnetism," by E. B. Moultin, Proc. of IRE, Vol 44, No. 3, March 1956.

50. W. H. Watson, H. R. Jory and J. R. Whinnery, "Cascade Backward-wave Amplifiers," L'Onde Electrique, Numéro Spécial du Congrès Tubes Hyper-fréquences, Paris, Vol 36, pp 951- 961, November 1956.

51. S. Silver, D. J. Angelakos and J. R. Whinnery, "Dynamic Field Equations," American Institute of Physics Handbook, Sections 5b-8 to 5b-15, McGraw-Hill, 1957.

52. J. R. Singer, C. Susskind and J. R. Whinnery, "Basic Research in Microwave Electronics," IER Series 60, Issue 215, October 1958.

53. J. R. Whinnery, "History and Problems of Microwave Tube Noise," invited lecture given at Institute for Advanced Electrical Engineering of the Swiss Federal Institute of Technology of Zurich, May 4, 1959.

54. J. R. Whinnery, Remarks on "The Dynamics of Electron Beams, Sections 4-1 to 4-7, R. W. Gould ed.

55. J. R. Whinnery, "High-Frequency Effects on the Potential Minimum on Noise," IRE Trans. on Elec. Dev., Vol ED-7, No. 4, pp 218-230, October 1960.

56. J. R. Whinnery, "Traveling Wave Tube," McGraw-Hill Encyclopedia of Science and Technology, 1960.

57. J. R. Whinnery, "Backward Wave Tube," McGraw-Hill Encyclopedia of Science and Technology, 1960.

58. J. R. Whinnery, "Magnetron," McGraw-Hill Encyclopedia of Science and Technology, 1960.

59. J. R. Whinnery, "Klystron," McGraw-Hill Encyclopedia of Science and Technology, 1960.

60. J. R. Whinnery, "Microwave Tube," McGraw-Hill Encyclopedia of Science and Technology, 1960.

61. T. Van Duzer and J. R. Whinnery, "Noise Problems in Cross-Field Devices," presented at 3rd International Conference on Microwave Tube, Munich, May 1960.

62. T. Van Duzer and J. R. Whinnery, "High-Frequency Behavior of the Crossed-Field Potential Minimum," IRE Trans. Elec. Devices, Vol ED-8, No. 4, pp 331-341, July 1961.

63. J. R. Whinnery, "Perturbation of Cavity Resonator," Encyclopedia Dictionary of Physics, Pergamon Press, 1961.

64. J. R. Whinnery, ed., "State of the Art Report on Wide-Range Voltage Tuned Oscillators," Classified Signal Corps Report, 1961.

65. J. R. Whinnery, ed., "State of the Art Report on High-Power Microwave Tubes for Radar," Classified Signal Corps Report, 1961.

66. T. Van Duzer and J. R. Whinnery, "Noise in Crossed-Field Electron Beams," Academic Press, Chapter 4.8, 1961.

67. J. R. Whinnery, "Noise Transport in the Crossed-Field Diode," IEEE Elec. Dev., November 1963.

68. D. O. Pederson, J. J. Studer and J. R. Whinnery, "Introduction to Electronic Systems, Circuits and Devices," McGraw-Hill, 1964.

69. M. A. Pollack and J. R. Whinnery, "Noise Transport in the Crossed-Field Diode," IEEE Tran. on Elec. Dev., Vol ED-11, pp 81-89, March 1964.

70. R. C. Leite, R. S. Moore and J. R. Whinnery, "Low Absorption Measurements by Means of the Thermal Lens Effect Using, AN He-Ne Laser," Appl. Phys. Lett. Vol 5, No. 7, pp 141-143, October 1964.

71. J. P. Gordon, R. C. C. Leite, R. S. Moore, P. S. Porto and J. R. Whinnery, "Long-Transient Effects in Lasers with Inserted Liquid Samples," Journ. Appl. Physics, Vol 36, No. 1, pp 3-8, January 1965.

72. J. R. Whinnery, ed., "The World of Engineering," McGraw-Hill, 1965.

73. P. K. Tien, J. P. Gordon and J. R. Whinnery, "Focusing of a Light Beam of Gaussian Field Distribution in Continuous and Periodic Lens-Like Media," Proc. IEEE, Vol 53, No. 2, pp 129-136, February 1965.

74. S. Ramo, J. R. Whinnery and T. Van Duzer, "Fields and Waves in Communication Electronics," John Wiley & Sons, 1965.

75. J. R. Whinnery, "Advances in Microwave Devices," URSI Review of U.S. Work in Commission VII, General Assembly.

76. R. W. Gould, A. E. Siegman and J. R. Whinnery, "Progress in Radio Electronics," H. Heffner, ed., Radio Science, Vol 12, No. 12, pp 1379-1388, December 1966.

77. J. Kerdiles and J. R. Whinnery, "Acoustic Gas Lenses for Light," IEEE Trans. MTT, Vol 15, No. 5, pp 321-322, May 1967.

78. D. Auston, G. Hong and J. R. Whinnery, "Mode-switching of a Multi-Mode Laser for Information Coding," presented at IEEE Conference of Electronic Device Research, Montreal, June 1967.

79. D. T. Miller, F. Dabby and J. R. Whinnery, "Laser Measurement of Low Optical Absorption Coefficients," presented at IEEE Conference of Electronic Device Research, Montreal, June 1967.

80. D. T. Miller, F. Dabby and J. R. Whinnery, "Thermal Convection and Spherical Aberration Distortion of Laser Beams in Low-Loss Liquids," IEEE Journ. Quan. Elec., Vol QE-3, pp 382-383, September 1967.

81. J. R. Whinnery, "Thermal Effects in Liquids," presented at Institute for Defense Analysis High-Power Laser Propagation meeting, January 1968.

82. J. R. Whinnery, "Thermal Lens Effect in Laser Beams," IEEE Student Journal, Vol 6, No. 2, pp 7-10, March 1968.

83. J. W. Chu, C. V. Shank, F. Dabby and J. R. Whinnery, "Short-transient Effects in Lasers with Inserted Liquid Samples," IEEE Journ. Quan. Elec., Vol QE-4, p 42, May 1968.

84. F. W. Dabby and J. R. Whinnery, "Thermal Self-Focusing of Laser Beams in Lead Glasses," Appl. Phys. Ltrs., Vol 13, pp 284-286, October 1968.

85. G. W. Hong and J. R. Whinnery, "Switching of Phase-Locked States in the Intra-cavity Phase-Modulated He-Ne Laser," IEEE Journ. Quan. Elec., Vol QE-5, pp 516-520, July 1969.

86. F. W. Dabby, R. W. Boyko, C. Shank and J. R. Whinnery, "Short Time-Constant The Self-Defocusing of Laser Beams," IEEE Journ. of Quan. Elec., Vol QE-5, No. 10, pp 516-520, October 1969.

87. F. W. Dabby, T. K. Gustafson, Y. Kohanzadeh and J. R. Whinnery, "Thermally Self-Induced Phase Modulation of Laser Beams," Appl. Phys. Ltrs., Vol 16, pp 362-365, May 1970.

88. W. Streifer and J. R. Whinnery, "Analysis of a Dye Laser Tuned by Acousto-optic Filter," Appl. Phys. Ltrs., Vol 17, No 8, pp 335-337, October 1970.

89. J. R. Whinnery, "Educational Technology Assessment - National Academy of Engineering," presented at the Conference on Computers in Instruction, Rand Reports 718, NSF July 1971.

90. M. S. Chang, P. Burlamacchi, C. Hu and J. R. Whinnery, "Light Amplification in a Thin Film," Appl. Phys. Ltrs., Vol 20, No. 8, pp 313-314, January 1972.

91. J. R. Whinnery, assistant editor, "Optical Communications," report of National Science Foundation Grantee-User Meeting on Optical Communication Systems, University of Maryland, January 1972.

92. C. Hu and J. R. Whinnery, "New Thermooptical Measurement Method and a Comparison with Other Methods," Applied Optics, Vol 12, pp 72-79, January 1973.

93. J. R. Whinnery, "Thermal and Acoustic Interactions of Light Beams in Various Materials,"presented at NSF Grantee-User meeting on OCS, Rice University, September 1972, published in Proceedings.

94. J. R. Whinnery, "Optical Communication Devices - Recent Results using Liquid Crystals," presented at NSF Grantee-User meeting on OCS, UC Berkeley, May 1973, published in Proceedings.

95. C. Hu, N. Amer and J. R. Whinnery, "Liquid Crystals in Integrated Optics," presented at Conference on Laser Engineering and Applications, June 1973 and published IEEE Journ. Quan. Elec., Vol QE-9, pp 684-685, June 1973.

96. Y. Kohanzadeh, K. W. Ma and J. R. Whinnery, "Measurement of Refractive Index Change with Temperature Using Thermal Self-Phase Modulation," Applied Optics, Vol 12, pp 1584-1587, July 1973.

97. J. R. Whinnery, "Electromagnetic Waves," 20th Century Encyclopedia, Instituto della Enciclopedia Italiana, December 1973.

98. C. Hu, N. Amer and J. R. Whinnery, "Optical Deflection in Thin-Film Nematic-Liquid-Crystal Waveguides," IEEE Journ. of Quan. Elec., Vol QE-10, No. 2, February 1974.

99. C. Haug and J. R. Whinnery, "Experiments on Transverse Mode Locking of Circular Cylindrical Optical Beams and Certain Flat Beams," IEEE Journ. of Quan. Elec., Vol QE-10, No. 4, April 1974.

100. J. R. Whinnery, "Laser Measurement of Optical Absorption in Liquids," Accounts of Chemical Reseqrch, Vol 7, pp 225-231, June 1974.

101. C. Hu and J. R. Whinnery, "Field-Realigned Nematic Liquid Crystal Optical Waveguides," IEEE Journ. Quan. Elec., Vol QE-10, No. 17, July 1974.

102. C. Hu and J. R. Whinnery, "Losses of a Nematic Liquid-Crystal Optical Waveguide," Journ. of Opt. Soc. of America, Vol 64, No. 11, November 1974.

103. Y. Kohanzadeh, M. M. Carroll and J. R. Whinnery, "Thermoelastic Waves Generated by Laser Beams of Low Power," J. Acoust. Soc. Am., Vol 57, No. 1, January 1975.

104. R. V. Pole, E. M. Conwell, H. Kogelnik, P. K. Tien, A. Yariv, A. J. DeMaria and J. R. Whinnery, "Integrated Optics: A Report on the 2nd OSA Topical Meeting,", Appl. Opt., Vol 14, No. 3, pp 569-579, 1975.

105. S. Sheem and J. R. Whinnery, "Guiding by Single Curved Boundaries in Integrated Optics," Wave Electronics, Vol 1, No. 1, pp 61-68, 1974/1975.

106. S. Sheem and J. R. Whinnery, "Modes of a Curved Surface Waveguide for Integrated Optics," Wave Electronics, Vol 1, No. 2, pp 105-116, 1974/1975.

107. O. Teschke, A. Dienes and J. R. Whinnery, "Theory and Operation of High-Power CW and Long-Pulse Dye Lasers," IEEE Journ. of Quan. Elec. Vol QE-12, No. 7, pp 383-395, July 1976.

108. O. Teschke, A. Dienes and J. R. Whinnery, "Thermal Effects in Jet-Stream Dye Lasers," IEEE Journ. of Quan. Elec. Vol QE-12, No. 8, pp 513-515, August 1976.

109. Z. A. Yasa, A. Dienes and J. R. Whinnery, "Subpicosecond Pulses from a CW Double Mode-Locked Dye Laser," Appl. Phys. Ltrs., Vol. 30, No. 1, pp 24-26, January 1977.

110. C. Hu, Y. S. Kwon and J. R. Whinnery, "Liquid Crystal Waveguides for Integrated Optics," IEEE Journ. of Quan. Elec., Vol 13, No. 4, April 1977.

111. J. R. Whinnery, "Status of Integrated Optics and Some Unsolved Problems," Radio Science, Vol 12, No. 4, pp 491-498, August 1977.

112. S. Y. Wang, M. Heiblum, T. K. Gustafson and J. R. Whinnery, "Ultra Broad-band Integrated Non-Linear Device," presented at the International Conference on Integrated Optics and Optical Fiber Communication held in Tokyo, Japan, July 1977 and published in Technical Digest, Paper A3:3.

113. M. Heiblum, S. Y. Wang, T. K. Gustafson and J. R. Whinnery, "Characteristics of Integrated MOM Junctions at DC and at Optical Frequencies," IEEE Journ. of Quan. Elec., Vol QE-14, No. 3, March 1978.

114. E. Bourkoff, A. Dienes and J. R. Whinnery, "Parametric Study of Double Mode-Locking of the CW Dye Laser," Picosecond Phenomena, C. V. Shank, E. P. Ippen, S. L. Shapiro, editors, Springer-Verlag, pp 99-102, May 1978.

115. E. Bourkoff, A. Dienes and J. R. Whinnery, "Measurements of Picosecond Pulse Shapes for the Highly Synchronous CW Double Mode-Locked Dye Laser," Appl. Phys. Ltrs., Vol 34, No 7, pp 455-457, April 1979.

116. E. Bourkoff, A. Dienes and J. R. Whinnery, "Independent Tunability of the Double-Mode-Locked CW Dye Laser," Optics Ltrs., Vol 4, page 179, June 1979.

117. M. P. Guedes, T. K. Gustafson, M. Heiblum, D. P. Siu, C. W. Slayman, Y. Yasuoka and J. R. Whinnery, "Photoinduced Currents in Metal-Barrier-Metal Junctions," Radiation Energy Conversion in Space, Kenneth W. Billman, ed., Vol 61 of of Progress in Astonautics and Aeronautics.

118. J. A. Buck, K. K. Li and J. R. Whinnery, "Optoelectronic Switching in a Stub Transmission Line," Journ. Appl. Phys., Vol 51, No. 1, pp 769-771, January 1980.

119. V. V. Cherny, G. A. Juravlev and J. R. Whinnery, "A Multilayer Fiber Guide with Rectangular Core,", IEEE Trans. MTT, Vol 28, No. 4, April 1980.

120. J. A. Buck, A. Dienes and J. R. Whinnery, "Effects of Separated Absorption and Emission Spectra on Degenerate Four-Wave Mixing in Organic Dyes," Journ. of Opt. Soc. of Amer., Vol 71, No. 11, November 1981.

121. K. K. Li, A. Dienes and J. R. Whinnery, "Optoelectronic Pulse-Forming Networks with Novel Input and Output Junctions," presented at Sixth Topical meeting on Integrated and Guided-Wave Optics, Asilomar, California, January 1982.

122. K. K. Li, A. Dienes and J. R. Whinnery, "Optical Switches for Generation and Pulse Shaping of Ultra-Short Electrical Pulses," presented at Society of Photo-Optical Instrumentation Engineers (SPIE) meeting, Los Angeles, California January 1982.

123. G. Arjavalingam, A. Dienes and J. R. Whinnery, "Highly Synchronous Mode-Locked Picosecond Pulses at Two Wavelengths," Optics Ltrs., Vol 7, No. 5, pp 193-195, May 1982.

124. "G. Arjavalingam, A. Dienes, K. K. Li and J. R. Whinnery, "Double Mode Locking of Dye Lasers; Optoelectronic Switches Using Short Optical Pulses," presented at National Science Foundation Grantee-User meeting on Optical Communication Systems, UC Berkeley, California June 1982. Published in Proceedings.

125. K. K. Li, G. Arjavalingam, A. Dienes and J. R. Whinnery, "Single and Double Mode Locked Ring Dye Lasers Theory and Experiment," presented at Third Topical meeting on Picosecond Phenomena, Garmisch-Partenkirchen FRG, Germany, June 1982. IEEE JQE, Vol QE-19, pp 539-544, April 1983.

126. K. K. Li, A. Dienes and J. R. Whinnery, "Stability and Astigmatic Compensation Analysis of Five-Mirror Cavity for Mode-Locked Dye Lasers," Applied Optics, Vol 20, p 407, February 1981.

127. J. A. Buck, A. Dienes and J. R. Whinnery, "Tunable Phase Conjugate Signal Generation Through Two-Frequency Four-Wave Mixing in an Organic Dye," presented at the 12th International Quantum Electronics Conference, Munich, Germany, June 1982.

128. K. K. Li, G. Arjavalingam, A. Dienes and J. R. Whinnery, "Propagation of Picosecond Pulses on Microwave Striplines," IEEE Trans. on MTT, Vol 30, #8, August 1982.

129. J. R. Whinnery, K. K. Li and A. Dienes, "Picosecond Signal Transmission in Microstrip Transmission Lines," presented at the workshop on Picosecond Photoconductors and Applications, Los Alamos, New Mexico, August 1982.

130. H. J. Fink and J. R. Whinnery, "Slow Waves Guided by Parallel Plane Tape Guides," IEEE Trans. on MTT, Vol 30, #11, November 1982.

131. A. Dienes, G. Arjavalingam, J. H. Chang, G. Hasnain and J. R. Whinnery, "Dispersion of Picosecond Pulses in Striplines and in Fibers," presented at NSF Grantee-User Meeting on Optical Communications, MIT, Cambridge, Mass., June 1983.

132. G. Hasnain, G. Arjavalingam, A. Dienes and J. R. Whinnery, "Dispersion of Picosecond Pulses on Microstrip Transmission Lines," SPIE Proceedings, Fall 1983.

133. G. Hasnain, G. Arjavalingam, A. Dienes and J. R. Whinnery, "Distortion and Pulse Shaping of Short Electrical Pulses from Dispersion of Microstrip Lines," Nuclear Science Symposium, San Francisco, California, October 1983.

134. J. A. Buck, A. Dienes and J. R. Whinnery, "Cross Coupled Phase Conjugation through Two-Frequency-Four Wave Mixing in Dyes," IEEE JQE, Vol QE-19, #11, November 1983.

135. K. K. Li, A. Dienes and J. R. Whinnery, "Pulse Forming with Opto-electronic Switches," Picosecond Optoelectronic Devices, C. H. Lee, ed., Academic Press, 1984.

136. J. R. Whinnery, A. Dienes, H. Ansari, J. H. Chang and G. Hasnain, "Recent Results on Generation and Switching of Short Optical Pulses," presented at NSF Workshop on Optical Communications, UC San Diego, June 1984.

137. Y. Twu, A. Dienes, S. Wang and J. R. Whinnery, "High Power Coupled Ridge Waveguide Semiconductor Laser Arrays," Appl. Phys. Lett., Vol 45, #7, pp 709-711, October 1, 1984.

138. S. Ramo, J. R. Whinnery and T. Van Duzer, "Fields and Waves in Communication Electronics," 2nd ed., 817 pages, John Wiley & Sons, August 1984.

139. J. R. Whinnery, Book Review for AAAS Science, "Masers and Lasers" by M. Bertolotti, Vol 225, August 31, 1984.

140. Y. J. Twu, A. Dienes, S. Wang and J. R. Whinnery, "High Power Coupled Ridge Waveguide Semiconductor Laser Arrays", Appl. Phys. Lett., Vol. 45(7), pp 709-711, October 1, 1984.

141. H. Ansari, A. Dienes, J. R. Whinnery and G. Arjavalingam, "Subpicosecond Pulse Development in a Xenon-ion-laser pumped Colliding-pulse Mode Locking Dye Laser," Optical Society of America Annual Meeting, San Diego, November 1984, Abstract in JOSA A, Vol 1; 1278 November 1984.

142. J. H. Chang, A. Dienes, S. Wang and J. R. Whinnery, "Nonlinear Coupling Between Monolithic Guides for Optical Pulse Compression", Optical Society of America Annual Meeting, San Diego, November 1984, Abstract in JOSA A, Vol 1, p 1278, November 1984.

143. H. Ansari, A. Dienes and J. R. Whinnery, "Subpicosecond-pulse Development in a Colliding-pulse Mode-locking Dye Laser Pumped by a Pulsed Xenon Laser", Optics Letters, Vol 10(1), pp 19-21, January 1985.

144. Y. J. Twu, K. Chen, A. Dienes, S. Wang and J. R. Whinnery, "High Performance Index-guided Phase-locked Semiconductor Laser Arrays", IEEE Electronics Letters, Vol 21, No 8, pp 324-325, 11 April 1985.

145. Y. J. Twu, K. L. Chen, S. Wang, J. R. Whinnery, "Eigenmode Analysis of Phase-locked Semiconductor Laser Arrays", Appl. Phys. Lett., Vol. 48(1), January 6, 1986.

146. Y. J. Twu, K. Chen, S. Wang, J. R. Whinnery and A. Dienes, "Mode Characteristics of Phased-locked Semiconductor Lasers Arrays at and above Threshold", AT&T Bell Labs Technical Memo dated April 1986.

147. G. Hasnain, C. C. Hasnain and J. R. Whinnery, "Use of Doping Superlattices for Tunable Emitters and Modulators", Proceedings of NSF Workshop on Optical Nonlinearities, Fast Phenomena and Signal Processing, Optical Sciences Center, University of Arizona, pp 303=308, May 22-23, 1986.

148. G. Hasnain, A. Dienes and J. R. Whinnery, "Dispersion of Picosecond Pulses in Coplanar Transmission Lines", IEEE Trans. on MTT, Vol MTT-34, No. 6, pp 738-741, June 1986.

149. G. Hasnain, G. H. Dohler, J. R. Whinnery, J. N. Miller and A. Dienes, "First Observation of Efficient and Highly Tunable Room Temperature Electroluminescence from Gallium Arsenide Doping Superlattices", XIV International QE Conference 1986 at Moscone Center, San Francisco, June 9-13, 1986.

150. G. Hasnain, C. J. Chang-Hasnain, G. H. Dohler, J. N. Miller, N. M. Johnson, J. R. Whinnery and A. Dienes, "Tunable absorption and electroluminescence in GaAs doping superlattice", presented at the 2nd International Conference on Superlattices, Microstructures and Microdevices, Goteborg, Sweden, August 1986.

151. C. Chang-Hasnain, D. F. Welch, D. R. Scifres, J. R. Whinnery, A. Dienes and R. D. Burnham, "Diffraction-limited emission from a diode laser array in an apertured graded-index lens external cavity", Appl. Phys. Lett. 49, pp 614-616, September 15, 1986.

151. G. Hasnain, G. H. Dohler, J. R. Whinnery, J. N. Miller and A. Dienes, "Highly tunable and efficient room-temperature electroluminescence from GaAs doping superlattices", Appl. Phys. Lett. 49(20), pp 1357-1359, November 17, 1986.

152. C. J. Chang-Hasnain, G. Hasnain, N. M. Johnson, G. H. Dohler, J. N. Miller, J. R. Whinnery and A. Dienes, "Tunable electroabsorption in gallium arsenide doping superlattices", presented at SPIE's Advances in Semiconductor and Semiconductor Structures, March 22-27, 1987 in Bay Point, Florida, published in SPIE Proceedings, Vol. 797.

153. M. Ogura, M. C. Wu, W. Hsin and J. R. Whinnery, "Surface emitting laser diode with bent waveguide", Appl. Phys. Lett. Vol. 50(2), pp 705-707, March 23, 1987.

154. M. Ogura, M. C. Wu, W. Hsin, J. R. Whinnery and S. Wang, "Surface emitting laser diode with bent waveguide", presented at CLEO/IQEC 1987 Conference, Baltimore, Maryland, April 1987.

155. C. J. Chang-Hasnain, J. R. Whinnery, A. Dienes, J. Berger, D. R. Scifres, and W. Streifer, "Narrow single lobed emission with high power and high efficiency from an external cavity coupled laser array", Conference on Lasers and Electro-Optics, Baltimore, Maryland, Paper ThT11, April 1987.

156. C. J. Chang-Hasnain, G. Hasnain, N. M. Johnson, G. H. Dohler, J. N. Miller, J. R. Whinnery and A. Dienes, "Tunable electroabsorption in gallium arsenide doping superlattices", Appl. Phys. Lett. Vol. 50(4), pp 915-917, April 1987.

157. C. J. Chang-Hasnain, J. Berger, D. R. Scifres, W. Streifer, J. R. Whinnery and A. Dienes, "High power with high efficiency in a narrow single-lobed beam from a diode laser array in an external cavity", Appl. Phys. Lett. Vol. 50, pp 1466-1467, May 1987.

158. Y. Twu, S. Wang, J. R. Whinnery and A. Dienes, "Mode characteristics of phase-locked semiconductor laser arrays at and above threshold", IEEE Journ. Quant. Elec., Vol. QE-23, pp 788-795, June 1987.

159. M. Ogura, W. Hsin, M. C. Wu, S. Wang and J. R. Whinnery, S. C. Wang and J. J. Yang, "Surface-emitting laser diode with vertical GaAs/GaAlAs quarter-wavelength multilayers and lateral buried heterostructure", Appl. Phys. Lett., Vol. 51(21), pp 1655-1657, 23 November 1987.

160. W. Hsin, M. Ogura, J. P. Weber, S. C. Wang, J. J. Yang, M. C. Wu, S. Wang and J. R. Whinnery, "GaAs/AlGaAs surface emitting laser diode with vertical distributed feedback optical cavity and transverse junction buried heterostructure", presented at International Electron Devices Meeting, Washington, D.C., IEDM 87 Technical Digest, pp 792-795, December 1987.

162. C. J. Chang-Hasnain, G. Hasnain, G. H. Dohler, N. M. Johnson, J. N. Miller, J. R. Whinnery and A. Dienes, "Tunable electroabsorption and electroluminescence in GaAs doping superlattices", SPIE Proceedings, Vol 792, pp 45-49, 1987.

163. C. J. Hasnain, J. R. Whinnery, A. Dienes, W. Streifer and D. R. Scifres, "Theoretical analysis of the off-center aperture mirror external cavity laser array", Conference on Lasers and Electro-optics (CLEO), Anaheim, CA, April 27, 1988.

164. G. Hasnain, J. R. Whinnery, A. Dienes and D. Mars, "Wavelength bistable electroluminescence from GaAs doping superlattices", Conference on Lasers and Electro-optics (CLEO), Anaheim, CA, April 28, 1988.

165. G. Hasnain, C. Chang-Hasnain, A. Dienes and J. R. Whinnery, "Characteristics of a monolithically integrated doping superlattice optical circuit", Appl. Phys. Lett., Vol 52, pp 1765-1767, 23 May 1988.

166. S. P. Dijaili, J. S. Smith, J. R. Whinnery and A. Dienes, "A novel method of analyzing optical pulse propagation: dispersion matrices and its application to ultra-high-speed time division multiplexed systems", IEEE Lasers and Electro-optics Society 1988 LEOS Annual Meeting, November 2-4, 1988, Santa Clara Convention Center, Santa Clara, CA.

167. C. J. Chang-Hasnain, A. Dienes, J. R. Whinnery, W. Streifer and D. R. Scifres, "Characteristics of the off-centered apertured mirror external cavity laser array", Appl. Phys. Lett. 54(6), 6 February 1989, pp 484-486.

168. "Low Threshold Distributed Bragg Reflector Surface Emitting Laser Diode With Semiconductor Air-Bridge-Supported Top Mirror", W. Hsin, G. Du, J. K. Gamelin, K. J. Malloy, S. Wang and J. R. Whinnery, Electronic Letters, 1st March 1990, Vol. 26, No. 5.

169. J. R. Whinnery, "The Teaching of Electromagnetics", IEEE Transactions on Education, Vol 33, No. 1, pp 3-7, February 1990.

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Interviews on the History of The University of California

Documenting the history of the University of California has been a responsibility of the Regional Oral History Office since the Office was established in 1954. Oral history memoirs with University-related persons are listed below. They have been underwritten by the UC Berkeley Foundation, the Chancellor's Office, University departments, or by extramural funding for special projects. The oral histories, both tapes and transcripts, are open to scholarly use in The Bancroft Library. Bound, indexed copies of the transcripts are available at cost to manuscript libraries.

Adams, Frank, "Irrigation, Reclamation, and Water Administration," 1956, 491 pp.

Amerine, Maynard A., "The University of California and the State's Wine Industry," 1971, 142 pp. [UC Davis]

Amerine, Maynard A., "Wine Bibliographies and Taste Perception Studies," 1988, 91 pp. [UC Davis]

Bennett, Mary Woods, "A Career in Higher Education: Mills College 1935-1974," 1987, 278 pp.

Bierman, Jessie, "Maternal and Child Health in Montana, California, the U.S. Children's Bureau and WHO, 1926-1967," 1987, 246 pp.

Bird, Grace, "Leader in Junior College Education at Bakersfield and the University of California," two volumes, 1978, 342 pp.

Birge, Raymond Thayer, "Raymond Thayer Birge, Physicist," 1960, 395 pp.

Blaisdell, Allen C., "Foreign Students and the Berkeley International House, 1928-1961," 1968, 419 pp.

Blaisdell, Thomas C., Jr., "India and China in the World War I Era; New Deal and Marshall Plan; and University of California, Berkeley," 1991, 373 pp.

Blum, Henrik, (in process) Professor Emeritus, Health Policy & Planning

Bowker, Albert, "Sixth Chancellor, University of California, Berkeley, 1971-1980; Statistician, and National Leader in the Policies and Politics of Higher Education," 1995, 274 pp. $70

Brown, Delmer M., (in process) UC Berkeley History Department

Chaney, Ralph Works, "Paleobotanist, Conservationist," 1960, 277 pp.

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"UC Black Alumni Oral History Project."

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ANN LAGE

B.A., and M.A., in History, University of California, Berkeley.

Postgraduate studies, University of California, Berkeley, American history and education.

Chairman, Sierra Club History Committee, 1978-1986; oral history coordinator, 1974-present; Chairman, Sierra Club Library Committee, 1993-present.

Interviewer/Editor, Regional Oral History Office, in the fields of natural resources and the environment, university history, California political history, 1976-present.

Principal Editor, assistant office head, Regional Oral History Office, 1994-present.