COMSAT HISTORY PROJECT

INTERVIEW WITH BURTON EDELSON

Interview with Dr. Burton Edelson
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TMS: The way I like to begin is by asking you, for the sake of our listeners--our prospective listeners--to sketch in how you came to COMSAT, what capacity you were brought on, and some of your early duties when you first joined COMSAT.

BE: I came to COMSAT the last day of 1967. I was retiring from the Navy and I came to work for Bill Pritchard, who at that time was Director of the then inchoate COMSAT Laboratories, at the time and I was Assistant Director of the Laboratories. I'll have to go back a little bit and tell you how I came to do that. I had been a naval officer and I had been involved in research and development and got involved in the very first early days of the space program by developing navigation and communications satellites for the Navy. Then I was selected to go over to the White House and I spent 3 years over there on what, at that time, was known as the National Aeronautics and Space Council, chaired by the Vice President of the United States and [which was] involved with formulating policy for the space program. I went over there in 1962; I was a Staff Specialist in, among other things, communications satellites. It was during that period of time that we wrote the legislation for the COMSAT Act and supported it through six different committees of Congress and then implemented the Act. We had to select the Incorporators for presidential appointment

and give governmental guidance to the formation of the Communications Satellite Corporation. We also set a government policy during that time which was to differentiate between the roles of the Department of Defense and the COMSAT Corporation in separating the military-commercial communications satellite systems.

I got an early vision of the company. Of course, I met with Dr. Charyk and John Johnson, who was also at NASA at that time and he was involved in....the various governmental committees that met. Another individual who was also involved at that time is Rich Colino, who was working for the FCC.

TMS: He was a staff attorney with them or something like that?

BE: Right. Most of the other people who were involved were legal; I was the only technical person on the job. I worked for a chap by the name of Ed Welch, who was Executive Secretary of the Council at that time, and Ed is the one who really authored the legislation, pushed it through Congress, and more than any individual could be called the "Father of the Communications Satellite Act;" and from that came COMSAT and from that, of course, as you know, came INTELSAT. Okay, then after three years there I left the White House agency and went back to the Navy, but I was posted with the Office of Naval Research in London and got involved at that time in setting up the British military communications satellite system, known as Skynet, and also the NATO communications satellite system.

It was during that time that I met Bill Pritchard who was then working for Aerospace Corporation. He came over to Europe as a technical consultant to them and it turns out he took the job of being the first Director of COMSAT Laboratories just at the time I was thinking of retiring from the Navy and going into industry and so he offered me a job as his assistant. I spent 5 years as Bill Pritchard's deputy at COMSAT Labs then he left and I become Director of the Labs for 6 years. That takes us from 1968 all the way through into the Spring of 1979 and then I was promoted to Vice President for Systems of the COMSAT Corporation for 2 years and then I went over to be Senior Vice President of COMSAT General. In early 1982, I came over here [to NASA]. The role I played in COMSAT was to formulate a research and development policy and capability. It was really an unusual opportunity in that Bill Pritchard and I, as a team,(and later after he left, I followed through on it) we had the opportunity to formulate a research laboratory starting from scratch. We helped to design and lay-out the building and to buy all of the laboratory equipment and facilities--a period which took a little bit over a year and a half--and then we moved into the building in late 1969. We hired all of the people, we created the organization, we decided what laboratories that they would have and what supporting facilities we would have. We organized the research programs: we decided on a course of work in microwave technology, and digital processing technology, spacecraft technology, physics and applied science and in systems work; and we pursued that.

Then we had to market the program and establish separate programs for INTELSAT R&D, for Corporate R&D and for Engineering support to all aspects of the company. As the company grew and got involved in business other than INTELSAT, we also started separate projects for COMSAT General and maritime communications and small earth stations, and so on. The thing that gave the company its technological experience and its reputation was our participation in INTELSAT. Our strength lay in our technical expertise and the technical expertise lay at COMSAT Laboratories. I had a feeling that in the most important way, we were contributing to COMSAT corporate health and well-being. It is my own opinion that as long as COMSAT stuck to its own field of technological knowledge and experience, they did very well from a reputation point of view and from a financial point of view. They started to go astray when they departed in different fields and fields where technology either wasn't important or whether the company didn't understand it and certainly in fields where they didn't have the management expertise or experience.

TMS: Well, it seems that although you haven't been at COMSAT all the time, you've been in a rather unique position to watch the development and commercializaton of satellite telecommunications. I'd like just briefly to drop back to your time with the National Aeronautics and Space Council at the White House. I have talked with Ed Welsh and he has his own particular perspective, a very good perspective, on the development of our national policy regarding satellite

communications under the Kennedy Administration. What are your recollections on it? How did the initial initiative for this policy develop? Who were the principle supporters of it? How did it evolve from the point where initial discussion began in the White House and in the Executive to the time where the Kennedy policy, in the form of an actionable Bill, was actually taken over to the Congress?

BE: Well, long before they ever launched the first satellite, people had thought about the fact that communication satellites would be very useful and the history, as you know, stems back from Arthur Clarke's original vision which he published in 1945. So that as soon as the first American satellites were launched in 1958, then a program of experimentation grew-up. In 1960, they had the Echo Satellite followed by the Relay and so on and so forth. So that was a very obvious and fertile field for exploitation. In the early days of the space program everyone was wondering why we were spending money and what we were pushing for. Was it just to keep up with the Russians or was there some value in it? The very obvious answer to that was: communications. Satellites were believed to be able to provide communications in a very efficient and effective manner and early experimentation had done so. So when Kennedy took on the Presidency in Spring of 1961, he was searching for certain initiatives and he asked the Space Council for a set of initiatives and they actually came up with two: The one which is very well known is the statement in the middle of the Spring on setting the goal to land a man on the moon safely in the

decade and return him to earth; and the second one was to make a major initiative to develop satellite communications for the benefit of all mankind and to do that through the private sector. There is a very significant and very important and very far reaching decision but I think it was over shadowed by the Apollo decision; but they were both made at the same time. The President issued a policy statement in July, 1961, which Ed Welsh wrote, that created that policy. Then, the Committee that I referred to, got together and started [the Committee] which Ed Welsh headed, and I which I later became Staff Specialist in, and which involved mostly lawyers, but they had to have at least one guy who knew what went on inside of the satellites and earth stations. They put all this together and submitted an Administration Bill. Meanwhile, the bill went over to Congress and there were two factions in Congress: one of them was a group of Democratic, liberal Congressmen and Senators; I guess Long was one and Kefauver was another.

TMS: Morris, I think was one of them.

BE: That wasn't my side of it. I can't remember. But there was a block of liberals who said that the technology was all developed with the taxpayers money and it would be wrong for the government to turn the benefits of that over to private industry. Then, on the other hand, there was a more conservative group who was pro-business and was dominated by AT&T-type of considerations, who felt that it should be turned over to the private sector and specifically to AT&T.

AT&T was willing to spend its own money to do it, they didn't need any help from the government, and it was the appropriate thing to do. It was Senator Kerr, I think, who supported that bill. So there were three initiatives, I think there were three bills pending at one time, but I'm not sure. There was the Administration's Bill, a Kerr Bill and a liberal Bill and it bounced around through various Houses of Congress (Ed Welsh can give you all the background on that) and through various committees. The bill that was finally passed was a compromise.

TMS: How did the compromise come into being in your recollection? Ed Welsh says that there was no particular compromise on the business; that this kind of new corporation involving joint ownership was really, the way he describes it, "quite what the Administration intended."

BE: The compromise as I remember it, and I suspect, first of all Ed knew more about it, and secondly, he kept more careful notes, but as I remember it, the compromise was that it would go to industry but that there would be a sharing. There would be a definite agreed role for the common carriers so that they could own not to exceed 50% and that the government retained a lot of right and power and the President would have the right to appoint certain Directors, (three Directors out of fifteen I think it was), and COMSAT was frequently referred to as a quasi-governmental agency. That has always been stoutly denied by everyone but to a certain extent it was half government and half private. It used governmental technology free of charge

and with a direct transfer. It was directed and regulated by the government. Some of the Directors were appointed by the government, but financially, it was completely private and all the stock was owned by the private sector. So it behaved very much like an arm of the State Department when it met with other countries. It behaved very much like a part of NASA with its access to technology and launch vehicles and other government proprietary and intellectual property rights, and so on. Its behavior was very much like the government in many ways, it was organized like the government, its policies were like the government. In the early days.....

TMS: When you say it was like the government what do you mean? What was it about the way COMSAT ran in the early days that reminded you particularly of the functioning of a government department or something along those lines?

BE: Its accent and sharing of....its organization and the way it handled its procurement, the way it handled its personnel, the way it was divided into staff and line functions very much like a government agency. A lot of that stemmed from the fact that Charyk came from the government and George Sampson, who was the first Vice President for Operations, organized Operations like a government agency. The only part that was not like the government was the Laboratories.

TMS: One more question before we go to your involvement with COMSAT directly, and that is in developing the national policy

and directing, or say mandating, creation of a new private entity, how did NASA feel about this? I realize you weren't involved directly with NASA at the time but it seems to me that there might have been some feeling here that, "This is something we could do. Why set this up with a private corporation and turn over a lot of technology that we helped to develop and expertise that we have, to this private agency whose kind of stealing our thunder." I don't want to put words in anybody's mouth, but was there that kind of feeling in your recollection?

BE: Yes, there was. Of course you really can't talk about how a government agency or a company feels, what you really talk about is how individuals felt. It is well known that the people up at AT&T were disappointed and resentful of the fact that another company was set up. In John Pierce's book, he deprecates the contribution that COMSAT made to the communications satellite industry or technology. At NASA here in the office of Leonard Jaffey, who was one of my predecessors in this office, Leonard and some of his folks, I think, were disappointed that COMSAT was in a position to take over a lot of the pioneering work in satellite communications and in fact, it was the establishment of COMSAT that later led unfortunately to NASA getting out of the communication satellite development business; a step which we (and I say we now because I'm NASA) lived to regret because the U.S. fell fairly far back in communication technology leadership by getting out of it.

In those early days though, COMSAT was such an outstanding success and made lot of very bold and correct decisions which are some of the things I think you might be interested in exploring. The first big decision they made was to go ahead with a geostationary orbit satellite. They undertook what later became Early Bird; and that was COMSAT's decision. It was only after they made the decision that INTELSAT was formed and only after INTELSAT was formed that INTELSAT endeavored to take over Early Bird from COMSAT and, of course, it [Early Bird] was a technical success and pioneered in the Atlantic Region. Early Bird, itself wasn't terribly successful financially. It lasted a good long time; AT&T put enough circuits over it for it to attract attention. But, it probably would not have spread traffic around the world if it hadn't have been, again, for NASA who came in with a set of requirements to provide satellite communication service in the Pacific Ocean and the Indian Ocean region in order to serve the .....

TMS: Apollo Program.

BE: Well, it was then the Gemini and later the Apollo Program. That is really what created the global system which came about through INTELSATS II and then III. So, COMSAT was very largely a government creation. Not only did they do the Act to form it, but they turned over all the technology to COMSAT to use and then created the traffic demand that allowed INTELSAT to

grow and become a worldwide system. It isn't often realized but in the early days when traffic grew in Europe (and later it was kind of interesting when it grew to the African nations and other places like that), that a very large percentage of the so-called commercial traffic, and in some countries 50% of the traffic, was U.S. Government traffic; was the telephone line that was leased by the U.S. embassy in that country or more frequently by U.S. military and related activities. Some countries would come in with only a requirement for 6 channels or something like that in the early days.

TMS: COMSAT owes evidently a great deal to the government and its needs and its patronage.

BE: Their entire existence. COMSAT's contribution to that was, in the very early days, the excellent technical decisions that were made and the development of succeeding generations of spacecraft which is the subject that I know most about and would at least like to talk a little bit about.

TMS: Go ahead.

BE: I think that a great (its not largely realized) but a great number of technologies were moved very far ahead by the existence of COMSAT Laboratories which undertook to develop technology across the whole spectrum of communications satellite systems.

TMS: We're getting a little ahead of ourselves. Since you were involved in the creation of COMSAT Labs why don't we, before we talk about the accomplishments of the Labs, talk a little bit about their formation. For instance, how did you decide what kind of research the Labs would undertake? For instance, if I can play devil's advocate, why didn't the Labs manufacture satellites; just as a broad kind of question? More specifically, why the particular areas of research that were chosen, how did you find them out and what were the kinds of challenges that faced you and Bill Pritchard in putting the Labs together in the first place? It is quite an undertaking to build a lab, a facility, as big as that from scratch.

BE: The concept of the Laboratory was Sig Reiger's. He really had a gut feeling that we needed a research and development capability and pushed for it. The support for the Labs came largely from the three AT&T Directors who were on COMSAT's Board and who were knowledgeable about the communications industry and so that COMSAT Labs was patterned very much after Bell Labs. We copied everything we could about Bell Labs. We went up there for advise and we talked to them a lot of times about their organization, about their personnel procedures, we copied their forms for recruiting people and for budgeting and how we set up our accounts and keeping track of research accounts and so on. The technologies that we would be involved in were really sort of dictated by communications satellite systems which consist of several different elements: satellites, earth stations, and transmission systems and the

different scientific and engineering disciplines. What a satellite system is is a radio link that goes from earth to the satellite and then back to earth and so we had to have a radio research laboratory and deal with radio equipment and the early days that was called the RF (Radio Frequency Lab) and its now called Microwave Laboratory. There was also baseband equipment which involves modulation and coding and transmission and so on. So we called that the Communication Processing Lab which came into being just at the time that the digital revolution was taking over. So, it became preeminent in digital communications in the world. Just, incidently, I can come back to it later if you're interested, there was a big infusion of Japanese technology because we had a leader in digital communications from Japan who came over, a chap by the name of Sekimoto. He came from Nippon Electric Co., spent a couple of years in the early days of COMSAT Laboratories, got the Labs started in digital techniques and then went back to Japan. And the gentleman is, incidentally today, president of Nippon Electric Company. In the early days of COMSAT Laboratories, we were really world leaders in digital communications and the only U.S. company that had any capability at all. There was no other capability in the United States, not in the Defense Department or not in any of the aerospace or communications industries. We were ahead even of the Bell Laboratories at that time.

There was obviously a requirement for spacecraft technologies in mechanical engineering and power system engineering and propulsion and so on; so we had a spacecraft

laboratory. There was an underlying requirement for applied science solid state physics and so on; so we formed a physics laboratory, and I think later it was called the Applied Science Laboratory. Of course, everything had to be put together in systems and so we had a Systems Laboratory. And those were the five laboratories and they still have them today with some minor modifications. We tried to get leaders in the field and we started out with some pretty high-powered individuals. In the early days, Lou Pollack, who later became my deputy of the Labs, was the leader in Microwave Technology; Fred Esch in Spacecraft Technology; John Puente, who went on to form Digital Communications Co. which later became MACOM, a leader in the field, was, following Sekimoto, the head of the Communications Processing Laboratory; Ed Rittner, who was the head of Applied Science; and the Systems Laboratory, was lead by Emiric Podracsky.

TMS: How did you get these people, acknowledged leaders in their field? It's quite an accomplishment for a new organization, (by organization, I'm referring to the Labs now), without a tremendous reputation to attract men of this stature?

BE: COMSAT had rapidly established a reputation and got a lot of publicity in those days and the people came from several sources, not many, but several sources to COMSAT Because most of the hiring was done first by Sid Metzger and then by Bill Pritchard, there was a large influx from RCA and ITT, both of which Sid knew, and which Bill followed up on. I guess the

two big sources for early technical people were RCA and ITT. A few NASA people came over from Goddard Spaceflight Center and other places. Then were several from the Applied Physics Lab at John Hopkins; Fred Esch brought them with him when he came, and other miscellaneous places.

TMS: Was there any problem in starting the Labs or a challenge that you recall as being particularly sticky or that you're particularly proud of having resolved?

BE: Well, we didn't resolve the sticky stuff.

TMS: I was going to add that, but I decided not to.

BE: The greatest problem we had and which the company I think still has, is appreciating the value of research and using it properly in the company and that's an ubiquitous problem; it happens all over. I know it's been true in the Bell System and at General Electric and I know it's true today in Ford and General Motors and other places. But even in a high technology company, like COMSAT, it surprised and discouraged me to find out how extremely difficult it was to transition between research and engineering; that is to say, to develop products in research and engineer them into the system so that they are useful. The company was extremely reluctant for example, to start using digital communications techniques when it was an obvious technical advantage and the company management just couldn't believe that there was a place for these digital techniques, there was just great opposition to it. Another

fact that was obvious is that small customer-premise earth stations were going to be very useful in the future. The company started out with very large remote earth stations way out in the country. By that I mean, the standard earth stations which were first used were a 100 feet in diameter and cost 5 million dollars and within a few years it was obvious that you could get by with earth stations that were 15 ft. in diameter and cost 50 thousand dollars.

TMS: They still have these behemoth stations.

BE: Yes, they [the management] were just very reluctant to make that change. Now, there were two things: one, the difficulty of getting old-time operators and experienced engineers to develop the new products of research and there also was, what you might call, the common carrier rate base syndrome where there thinking was: "Don't bring in any new high efficiency cost-saving technique because it will lower the rate base and cut our profits." To me, that was the most frustrating and difficult problems that we faced. But, the opportunities in research were glorious. Just to tick off a few of the things: we built the first digital modulators and coding equipment for satellite communications; we developed the echo control, echo canceller equipment multiple access, which is the the first digital echo canceller.

TMS: COMSAT still markets a varient, or I guess a later generation of that same device.

BE: We were very early into the time division sharing of communications capability in the satellite on a time basis rather than on a frequency basis. On the component level, we developed microwave integrated circuits and a number of variations on them including monolithic devices; we pioneered in small earth stations and in unmanned earth stations, so that we developed the first completely automatically or remotely operated earth stations. In the satellite area, we developed advanced stabilization systems, we worked with the idea of a body-stabilized spacecraft like this, as opposed to a spin-stabilized spacecraft like that.

TMS: The three axis....

BE: Completely stabilized along three axia, rather than spinning around one axis, like that, which was, very obvious early on, despite the opinion of the Hughes Aircraft Company, who built the other kind, the way to go. COMSAT Labs pioneered in all those techniques in the momentum wheels, in the propulsion system and all aspects in the sensors, all aspects of positioning orientation and stabilization. We had a couple of genuises out there who made major contributions to the solid state physics of photoelectric devices and developed, very high efficiency solar cells. Those chaps left the company, formed their own company known as Solarex and they're now one of the nation's leaders in solar cells; largely for terrestrial purposes. There are several other areas that escapes my memory right now. It was a source of great pleasure to work on these

programs, and great pride. I know when you'd show visitors around and you'd take them through the laboratory let's say, in the mid-'70's, and they would see all this work going on and all these obvious products. We'd have a bench where we'd line them up and show that all that was coming out of a very small, talented group at COMSAT Laboratories, with a very small investment. The investment in the buildings and grounds and everything out at, and so on, was around.

TMS: Around $7 million, as I recall, with the initial...

BE: I was going to say around $10 million or something like that.

TMS: You couldn't do it today for that amount of money.

BE: Oh no. Our annual budget during the year was something less than 10 million dollars a year and we perhaps had three to four hundred people out there during that time. We were making many technical contributions to the extent that we dominated international conferences on digital satellite communications, the AIAA and IEEE Conferences that were being held in the area of satellite communications.

We pioneered in new systems as well. We developed an electronic mail system for U.S. Postal Service. We developed, in conjunction with IBM, the first computer communications network; this was even before we got involved in SBS. In fact, it kind of led to a close association with them so that SBS's

chances were improved. There were many, many significant accomplishments. And, of course, INTELSAT was a great success. INTELSAT I through IV were largely the products of NASA and DoD technology, but INTELSAT V, the Ford version, was a triumph for INTELSAT technology. All of the technologies that COMSAT had been working on for INTELSAT were incorporated into that satellite. I didn't phrase that right. That satellite had the benefit of all the technologies and was a great advancement over the state of the art. That's all been written-up in the INTELSAT R&D book, Ten Years of INTELSAT R&D. Have you seen that?

TMS: Yes, I have. I don't pretend to understand it all, but I have seen it.

BE: There's a set of case histories in there that show how it found its way through a number of systems studies into the system research got started at COMSAT Laboratories and when I was ticking off a list of technologies before, I forgot multi-beam technologies and I also forgot the use of frequencies above 10 GHz, the 14 and 12 frequency band, the 30-20 GHz frequency bands.

TMS: You seem to be saying that the Labs have really payed for themselves. At least early on, there some critics, among the member countries of INTELSAT, who at least questioned the necessity of forming a lab. They would raise the prospect that this research might be done as well and on a much more cost

effective basis if it were contracted out to existing laboratories, rather than building an in-house capability.

BE: I don't think that that was it. Have you spoken to some of the....

TMS: No, this is stuff that I've read. I haven't spoken to anybody who now holds that point of view.

BE: There was some opposition to what COMSAT was doing in research & development in those early years. Most of the foreign concern was the domination of INTELSAT by COMSAT and they felt that COMSAT setting up its own laboratories and then being a sole source of R&D for INTELSAT was increasing that domination very much. It was not that they thought that INTELSAT R&D was ineffective but rather that it was overly effective in supporting COMSAT--its role in INTELSAT. Indeed, the first thing that happened when INTELSAT started to become independent of COMSAT was for them to take research away from COMSAT Laboratories and give it, not to other U.S. companies, but to give it overseas to R&D agencies overseas.

TMS: Well we've seemed to have reached just about the end of our time, as agreed, and we've covered most of the questions that I wanted to cover.

BE: Good, I think I've said most of the things I'd like to say.

TMS: Good, well then I thank you very much.