RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY

NEW BRUNSWICK

AN INTERVIEW WITH ELMER C. EASTON

FOR THE

RUTGERS ORAL HISTORY ARCHIVES

WORLD WAR II * KOREAN WAR * VIETNAM WAR * COLD WAR

INTERVIEW CONDUCTED BY

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TRANSCRIPT BY

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[Editor's Note: This begins an interview with Elmer Easton, Part II, on August 22, 2008, in Piscataway, with Sandra Stewart Holyoak and Michael Geselowitz. This interview has also been filmed and made available for research by the IEEE History Center.]

Sandra Stewart Holyoak: For the record, please state where and when you were born.

Elmer Easton: I was born in Newark, New Jersey, at 200 North Third Street in a coldwater flat on December 23, 1909, which seems like a very long time ago. I think it was Dr. Campbell who delivered me. I went through the Newark Public School system. I attended kindergarten at the Sussex Avenue School; then we moved to 34 North 11th Street and I transferred to the Roseville Avenue primary school through fifth grade. I went to the Garfield Grammar School for grades sixth through eighth. I don't know how much detail you want in this.

Michael Geselowitz: That is okay, as much as you want to fill in. We are interested in your path that got you through engineering school, mainly.

EE: Yes, well, as a youngster, I always took things apart and tried to put them back together again. I guess I was almost born an engineer, [laughter] and my father used to tell me, I would ask him for tools, and he said, "No, no; give me a man who can make something with a stick," and that was his philosophy. I got very little of the specialized tools.

MG: Was he a craftsman?

EE: No. He was in the painting and decorating business, born in England, remarkable man, really, … had to go to work at the age of twelve. That's very hard work and, finally, came to the United States and started a painting business here, in Newark, and he did very well indeed in that. … When it came time for me to go to college, as you know from the previous episode that we had here [on July 21, 2008], I went to Lehigh [University] and I could qualify for a scholarship at that time, and I brought home the scholarship application and showed it to my father. … I remember, vividly, he just looked at it and he said, "Let's leave the money there for those who need it more than we do." Now, here was a man who went to work at the age of twelve, started his own small business, but he wasn't going to apply for a scholarship, because other people needed that money more than we did. He paid my tuition for Lehigh. … When I got into Lehigh, one of the teachers there, one of our professors, I'm sorry I can't remember his name, in the middle of a class, he interrupted his discussion, this was in electrical engineering, and he said, "I want to ask you fellows a question," and he says, "Who paid for your tuition? Who paid for your education here at Lehigh? Who paid for your education?" and he looked at me and I said, "My father, my father paid my tuition," and he went around the class in a similar fashion, and then, he finally said, "No, you only paid half of the cost of your education. Alumni and other friends of Lehigh have contributed enough to pay the other half," and that started me off on a, I can't call it philanthropy, but I made up my mind, at that very point, that, when I got out of college and got a job, I was going to pay back to Lehigh the half of that education cost that somebody else had paid for me.

MG: Wow.

EE: When I began to accumulate a few dollars, which it took a long time, I did contribute back to Lehigh. … Of course, then, I contributed back to Harvard, because Harvard did give me an education also, and I contributed to Rutgers, because I was working here at Rutgers and I had a great deal of respect and admiration for the institution and for … its students.

MG: You graduated from Lehigh with a master's degree in electrical engineering.

EE: Yes. I got a bachelor's degree at Lehigh, and then, I stayed on for a master's degree, because, when I got out [with] that bachelor's, in 1931, it was at the depth of the Depression. There were no jobs available anywhere. … People living today have no conception whatever of the difficulty we had in 1931. There was no unemployment compensation, there was no Medicare, there was no Social Security. [If] you were out of work, that was it; you were on your own. … Since I couldn't get a job, one of my professors at Lehigh said, "Why don't you apply for a fellowship here at Lehigh, get your master's degree?" I applied for the fellowship and I got the James Ward Packard Fellowship. The [founder of the] Packard Automobile Company was a Lehigh graduate and that fellowship gave me free tuition for my master's degree for two years. I was to work half time for the university, study half time, get my master's degree, and they would pay me seven-hundred-and-fifty dollars a year stipend, in addition to the free tuition. That was a marvelous opportunity, because, with seven-hundred-and-fifty dollars, I not only paid all my expenses, but I saved a little money. … When I got my master's degree, in 1934, then, I decided, things were still tight and one of my professors said, "Why don't you go on for a doctorate?" I decided, "Well, that's a good idea. I'll try that." I applied for … an application to Harvard and I was admitted up there. They gave me a scholarship, … free tuition, and I'd saved enough money from my fellowship at Lehigh that I could afford to go to Harvard for a year without impinging on my father's generosity. … At the end of that year, I ran out of funds and had to leave Harvard and come home, but that's a long, long story of how I got my doctorate, eventually, but I eventually did.

MG: According to our records, you joined IEEE [Institute of Electrical and Electronics Engineers] for the first time in 1933, when you received your master's degree.

EE: That's right.

MG: Do you remember why you chose to do that?

EE: Sure, because it was my field. I was an electrical engineer and very proud of it and, of course, IEEE did not exist at that time.

MG: Correct.

EE: It was the American Institute of Electrical Engineers. Lehigh had a chapter, incidentally.

MG: A student chapter?

EE: A student chapter.

MG: One of the student chapters, back in 1933.

EE: Yes. 1931, that was, and I was active in that. I was treasurer of that chapter and I got [to] going to the AIEE meetings of the Boston branch, the professional group. They were a great bunch, "fun raisers." "Fun raisers," without the "D," at all of their meetings, and do you want me to tell a little episode? …

MG: I would love to hear it. Is that okay, Sandra? We would love to hear an episode.

EE: All right. To give you an idea of what happened at the meetings of the AIEE, and one of the reasons why I was so happy that they did call me there, not only did I get information about electrical engineering, which was the primary reason for going, but we always had fun at those meetings, and we had … at Harvard, a distinguished professor, Chester Dawes, who wrote *Dawes Volumes I and II*, [*A Course in Electrical Engineering, Volume I: Direct Currents* and *Volume II: Alternating Currents*] famous textbooks in electrical engineering. … He was a very modest man, very quiet, shy man, and they had him sitting up at the head table at this meeting. … One of the waitresses went behind him and let out a scream, and she said, "That man pinched my leg," pointing to Chester Dawes, who turned red. [laughter] … Of course, the fellows who were running the meeting had put her up to this and so they kidded him about it and they said, "Well, just to make up for that, Chester, we're going to give you a prize, and the prize," … the language is not appropriate, but he says, "the prize we're going to give you is a hand-painted piss pot." [laughter] … They gave him the kind of pot you used to have under the bed, in those days, hand-painted, with his name on it, but that's the sort of thing, what I'm talking about, about a "fun raising" group of fellows. I was very active with the AIEE. …

MG: You stayed on at Harvard to teach radar during the war.

EE: Yes, I did, yes. [laughter] When I left Harvard, I told you I ran out of money, and I was looking for a job and … there weren't any jobs at all. … I've told you this story. Along about February, I got a call from a friend of mine who said there was a teaching job available at the Newark College of Engineering. Well, I lived in Newark at that time and I said, "I don't want to be in teaching. I want to be an engineer. I want to go out and make things, do things." He said, "Well, it's a job." [laughter] I went down to the Newark College of Engineering to look into this job. … The person had interviewed me and he told me that the professor who was teaching the course, in mathematics, incidentally, teaching this math course, had been driven right out of the classroom by this bunch of hell-raising students. He couldn't put up with them, so, he quit, he left. … They were very desperate to have somebody to take over at the beginning of the semester in February, and this was only a couple of weeks in advance. I said, "Well, I'm really not much interested in teaching, but I need a job," and he said he needed help. I said, "I'll take the job … and I'll keep it as long as I'm having fun at it." I got into the Newark College of Engineering, started teaching. [laughter] … I could see why they drove that other guy out of the college all together. They raised the devil when I got in there. I said, "Well, fine, I'll go along with you." We spent the whole hour there just having fun, telling jokes and cracking wise, and we did it the second period. … At the end of the second period, when I went back to my office, the tallest guy in the class, a big fellow, came, put his arm around me, said, "Okay, you win," [laughter] said, "You get back in that class next time, call them to order and we'll back you up."

I went in there and said, "Now, I'm the boss. We're going to study mathematics," and it worked fine, and I was in teaching ever since that time. Well, now, while I was at the Newark College of Engineering, war broke out, of course. The Japs invaded [bombed] Pearl Harbor, and I had finished my doctorate at that time, and when the war broke out I decided, "Maybe I'd better get into this thing." I tried to get into the Navy, because I was an electrical engineer, I was also a radio operator, and … the Navy needed both. I tried to get into the Navy, but they turned me down because of my sight. My sight was too poor. It was poor then because of astigmatism. Today, I have macular degeneration. I'm looking at you, but I can't see you. At any rate, I applied for the Navy. They turned me down. Then, I went into New York, to the Navy recruiting office there, and I thought, … since I was an electrical engineer and a radio operator, I might get a commission in the Navy through the officer's commission school. … While I was waiting for a response from the Navy, I got a call from Harvard, from this Chester Dawes, who I just told you that story about, [laughter] and he said, "We turned the whole university here over to the military and we've started a radar school and we need professors in electrical engineering who can teach radar." He said, "Can you come up? … We're desperate for help." Here I was, waiting for the Navy to tell me, and I get this call from Harvard and, of course, in those days, in the draft, you couldn't make any change without consulting your draft board. I immediately went to the draft board and said, "Here's the situation. I'm waiting to hear from the Navy; I get this call from Harvard to teach radar. What shall I do?" and, without any hesitation, they said, "Take the radar job."

MG: Had any of your master's or PhD work been on radar, or had it been in other fields?

EE: No, in other fields, but, you see, radar was very new at that time. … It'd just been developed, but, since I was in radio and communications, I had the background necessary for it. I went up there and I spent the entire war years at Harvard, and, as I just mentioned, the place was turned over entirely to the military. We had no civilian students, in engineering or physics or any of the sciences, and we were training officers and had many different laboratories there, all devoted to military operations, but I was on the radar side of it.

MG: Did you interact at all with the Rad Lab [Radiation Laboratory] people down at MIT [Massachusetts Institute of Technology]?

EE: Yes, yes, we did. The radar program was divided into two parts. We had what you called the basic theory. We taught the fellows how these things were put together and how to repair them if they broke down, and that was a lot of fun, because we would bugger up some part of the system, and then, have them try to find the fault, and then, teach them why they couldn't find it. We were giving them the basic training on how the thing worked, and then, at MIT, they had a further extension of that on the application of how these things worked into the specifics of a particular radar set, and, yes, we worked very closely together.

MG: I do not suppose you knew a young kid named [Theodore S.] Ted Saad.

EE: Saab?

MG: Saad, S-A-A-D.

EE: Not "D," no; there was a S-A-A-B there.

MG: No, this is Ted Saad. I know him well. He is about, I think, twelve years younger than you. He would have been a kid to you, but he was at the Rad Lab during that same period. I interviewed him a couple of years ago about the Rad Lab.

EE: Yes. He was at the Rad Lab?

MG: Yes.

EE: Yes; no, they were down the other end of the city, of Cambridge.

MG: I also know he was active in the AIEE chapter. I thought maybe you knew him that way.

EE: No, no.

MG: If you were a radio person, were you also involved in the IRE [Institute of Radio Engineers]?

EE: No, no, I wasn't. I became involved in that … incidentally, when IRE and AIEE merged to form the IEEE. That's when.

MG: Is that because of the students that Lehigh was focused on the AIEE, and so, you sort of got into it that way?

EE: I think so, yes, because, as I said, I was always interested in electricity and electrical engineering, and, when … they had the student branch of AIEE, I just had to belong to that, and I also belonged to the Radio Society. They had a radio society there as well. I belonged to a lot of things. [laughter]

MG: I know. I heard, from the first interview, you were a good joiner.

EE: Yes.

MG: You belong to many organizations. Okay, what happened after the war ended?

EE: After the war ended, they kept me on at Harvard and I became the assistant dean of the Faculty of Engineering at Harvard. … While I was at my office one day, I get a letter from Rutgers University, saying that my predecessor at Rutgers, Parker Daggett, wanted to return to teaching. They were looking for a replacement. Would I be interested in coming down for an interview? I thought, "Gee, here I am at Harvard, in a dean's office at Harvard, I had my own office, my own secretary, a good position, a good salary, why would I want to change?" I thought, "Well, I'll look into it anyway." I came down to Newark. Incidentally, we had a home in Newark, and I told you we lived there. … When the war broke out and I went to Harvard, we retained the house that we had normally lived in. We rented out the first two floors and kept the

third floor for ourselves, myself and my mother was living then. I could go back to that house in Newark, and I went back there for the interview with Dr. [Robert C.] Clothier, who was President of Rutgers at that time, and he offered me the job. … I distinctly remember, that was in the Winter of 1947, when we had that terrible blizzard that stopped all traffic in all directions in New Jersey, and I remember walking home from the railroad station in Newark to get to my house. Nothing was running, no taxis, no automobiles, no trolley cars, nothing, and I had to walk several miles through the snow, which was waist deep at points, to get to my home in Newark, but that's getting far adrift from what we're talking about here.

MG: No, it is interesting. It is an interesting part of the story.

EE: And that's how I got to Rutgers.

MG: Before you tell me what happened when you came to Rutgers, who recommended you, that they wrote you the letter? Did they know you were a New Jersey boy?

EE: Now, that's a very good question, and I really don't know, exactly, the answer. I had heard that a man, Dr. Bill Cole, who was a biologist, incidentally, … he was a biologist at Rutgers, and he had heard about me and had suggested my name. … There was another friend, Jack Newton, who had been a student of mine up at Harvard, incidentally, and he was working at Rutgers, and I think he may have had something to do with it, … suggested my name, but, at any rate, as I said, I was the assistant dean at Harvard when I got this invitation from Rutgers.

MG: What did you find when you took the job?

EE: [laughter] Well, I found a disaster, because, I have to go back a long way on this. How did I first meet Rutgers? … I'm repeating; is it okay to repeat?

SH: That is okay, please do.

EE: How did I first get involved with Rutgers? I had a Sunday school teacher, back in Newark, when I was just a teen; well, I was ten years old at the time, as a matter-of-fact. … He was a student in engineering at Rutgers and he lived in Newark, but he was going to school in New Brunswick at Rutgers. He was coming home weekends to teach the Sunday school class, and, one Saturday, he came to my house, picked me up and drove me down to New Brunswick, to see the Rutgers College of Engineering, and, at that time, I really was interested in medicine. I was going to study medicine, not engineering, [laughter] but this fellow got me interested in electrical engineering, and he was also a radio ham operator and he had built his own wireless set, as we called it in those days, and he showed me his wireless set and I was absolutely intrigued. … That contact with this Rutgers engineering student, who was my Sunday school teacher, got me down to Rutgers and got me to see a college of engineering for the first time. … It really turned me on to electrical engineering, and I distinctly remember going home that day from Rutgers and telling my father I'd changed my mind. I wasn't going to go into medicine, I was going to be an electrical engineer, and he said, … "Well, it's all right if you want to change your mind. You can go into engineering," but he said, "Why don't you go into something like civil engineering,

because, if you go into electrical engineering, you might be electrocuted?" That thought never occurred to me at all, but, at any rate, that got me started. [laughter]

MG: Now, you came full circle, because you came to Rutgers as a dean.

EE: … Came back to Rutgers, and that was my very first contact with a college of any sort, my first contact with engineering was at Rutgers, … back in 1923. That's a long time ago. …

MG: Now, you came back to Rutgers as the dean, and what did you find?

EE: Yes. … When I visited Rutgers in 1923, the [College of] Engineering was a pretty small operation. The whole thing was housed in what they called the Engineering Building, over on the College Avenue Campus, [Murray Hall], and there were only, fewer than two hundred students in the whole college, so that you could house them all in one building. When I came down for the interview, in 1948, the enrollment had shot up to over seven hundred, because of the returning veterans and the GI Bill. … Rutgers was trying to accommodate them by putting up a bunch of temporary barracks buildings, war-surplus barracks buildings, over on what we called University Heights. It's now Busch Campus, and when I got here, most of the students were housed in these temporary shacks, and my predecessor was going out of his mind trying to accommodate all these students. When I was interviewed, I thought, "Well, it's an awful mess here, but there's an opportunity to build," and I liked … the challenge to build something, and that's why, when the President offered me the job, I accepted it, with the understanding that I was going to build it. … I told the President, at the time, that, in order to build the school that I had in mind, … we would have to move off of the College Avenue Campus, there wasn't enough room there, and build some new buildings, … adequate to support maybe a couple of thousand students, over on the new campus, and he agreed with that. … That's the way we got started.

MG: Did Rutgers have a student branch of the AIEE at that time?

EE: No, no, did not.

MG: Did you encourage them to start one, because of your background?

EE: [laughter] I was afraid you were going to ask me that question, and I've been thinking about it all morning and I thought, "I don't recall that we ever had a student branch there."

MG: Your whole time, because there is one now? There is an IEEE student chapter there.

EE: Yes, yes. Well, I really can't say why we did not have one, except for the fact that I was primarily concerned, right from the beginning, with interdisciplinary engineering education. I wanted to get them all together, working as teams, and, also, working with people in the arts and sciences, and I set up several new curricula, including biomedical engineering, and, also, had set up five-year programs, combining programs in liberal arts with engineering. At the end of five years, you could get a BS degree, let's say, in electrical engineering and you can get a BA degree in music or philosophy or history, whatever you wanted. … I was concerned with that interdisciplinary activity.

MG: Were there a lot of other schools doing that at the time? That sounds very progressive.

EE: A few, a few, relatively few.

MG: Rutgers was a leader in that area.

EE: Well, I don't know that you would say it was a leader, but we were right in among the early ones, let's put it that way, yes. Lehigh had a program like that. They'd just started one, about the time that I did, or maybe a little earlier, but we were among the early ones at Rutgers.

MG: My other, related question was, I know there obviously was a local Central New Jersey Section of the IEEE and I was wondering if you got involved in it and if they were as much fun as the Boston gang. [laughter]

EE: No, they were not. The Princeton Section of IEEE was very active, and they served our whole area and I went to those meetings, sure, went to a lot of those meetings, but never like the ones up in Boston, much more sedate, much more professional. [laughter]

MG: Did you get involved in any way as an officer or did you just attend the meetings?

EE: No, I just attended the meetings. I became an officer in a lot of other things, but not that, and, of course, at Rutgers, … one of the first things I did was to set up the Rutgers Engineering Society, which was an alumni group, and I hope that's still in existence, but it's now part of the [Rutgers University] Alumni Association, and we were very active. I was very active in that and, of course, I got involved with the National Society of Professional Engineers and we had various chapters in that, where we had the Raritan Valley Division, Raritan Valley Section. I became president of that. …

MG: You said in the first interview that you got active in the ASEE, the American Society for Engineering Education.

EE: Oh, yes. I wanted very much to get Rutgers' name known throughout the country, and I saw a great opportunity by joining the ASEE, the American Society for Engineering Education, and that involved people from engineering colleges all over the country. … I immediately became quite involved in that, a member of the Deans' Council, because I was a dean, of course, and then, a member of the board, and then, the president of the national organization and we, the board and the organization, met in various parts of the country. … Wherever we went, I made very sure that the Rutgers College of Engineering was known for its presence there, yes; questions?

SH: Do you have more?

MG: Are you still comfortable running the video or do you just want to go to the audio?

EE: It's up to you.

MG: I am fine if you are okay.

SH: I would like to back up a bit to when you first came to Rutgers in 1948. You talked about the rebuilding program and the huge influx of students that had come to Rutgers on the GI Bill. What about the faculty? Had they left Rutgers to go to the war or had they stayed?

EE: No. Well, some did, some did, of course, but my predecessor had acquired enough faculty to handle the load.

SH: He had maintained it.

EE: With difficulty, I must say, but he did it.

SH: They had been teaching the ASTP [Army Specialized Training Program] program as well.

EE: Yes, yes.

SH: Was there competition among all the universities to try to pull faculty away to their programs, as you were pulled away from Harvard?

EE: I suppose there was. There had to be. [laughter]

SH: Did you work on trying to build up faculty as well?

EE: Sure, that was my first job, definitely my first job, because, … when Dr. Clothier, who was then the President, asked me what I would do if I were the dean, I said, "The first thing I would do would be to try to organize a faculty made up of distinguished professors from many different engineering fields," because Rutgers had only, really, three major fields, civil, electrical and mechanical. … That was my first job, was to get that faculty together, and then, to have that faculty not only teach students, but, also, conduct research to discover new bits of knowledge that we could build on in the future, and that was my primary function, to build a faculty, build a research program involving the faculty and the students, yes.

SH: Were you able to pull any students into the graduate program?

EE: Oh, yes, yes.

SH: Who had been at other institutions?

EE: Yes, we got them from all over, yes, especially from Europe. [laughter] …

SH: Can you talk a bit about the students that you brought in from Europe?

EE: Well, I don't know if I can talk about … any particular ones, but [for] one program that we had, in crystallography, we acquired, I acquired, somehow, … a professor who was very

competent in crystallography and he developed an excellent program there. I told him, when he came, I said, "I don't have a line for you. I don't have a faculty line here, but, if you can get enough research grants to pay your salary, I'll take a chance and bring you in here and we'll get started," and his name was Sigmund Weissmann, and that's how we got started. He came aboard with that understanding. Now, I have to give you an idea of what the situation was when I started here. Back in 1864, the State of New Jersey had declared Rutgers to be the land-grant college of the State of New Jersey, and that's how we started agriculture and mechanic arts, mechanic arts being now engineering. … The State created an agricultural experiment station, and an agricultural and an engineering experiment station, both. When I arrived, we had an engineering experiment station, and what do you suppose the budget was for that Engineering Experiment Station? eight thousand dollars a year, eight thousand dollars.

SH: Where was it located?

EE: You tell me. [laughter]

SH: Okay.

EE: I said, "Never mind this Engineering Experiment [Station]; we're not going to go do experimenting, we're going to do engineering research." I changed the name to the Bureau of Engineering Research, and then, started to run a business. We wrote contracts, contract proposals. [laughter] "Give us some money and we'll do some research," for industry and for the government, and we built up a research program that way, yes.

MG: Now, had students at that time; you were talking 1974, I think you said.

EE: Yes.

MG: Had students started to come from Asia?

EE: Oh, yes, yes.

MG: Already, at that point? Did Rutgers lure in some of those students?

EE: … I started to tell you about Dr. Weissmann and the crystallography. The Japanese were very much interested in crystallography also, and they had a professor over there, Dr. Tora Imura, and he and Sigmund Weissmann, somehow, got into contact. I don't know how they made this contact, but, at any rate, Dr. Imura got a leave of absence from his university in Japan to come over here and work with us, with Dr. Weissmann, and he was a fascinating man, and he and his wife sat around this table, when this table was a dining room table, and we had dinner together. … We made contacts with Japan at that time, and then, as I told you once before, the State Department called on me to go over to Korea, to investigate our foreign aid program. … On the way, I stopped in Japan and I met Dr. Imura over there and he introduced me to a lot of other Japanese and, through these contacts, we began to get an influx of Japanese students, and then, they came from India and from all over. If you were to go over there [to the College of Engineering] today and attend one of their seminars in electrical engineering, you'd find the

majority of them [are] foreigners, from countries outside the United States. We've become known and … they come to us from all over.

MG: What other changes did you see? You talked about, when you first got there, initiating this humanities option and the growing internationalization of the student body.

EE: Yes.

MG: I am curious to hear, over your long deanship, what other changes you saw, both in the education side, the requirements and the nature of the degree, and, also, the nature of the student body?

EE: Well, I became involved in the accreditation program for engineering education and we had an organization called the Engineers Council for Professional Development [ECPD], which was really connected, somewhat indirectly, with ASEE, and they set up standards for what would be considered good engineering education, so many courses in this field, so many in that field. … We always had a certain percentage of courses in the humanities and social studies, and, because of this accreditation program and because of all the studies that the ASEE had made and the ECPD had made, we began to get a sense of higher quality and more uniform adherence to broad education in engineering throughout the country, and I became very much involved in that. … I was director of the Region I, with the accreditation program, and had to accredit "E" colleges all over the New England states, New York and Puerto Rico, of all places. [laughter] I don't know whether I answered your question or not.

MG: No, you did. Was that organization the predecessor of ABET?

EE: Yes.

MG: Nowadays, there is actually a particular organization called ABET, which is the Accreditation Board for Engineering and Technology.

EE: Correct, correct, it was, yes.

[TAPE PAUSED]

MG: I was wondering if you could say a little more about, also, in that period, you mentioned your focus on interdisciplinary engineering. During the break, we were discussing that my father was a biomedical engineer and you started the biomedical engineering program here. What were the trends you saw on the technical side of engineering education while you were here? In other words, not the pedagogy side, but how did you see the content of the field changing over the years that you were dean?

EE: Oh, when computers came aboard, of course, because I recall, so plainly, when I was a student, we had to use slide rules, of course, which was a very powerful tool, but, when it came to long calculations, many additions, subtractions, multiplications, that sort of thing, with a degree of accuracy that you cannot get on a slide rule, we were stuck. … I remember that, when

I was a student of Lehigh, the department bought a hand-operated hand adding machine. You punched in the numbers, and then, pulled an arm, punched in some more numbers and pulled an arm, and I thought, "Now, this is solving my problem. I'm not going to make any more mistakes. I've got an adding machine," and I discovered that I made just as many mistakes with the adding machine, "garbage in, garbage out," but that was the beginning of my … experience with computational machinery, and then, of course, when I got to Rutgers; well, going back, during the war, of course, we began to develop computers, and a lot of this work was done up at Harvard, where I was. … I had nothing to do with it at the time. We had a man up there named Howard Aiken, who had made a mechanical calculating machine, which occupied more space than this house, all mechanical parts on it, and he could actually perform certain calculations, and then, of course, down at MIT, Vannevar Bush had his famous differential analyzer, which he built, mechanically, to solve differential equations. We were beginning to move in an area where we could solve problems that were just beyond our reach previously. We knew that if we could only do the arithmetic, we could get the problem solved, but it would take a lifetime to do that many calculations. Eventually, we began to develop, we, the whole profession, began to develop electronic calculating machines, computers, and, again, at Harvard, when I was up there, Howard Aiken built the first electronic computer, using vacuum tubes, and I remember that so very well.

MG: So, you saw, that's the famous Harvard Mark I.

EE: Mark I, that was the Mark I, and it involved thousands of vacuum tubes, which required a lot of power, and my part in the operation … simply was to help design the power supply to supply enough power to run this thing. … Of course, it occupied space, oh, an enormous amount of space, but that computer, during the war, was used to calculate Bessel functions, which are mathematical functions, which were very much in use by the artillery, which surprised me [to] no end, that the artillery was using Bessel functions to calculate where the shell should land, with a such-and-such trajectory. But, once we got that start, we were able to carry out problems, solve problems, that we could only think about before, but could not even begin to attack, because it would have taken a lifetime to do it. … Of course, at Rutgers, I was very anxious to get computers as soon as I could possibly get them. … I remember, one time, I had organized a symposium on computers and we had an open house, too, open to the public, and I had companies who had made all kinds of the early computers bring their computers to the old gym down there in New Brunswick and set up this demonstration. … That was 1952, as I recall, and to indicate the reaction of the public to all this, I got several letters from people who had attended the affair and had seen what computers could do, and I got one from a lady who said, "Have you no fear of God?" [laughter] She was afraid that we were producing machines that were going to replace human beings, I guess. I didn't know what she had in mind, but … those were the early days of computers, and we eventually got a Wang computer, I remember, paid forty thousand dollars for it, which was a lot of money in those days, a lot of money. … That helped us get started in computing, a punch card system, and then, we developed much more complex pieces of equipment. … I say "we;" the whole University did. The Math Department became very much involved in it and they had a whole math center. The Hill Center was put up in those days, … but it opened up; well, I'm repeating myself. It made it possible to do things that we could only think about before but could not even begin to attempt, because of the time that it would have taken to have done the work. … I found an interesting situation. When we first set up the computer system, we had an IBM system, a very elaborate one, and you had to type in your

commands. You'd make your own algorithms and punch it all in, and then, when you were ready, you'd type in the word, "Execute," and the machine would execute … what you had programmed it to do, and one of my professors, Robert Page, says, "Come down to the lab. I want to show you something." [laughter] This student had been down there and he had entered his algorithm, he wanted this work to be done, and then, he brought in the word, "Execute." He said, "E-X-A-C-U-T-E," [laughter] and the computer types back, "No such command." Then, he spelled 'execute' at least three different times, all wrong; each time, the computer said, "No such command," and he gave up and never got it. I don't know how many times I've told students to "learn how to spell."

MG: That is why you started the humanities/engineering joint program, probably. [laughter]

EE: That might have had something to do with it, but, no, that came along much later.

MG: Speaking of that, back to your education side, wearing your dean's hat, I am curious, the first computers were developed and designed and built by engineers, and it clearly had an engineering application, as you pointed out, in replacing the slide rule and extending engineering, especially electrical engineering, way beyond its previous boundaries.

EE: Sure, right, yes.

MG: Could you say something about the development of computer engineering as a discipline and computer science, and the tension between the Mathematics Department trying to take control of computers and the Engineering Department trying to keep control of computers?

EE: [laughter] Well, that's interesting. The Math Department, through the Hill Center [for the Mathematical Sciences], had the main computer, IBM, I forget the number, 360, whatever the number was, [the IBM System/360 mainframe], a big computer, and we had smaller computers.

MG: Like PDP-8s, PC12s.

EE: 1230, was that a number? The PDP-8 was a punch card one, punch tape. We had smaller computers that would feed into the big one and, on one occasion, I had a call from the fellow over in the Hill Center. He was mad. He said, … "One of your students has fouled up the computer." He says, "It's going to cost us at least twenty thousand dollars to repair this thing." I said, "Wait a minute, what's going on here?" I went down there, and we got an IBM technician to come in and find out what was wrong with this computer, and, of course, one of our engineering students had used it and it had failed when he was using it, there's no question about it, but the guy in the Math Department was complaining about my engineers had ruined this computer and it's going to cost thousands. It turned out that the student had done something that blew a fuse. The technician came along, put in a new fuse and we were all back in business. [laughter] I don't know whether I'm answering your question.

MG: You partially answered it, and that is a great answer. I am still curious about if you had tension, when you were the Dean of Engineering, with the Dean of Arts and Sciences saying that

certain teaching of computing should be in the Math or Computer Science Department and not in the Engineering Department, to be blunt, that is what I was getting at.

EE: Well, I can give you … a different example, totally different. My predecessor, Parker Daggett, had started a program called City and Regional Planning and he had brought in a professor, Ed Wilkins, who was knowledgeable in that field, and I inherited that program from Parker Daggett and I liked it and we were pushing it. … We had Ed Wilkins as the professor and, maybe, a couple of teaching assistants, and, getting back to your question, the Provost at that time, Richard Schlatter, suggested that maybe a program in city and regional planning should be in the College of Arts and Sciences and not in the College of Engineering, and I agreed with him. I said, "Fine. We started it, but you can have it." It moved over and, now, it's the Edward Bloustein School of [Planning and] Public Policy.

MG: Now, they have a whole college, right.

EE: Yes, but, yes, we got along very, very nicely in those regards. … Even though we had started it, I had no desire to maintain it when I could easily see that the bulk of the work in city and regional planning had to be in a field other than engineering; any other questions?

SH: What about the computers? Did you feel that the Computer Science Department should remain under Engineering or that it should fall under Math?

EE: Oh, yes. There are two aspects to this. One, somebody has to build the computers; [the] other, somebody has to use the computer. Now, there's no question in my mind that engineering should have control over the programs leading to the construction of computers. That's what engineers do, they build things, but, now, when it comes to the software, how to write a program, let's say in economics, I don't care whether that's an engineer who does that or somebody else does that. As a matter-of-fact, it probably is better for somebody in the Economics Department to set up that program software in how to solve an economics problem, … using a computer that engineers have designed. I separate it in terms of who builds it and who uses it, and there's a distinctness. … There's not a total difference.

MG: But, in-between, you have things like assembly language. In other words, someone has got to teach the computer, has to write a language that, then, the economist can use the language to write software.

EE: … That's just what I was saying. There's something between the building it and the using it; there's nobody in-between, shows you, … "How do you use this thing? Who writes the instructions? … How do you go from this point to some other point that you haven't done before?" Yes, there's an intermediate area there, definitely.

MG: Should that be engineers?

EE: You need a combination, because it's like in medicine and biomedical engineering. You not only need somebody who has a problem, [who] says, "I need to solve this problem. Here's my problem," and then, somebody has a machine over here and says, "Well, I think I know [that]

this machine might be able to solve that problem." You have to put the two of them together and find out how you put this need into that machine and come out with the right answer. … In Biomedical Engineering, for example, there's a program, the MRI, Magnetic Resonance Imaging, program, which is purely engineering, to develop that magnetic resonance imaging device, purely engineering, but physicians are the ones who use it all the time. … It occurred to me, way back when we started this program, for things like that, you needed somebody with a biomedical engineering program, education and engineering and education and medicine together, so that the fellow who's using the thing, the physician who's using this thing, will know what he's getting out of it because you can push a button and the answer comes up and you say, "Oh, yes, that's perfect." It may or may not be the answer to your question. You needed somebody in-between, the biomedical engineer, who can not only use the machine, but know what it is that he's getting out of the machine, or vice versa. Well, I'm drifting again.

MG: I think bioengineering is a particular area where that is true, like, if you look at the pacemaker.

EE: Yes.

MG: Earl Bakken, who invented the wearable pacemaker, worked very closely with [C. Walton] Lillehei, who was a surgeon. They needed both man's expertise or they could not have moved forward.

EE: Yes. Well, to go beyond that, … pacemaker, one of the first programs we had, research programs we had at Rutgers in biomedical engineering, was on the pacemaker. You know what a pacemaker does; it generates pulses of electricity which are fed into the heart and, each time the heart gets its pulse of electricity, the heart beats. It's easy, fairly easy, for an engineer to design a pacemaker that, let's say the doctor wants the heart to beat seventy-two times a minute. The engineer can design his pacemaker to make that thing go seventy-two times a minute, but suppose this fellow gets up and starts running. His body needs more blood. The heart's supposed to speed up and produce more blood. How do you get the pacemaker to speed up to match what the body needs? That was one of the research projects that we were on in biomedical engineering, and it was primarily an electrical engineering problem, run by the Electrical Engineering Department. … Of course, you needed physicians in there to tell you what they needed for the heart, and the engineer then says, "Yes, I'll provide what you need," and, of course, they have it now so that the physician, sitting in his office, can actually change the pacemaker rate over the telephone. [laughter] It's incredible. But, we also had one of our first projects on artificial hearts and heart assist devices, and we ran that in cooperation with Dr. [Adrian] Kantrowitz, who was a cardiologist in New York and one of the early workers on artificial hearts. We had that combination of a cardiologist working with our electrical engineers and mechanical engineers to build these artificial hearts, yes; any other questions?

SH: What were some of the other very early projects? You said you needed to go out and make it a business, make it pay for itself. What were some of the earliest ones that you remember, that were so unique, like this pacemaker project?

EE: Well, one of the early ones that we had was with the Army Signal Corps on voice recognition. Today, they have machines that recognize your voice. If you have a cell phone, a certain kind, and you want to call your home, you just pick up the cell phone and say, "Home," and the cell phone recognizes that voice … and punches in the number. Well, we did some of the very early work for the Army Signal Corps on voice recognition of electrical signals. That was way back.

MG: They were at Camp Evans at that time, still?

EE: … Fort Monmouth, at that time, yes. That was one of our early ones, but, oh, gosh, we got into all kinds of things. … In Ceramics, we got some fascinating programs in Ceramics. … Incidentally, Ceramics got started at Rutgers, I think about 1902, as a school for clay workers, to help people make better bricks in Perth Amboy, that sort of thing, a school for clay workers, and then, one of our early professors, John Koenig was taken on and he wanted to go beyond clay workers and go into a much broader branch of ceramics. He talked my predecessor, Parker Daggett, into taking ceramics into the College of Engineering, make it part of Engineering, and go on to a broader scale of activity, and we did a lot of broader scale activities. For example, one day, John Koenig came into my office and he had two little ceramic rings you could slip on your finger and he had a little glass tube, a little glass rod, … on this stool, sitting up. He put one of the little rings … over the glass tube and put the other one above it and the other one floated in the air, floated over it. I said, "Ceramics? They're magnets." Now, this was a first, because magnets, you always talk about iron, ferromagnetic materials, but these fellows in Ceramics had actually made a ceramic material that was magnetic, and they're used extensively now. … Practically every automobile has ceramic magnets in the generators. That was an exciting thing for me, to see that, and, on another occasion in Ceramics, John Philips came in, a professor. He had a paper bag with him. He said, "Dean, look at this. I want to show you something." He came over to my desk and he opens up the paper bag; broken glass all over the top of my desk. I said, "What's this?" He reached in his pocket. He pulled out a magnet and he picked up every piece of glass with a magnet; now, magnetic glass? Nobody ever heard of such a thing before, but our fellows had developed magnetic glass, and then, we got into fiber optics. Boy, that was exciting and we did some of the early work in fiber optics here at Rutgers, fascinating. Now, there's a whole fiber optics laboratory over there, transmitting light or very, very high frequency electrical signals through fiber optics, fascinating. Well, again, I'm drifting.

SH: No, you are not.

MG: No, it is interesting to know that Rutgers was a pioneer in so many of the areas of technology that, in fact, have proven themselves over the years. In fact, I am curious, a big issue now with universities is intellectual property and technology transfers.

EE: Yes, I know.

MG: Did you and the President talk about that? Did you get into that at all, how can we get some money for the University out of these basic discoveries, or was that not done in those days?

EE: … I know we had a lot of discussion about that, but, for instance, Selman Waksman's streptomycin, and, gosh, I got involved in that indirectly, the question of, "Who gets the money for that invention?" and, well, the story of that much better than I do, but we had, I don't know how to begin with this, a policy there that any member of the faculty could develop a patent, but the patent had to belong to the University under certain conditions, that the work was done at the University, paid for by the professor who was doing the work; I've forgotten it all. You're taking me back forty, fifty years, but that was a very big problem as soon as we began to see some profit in what could be obtained from these patents, and one of the things that I did, early in the game, was to set up, organize, what we called the Rutgers Engineering Associates. This was a group of companies that I talked to and convinced that they ought to come to Rutgers and help us, guide us in directions that would be of interest to industry, in research, and we got some interesting ideas from them. … Then, of course, the question always comes up, "Well, what happens? You take this idea and you use it in industry; who gets the credit for it?" I don't know how those things finally were resolved. I'm wandering again and I've lost the whole trail.

SH: No, I think you stayed right on, because you did not see how it finally finished.

EE: No, I didn't.

MG: It had not been resolved by the time you retired. Now, what actually happened was, Congress passed a law, after your time, in the early 1980s, I believe it was …

EE: That was after my time.

MG: … That made it easier for universities to keep patents, even if it was federal money, because a lot of the grant money is federal and, theoretically, that should belong to the people, but they allowed the universities to keep the patents and that changed the whole technology transfer field, radically, since your time.

EE: Yes. Well, we got a lot of money out of the National Science Foundation, of course. A number of times, I went down to Washington with my tin cup and my contract research proposals, oh, gee, yes. [laughter]

SH: What were some of the new departments that you saw develop under the Engineering Department while you were here?

EE: Well, of course, the major one was Chemical Engineering, because, when I came here, … as I said, there was only civil, electrical and mechanical, and there we were, in the middle of New Jersey, with the … leaders in the chemical industries in this state and we had no chemical engineering program here, and, of course, Dr. Clothier, who hired me, was well aware of that fact. My very first job was to organize the chemical engineering program. Of course, I told Dr. Clothier, "First, we've got to get a building to house it." We eventually did, some years later. Chemical Engineering was clearly one that we very much needed. Then, I set up another program in industrial engineering, and then, we got Ceramic Engineering and Materials Engineering, and then, we introduced Mechanical and Aerospace Engineering. We tacked on aerospace to mechanical engineering, [laughter] and I've got to tell you a story about this,

aerospace. … We used to have what they called the Deans' Council. It met with the President and it met over in Old Queens, in the President's Office. A bunch of deans, we were all sitting around, discussing the things at the University, and, while I was there, the Vice-President for Administration opened the door and he motioned to me … to come out. I excused myself from the President, went out, [and] said, "What's going on?" He said, "Some man just walked in off the street and he wants to give us a helicopter," [he] said, "You talk to him." [laughter] I said, "You want me to talk to the guy that just walked in off the street and wants to give us a helicopter?" I went in and met the man. We have no idea, to this day, why he walked in off the street. He lived in Florida, incidentally. My wheels started to turn, in my head, and I said, "Well, helicopter, we really don't need a helicopter, but I'll tell you one thing we do need is a supersonic wind tunnel." He said, "I'll give you one," just like that. I said, "Fine," and he gave us the supersonic wind tunnel, the money to build it; not only that, but he gave us a stipend, each year, to maintain the thing. His name was Emil Bueller and he was an aircraft engineer, designing unusual aircraft, one of which killed him, incidentally, but that's beside the point. Why he ever walked off the street, why he ever came to Rutgers, we have no idea, but he was a very good friend from that time on, but you wonder how you get things? Here I am, going out, beating my brains, trying to get contracts, money, money, money; here's a fellow who walks in off the street and gives us a supersonic wind tunnel. … But, that supersonic wind tunnel …

MG: Do not tell the Rutgers Foundation. [laughter]

EE: Got to tell you a story about that one. …

SH: Please do.

EE: Yes, to get the high-speed air through this supersonic wind tunnel, we had a huge tank, the size of this room, and we'd compress the air in that tank, fill it with high-pressure air. … Then, when everything was ready to get the supersonic air flow through it, supersonic, it's above the speed of sound, through the tunnel, the wind tunnel, we'd open up the valve and all this compressed air would shoot out into the wind tunnel, and then, it would go out through a pipe in the roof. … Of course, when it went off, it made a colossal noise [laughter] and I got a call from Mason Gross, who was then President of the University. He says to me, "What the hell is that noise over there?" I told him that was our new supersonic wind tunnel. He says, "Cut it down. Get rid of that noise." We had to design a huge muffler, like the muffler on your car, to muffle the sound coming out, but that supersonic wind tunnel gave us a lot of very interesting information, and it enabled us to tack on aerospace engineering to our title, and we've done a lot of interesting work on supersonic flow, flow of air over [and/or] through air foils, convolution at the tail-end of an aircraft and that sort of thing, fascinating work; any other questions?

SH: When did you start the Aerospace Department?

EE: Well, of course, we had Mechanical Engineering before I came here, and this was still the Mechanical Engineering [Department], but we had a man named Robert H. Page; incidentally, he just called me up the other day from his home in Texas. We keep in touch over the years, a nice guy. I hired him as the head of Mechanical Engineering and he was interested in this air flow and, of course, as soon as I was able to get him his wind tunnel, then, he was off to it, and then,

he brought in some very competent young fellows, who've gone off, at Rutgers, too, to take leading positions throughout the country. Bob Page, … after I retired, he left Rutgers, became dean out at Texas A&M, and then, retired from that and … has a chair professorship out at Texas A&M, and another one of our; oh, well, … they've gone all over the country.

SH: Good to hear. Did this tie-in with the space program, the satellite program? Was Rutgers right there as that developed?

EE: Yes, it was, but …

SH: NASA.

EE: It had no direct connection to it. No, I don't think so.

MG: What year was that, that the gentleman walked in off the street and gave you a supersonic wind tunnel? Do you remember?

EE: Gee, I don't, I don't. It could have been the late '50s. …

MG: It was early on in the development of astronautical [science].

EE: Oh, yes. … We had the new building. We moved into the new building in 1963, so, it had to be after that, but only shortly after that. It must have been mid or early '60s, yes, '63, '64, somewhere in there. That's when it was, yes.

SH: In light of the time, I think we will break for this session, with the caveat that we perhaps can come back again, if you are amenable?

EE: Oh, sure.

SH: All right. Thank you again.

MG: Thank you very much. It was fascinating. We really enjoyed it.

EE: Good to meet you.

SH: Thank you, and thank you, Michael Geselowitz, Director of IEEE.

MG: History Center.

----------END OF INTERVIEW----------

Reviewed by Rabeya Rahman 11/12/08
Reviewed by Shaun Illingworth 12/11/08
Reviewed by Sandra Stewart Holyoak 1/5/09
Reviewed by Elmer C. Easton 2/24/10