# COMSAT HISTORY PROJECT

## Interview with Martin Votaw

Interview conducted by Thomas Maxwell Safely

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Martin Votaw's residence
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TMS: When and in what capacity were you most closely associated with COMSAT? Kind of sketch you career at COMSAT for us.

MV: It began in August 1963, and I started as the Project Engineer working on the Early Bird satellite project. At the time, it was merely a concept. I worked on space segment engineering from then until, well, about 1972, and was responsible for the engineering and the contracts for the satellites from Early Bird through eight INTELSAT IV satellites. Four years of that time, the last four years of that, I spent in California as the customer in the contractor's plant.

TMS: That would be Hughes Aircraft in this case?

MV: Yes. That was first at TRW and second at Hughes. I managed a group of about thirty people who were engineers with a fair amount of experience in the various technical areas on the satellite. We monitored the production of the satellite and decided whether or not the satellite was satisfactory to ship. We evaluated the test data and decided whether it met

the specs or not.

TMS: Who was it that hired you?

MV: Sid Metzger was my supervisor when I first went there. He was head of the Engineering Department at that time.

TMS: What was the specific mandate that he gave you at the time? Were they already thinking about Early Bird? I'm trying to evoke the first days that you were there and what you had to do.

MV: In the first three months, we were merely putting together papers on satellite engineering characteristics from a general standpoint and trying to develop size determinations--communications capacity versus size of the satellite. The work on Early Bird started in about October that year [1965] and it began with Hughes Aircraft Company making a proposal, a very slim proposal, to COMSAT to build them a commercial satellite and get it ready to fly.

TMS: What do you mean by slim?

MV: Not much information provided. What they essentially said was, "We'll make you a satellite, like you buy a TV set, here

it is, if you like it you can have it." We had to spend quite a bit of time with them to convince them that any such endeavor would have to be associated with contract specs, performance parameters, and a full set of terms and conditions in the contract. They were a little reluctant at that at first, but eventually we did negotiate a contract and it was a complete contract.

TMS: Why would they be reluctant? It seems to me that that would be normal operating procedure, that is, the company would provide specifications for the satellite that they want, and ask for bids on these specifications. Maybe I have the whole thing turned around in my mind?

MV: Well, they turned it around a little bit. They said, "Wouldn't it be nice if we could build satellites like people build TV sets, and then it's take it or leave it."

TMS: Buy your satellite off the shelf.

MV: That's right, off the shelf, and then you don't have all this interaction between the customer and the contractor as he puts it together. That may develop in another twenty or thirty years, but it hadn't developed then and it hasn't developed now.

TMS: That's interesting. I do want to ask some technical questions, since you were most closely involved with the technical aspects of the business, and we can kind of proceed accordingly. It seems to me that there are a number of things that one might talk about on the technical side of what COMSAT does. One, perhaps, is what has been described as the dramatic decision for geosynchronous satellites, as opposed to medium orbit satellites. Could you reflect on that since you were there at the time and involved in the considerations? You know, what were the reasons for choosing a synchronous satellite and what people were directly involved? Who, if there could be one person, was the real mover; what were the real reasons; and who were the people who made the decision for a geosynchronous satellite?

MV: About the end of the summer, in October and November of '63, COMSAT was slowly putting together a technical organization that could begin to address the questions of what types of satellite systems [could] be used for commercial communications. We had hired Jim Reinhart, who was competent in the area of computer analysis, and he, working on a rented computer, did analyses of the outage times that would occur for medium altitude random and medium altitude phased satellites. There was extensive study. Of course, NASA had done preliminary work in communications satellites for medium

altitude and for synchronous altitude; as they went with the Syncom Program for synchronous studies and RELAY for medium altitude satellites.

There was, also, a lot of pressure from the international scene to avoid synchronous altitude satellites because the time delay. The telecommunications people in Europe had had a lot of time delay difficulties with loading coils in longer and longer transmission lines throughout Europe. So, they knew that time delay could get to be a problem on voice communication circuits circuits. COMSAT, while they began to look into the technical characteristics of satellites and satellites systems, was also beginning to try to establish an international framework through which international satellites could be organized and owned. They had meetings, I think the first meeting was called the Washington Group or something and they invited representatives from the PTTs [Post, Telephone and Telegraph] in four or five European countries to come in and talk about international commercial communications satellites. In that group there was a lot of pressure to stay away from synchronous altitude because the time delay would just be terrible. They predicted that it would just be awful if we did that [synchronous altitude system], nobody should do that, it's just completely unbearable.

So, we were doing a lot of work on medium altitude, looking at random and phase satellites and we knew how many

satellites you would have to have in the system in order to have continuous communications that way. It would take maybe eighteen satellites for a medium altitude random system and the Earth stations would be tracking satellites, then they would turn off one satellite and on to the next one in order to manage the next one or two hours of communication. So, we had a pretty good idea of the space segment and also the operational difficulties associated with handing over [signals] from one satellite to the other throughout the day.

At the same time, the Hughes Aircraft Company was becoming convinced that synchronous altitude [satellites] were the only way to go. They came in with a strong proposal that synchronous satellites are the only thing that makes any sense because one satellite provides a link across the Atlantic continuously, you have no handover, and you have no outage times. Everything would really be great. So, the proposal to do an Early Bird commercial communications satellite was partly the Hughes Aircraft Company trying to convince COMSAT that that was the proper way to go, not medium altitude random or phased. And that, even if COMSAT didn't know whether that was the way to go or not, COMSAT ought to buy one satellite and use it and see how it turned out. In other words, carry it along as a prototype demonstration project to demonstrate commercial communications by that technique. If you look at the cost advantages of a single satellite at synchronous altitude

compared to multiple satellites at medium altitude, well the cost advantages were very dramatic. So, I guess, there were a lot of people at COMSAT that thought it was a good idea, but it was really Charyk that made the decision to proceed or to go ahead with Hughes and to get to the point where we had a contract that he could look at with hard dollars on it.

That put him [Charyk] in a position that he could turn to the International Group and say, that we have a contract in hand for a single synchronous communication satellite; it's our intention to proceed and develop that and launch it and use it as a demonstration project to show whether synchronous satellites are suitable or not--not to answer the question now, but answer it later. He decided that we would go ahead with that contract and we did sign the contract. I think we had an eighteen month delivery time on the satellite which was unusually short. By that time, the International Group had developed to the point where it had become an interim communications satellite committee. Then he [Charyk] turned to the committee and said, "Would you like to join in with us and share the project or would you like to wait and see after we've developed it?" Well, they decided they wanted to join in and share in the funding, in the operation, and in the benefits, if there were some.

TMS: Why, if it was essentially unproven, as it seemed to be,

and with quite a number of good reasons for going medium orbit --as they seemed inclined to do, that is the international group--why did they want to jump in at this point?

MV: I think they didn't want to be on the outside looking in. They wanted to have some measure of control over what would be done, what tests would be conducted, how would they be conducted, who they would be conducted with, and how do you evaluate the data when we were done.

TMS: Was there any resentment about the way COMSAT had handled it?

MV: I don't think so at the time, I think they were merely anxious to get in. Later on there tended to be resentment because COMSAT did indeed run a substantial program. I think the resentment didn't come in until maybe around '67 to '68, when it was time for INTELSAT to address permanent management arrangements. The interim management arrangements that had COMSAT managing the entire system while the international group were owners and operators. There was some resentment there.

TMS: At the time of Early Bird though the international group was well satisfied, excited, even though they had tended to favor the medium orbit technology? Were they pretty much "gung

ho" about the business in your recollection?

MV: Yes.

TMS: Were there competitive pressures that favored a geosynchronous satellite? That is to say, did some people see obvious advantages, say as a way to carve a particular niche in the future telecommunications market for COMSAT? After all, RCA and AT&T had both orbited medium and low altitude satellites. If you had to characterize what was going on in their programs you might say that they tended to have a headstart on those technologies. Were there commercial considerations involved, what were they with the Early Bird that is?

MV: Well, nobody proposed to do a medium altitude random system to see how well it worked. Primarily, because the cost of doing it was just so high that you wouldn't want to propose such a thing unless you knew it was going to work.

TMS: Even AT&T wasn't really pushing for a system of TELSTARs at the time?

MV: Not really. I think that the other groups (the AT&T's and the British Post Office), had they been left alone to build

their own system, they might have decided that medium altitude random is the reliable way to go and therefore we'd do it and they'd go ahead and build such a system, even though it was not advantageous economically. In the environment where everybody has to get together and talk about what's going to be done the medium altitude proponents gradually faded away as the Early Bird project went on. After the satellite was launched and it was put in service then there was an extensive test program that ran for four to six months. Where AT&T would put traffic on the satellite, some 60 circuits, then after a transatlantic call was over they would call back the user and ask them a series of questions about the call. By doing that they tried to develop a data base that said, "Here's what the people who use the satellites (or communications circuits) think about communication satellites through a synchronous system." I think that data didn't come out as bad as some people thought it would. So, there was less pressure for medium altitude systems after that point. There were still some comments from the British group, "That even though you've tested it for six months and you are not getting a lot of unfavorable reactions, after 12 months or 18 months then people are really going to get irritated with it." They continued to hang on to the idea that time delay would still be a problem later on.

TMS: It sounds like the British were dragging their feet, can

you explain a little bit of why? The satellite up, seems to be working and the initial data, at least after six months, seemed good.

MV: I think they were ultra conservativism. That's not too surprising from a government-owned system that has been in operation a long time and provides high quality service by their own standards.

Then, soon after the Early Bird launch, it wasn't too long after that, the plans for INTELSAT II's began. Because NASA came to COMSAT and said, "We need communications for the Apollo system around the world, so we'd like synchronous satellites over the Atlantic and Pacific Ocean regions in order to connect our far flung Apollo network back to Houston." So, we began with that. After the contract was signed with Hughes for the INTELSAT II's, COMSAT then went to the international group and said, "We are buying these satellites for Apollo communications, they are suitable for international communications, would you like to participate in the program or not?" Eventually they said, "Yes, they would." So, then those became the INTELSAT II satellites.

At the same time, INTELSAT showed a little bit of resentment for two programs having been started by COMSAT alone, with them joining in afterwards. So, they started the development of the what they called the Global Communications

Satellites Specifications. INTELSAT was going to write the specs, it wasn't going to be COMSAT doing it alone. INTELSAT was going to do it. So, the technical staff in COMSAT would prepare draft specifications and give them to the BGT (Board of Governor's Technical Group) and they would massage and change and alter and add new specs and, over a period of, oh, I guess a year, year-and-half, those specifications were developed to meet all of INTELSAT's worldwide needs. Then, we used those to issue an RFP. We received proposals, evaluated the proposals, selected a contractor and negotiated a contract. So, INTELSAT III was the first of the satellites to be bought [according] to the specifications that INTELSAT put down on paper, that they said they'd need.

TMS: TRW was the contractor?

MV: TRW was the successful bidder. As it turned out, those specifications were not so practical. In some cases, the communication specifications were beyond the state-of-the-art. As a result of that, when the second engineering model satellite was tested and it didn't meet the specs, we rejected it. TRW worked another eight months, trying to meet the specs, and still couldn't do it. Then, we decided that the specs aren't practical, they can't be met. Nobody could build a filter to meet the communications characteristics that were

described in the contract. So, then we accepted the spacecraft based on its performance characteristics, rather than based on whether it meets the contract or not. But that was a tough thing for COMSAT and INTELSAT to learn, that our specs were unrealistic, because the rest of the INTELSAT III contract essentially went without communications specs.

TMS: This kind of brings up another issue area that I would like you to go into a little bit if you would, and that is relationship between COMSAT and its suppliers--Hughes, TRW--the vendors who essentially designed and built the satellites for COMSAT/INTELSAT. I guess, generally, would you say that COMSAT has always purchased satellites in a cost effective manner, that is, to use the jargon that you run into, the best quality at the lowest cost with timely delivery? Now, there has been some give and take over this issue with the international group, that is, with INTELSAT today. Their desire to have a certain amount of construction done in their own countries, a certain amount of development done there, and COMSAT replying that American aerospace firms are in the best position to give us satellites in a cost-effective manner. Would you agree with what COMSAT did through the early period?

MV: Well, COMSAT did a lot of different things. It's not really a monolithic arrangement. I think COMSAT did, for the

most part, get the best performance out of the satellite at the lowest price. And for the most part, delivery occurred fairly close to the delivery date scheduled in the contract. If you look at how COMSAT achieved that, why there are a lot of different approaches to different satellite programs. Early Bird was proposed by Hughes and we went along with their proposal. We were very energetic in making sure we had a good contract based on performance specifications and a proper set of terms and conditions, payment schedules, milestone items and so forth. We did intend that we would monitor the performance of the spacecraft throughout the environmental test phase. We didn't have anyone in the contractor's plant throughout the Early Bird program. We were a normal, I'll call it a normal, customer at that time. We negotiated a contract and then let the contractor work until the spacecraft was put together. Then we sent people to the plant to evaluate performance during the environmental test program; basically, that's the last three to six months of the spacecraft cycle. Early Bird performance exceeded the contract specs in every parameter, didn't fall short in any. We had good cooperation with Hughes for access to the work in the contractor's plant throughout the test program. So, there was a cooperative arrangement between Hughes and COMSAT that was established early in the Early Bird program and it worked very well. That continued through the INTELSAT II program. We tried working the same way with TRW in

the INTELSAT III program and it bogged down.

TMS: Why was this?

MV: Well, INTELSAT III didn't meet all the specs, it missed by a wide margin some very "critical" communications performance characteristics. So, they couldn't meet all the specs. We were trying to get them meet the specs. We had already gone through two programs developing the experience that says, "The contractor meets all the specs all of the time and you don't pay them additional money to do it." Here was TRW, they had clearly signed a contract that they couldn't meet, we didn't know it, I don't know whether they knew it or not. When they couldn't meet it, we insisted that they had to meet it. Well, they spent a lot of extra money and a lot extra time trying to meet it and then they gave up. We refused to pay them additional money to keep trying. So, INTELSAT III was a completely new experience for both COMSAT and TRW. TRW had not been involved in commercial satellite contracts before. TRW had been involved in NASA and DOD satellites, where they didn't use performance specifications. When they had troubles, well the customer would pay additional money to get it fixed. So, we were trying to get them to follow our method of contracting and they were trying to get us to follow theirs. There were losers on both sides. We lost a lot and they lost a lot,

because hard-headed people on both sides were knocking heads trying to get the other one to change. It was in the middle of that process that COMSAT's Vice President-Technical and I would go to California every Sunday night. We would meet on Monday and Tuesday at TRW and we'd come back on Wednesday. We weren't getting anything done in California and we weren't getting anything done here. So, Reiger decided that I should move to California, be there all the time, and that all of the space segment engineering group in Washington should move to California. We ought to be there seven days a week. So, we did that. What started out to be seven months, temporary, has become COMSAT's mode of operation with the customer in the contractor's plant throughout the entire contract. INTELSAT has adopted the same thing as they continue on with INTELSAT V and INTELSAT VI. COMSAT and INTELSAT eventually did put quite a bit more money into the TRW contract and TRW did put new people on the project that would make changes to improve the characteristics of the satellite. Unfortunately, that effort came too late. Because the satellites after we launched them, we had a bad experience with our launch vehicles. We had three launch vehicle failures out of eight launches and we had failures on practically all of the satellites that were launched successfully. We just barely kept the operation in three ocean regions until the first INTELSAT IV came along. The INTELSAT III's couldn't make the five year lifetime that

they were supposed to make. The difficulties that we had in orbit were things that we should have been focusing on the ground when we were fighting over specs that couldn't be met. So, it was not all TRW's fault. They got a bad reputation out of it, we got poor service out of the satellites.

TMS: How did that affect COMSAT?

MV: A great deal is made of the dependability, especially of Early Bird which functioned far past its specified lifetime.

MV: Yes, it went to five and half years, it was supposed to have an eighteen month lifetime.

TMS: So, relative to INTELSAT I and II, INTELSAT III looks like a total failure or very close to it--substantial failure let's say.

MV: Yes, it was the worst program we'd had.

TMS: What was the impact on COMSAT in terms of the trust of the INTELSAT members and in terms of the trust of the buyers of COMSAT services--the international common carriers?

MV: The common carriers never saw it. Because we had planned

to have an operating satellite and a spare in each ocean region. So, when the operating satellite gave us trouble, we'd switch the traffic to the spare and we would go on and continue to provide the service. We never had an outage longer than 45 minutes, I think, even throughout the entire operation of the INTELSAT III program. So, the user never saw unreliable service. We merely saw satellites that didn't live up to their design lifetime. I don't want to put too much emphasis on how poor the TRW performance was. TRW does a good job building satellites. It was tough for them to get introduced to commercial satellites, in a program where our specs were no good. So, the INTELSAT III program we thought was business as usual, but by the time we finished that we were convinced that keeping people in the contractor's plant from the beginning of the contract to the end was a good idea. So, we had people move up the street from TRW to Hughes for the INTELSAT IV. Hughes won the INTELSAT IV competition and nobody, I don't know, I don't think TRW even bid. They had become convinced that they did not want anymore commercial satellite business and I don't think they [have] bid on a COMSAT proposal since. We went back to Hughes with INTELSAT IV. The work went as well as we could expect. You know, our INTELSAT I and II experience was continued with INTELSAT IV. Satellites were built and launched. There were no serious problems--the launches were all successful and all the satellites worked. So, eight out of

eight, everybody was really tickled.

TMS: And Hughes was agreeable to having you in the plant all through design, construction and testing?

MV: By that time, it was in the RFP that we'd be in the plant full-time, they agreed--they didn't really object to that at all. But, in addition to the INTELSAT string of satellites, COMSAT bought the MARISAT satellites on a negotiated basis with Hughes. They just went to Hughes and said, "We need some MARITIME satellites, this is what they look like, give us a proposal." Hughes wrote them a proposal. COMSAT looked at the proposal and decided to buy it. It wasn't a competition. They did the same thing on the COMSTAR satellites for AT&T. They went to Hughes said, "We need satellites, probably looking about like an INTELSAT IV, here is what we want it to have, give us a proposal." Hughes gave them a proposal. They bought the satellites and it went off. We haven't done them all alike. We don't always go for a competition to get the lowest price. If we've got a bench mark in another similar satellite and we know what a reasonable price is, we can go negotiate the arrangement, see that it is reasonable, and sign up, and we avoid a year and a half or two years of work writing an RFP, somebody else writing proposals and our doing the evaluation.

TMS: This kind of flies in the face of a traditional bit of wisdom about the marketplace and especially about contracts of this sort that they ought to be competitively given. You seem to feel that the efficiency, under certain circumstances as you point out, of going to a certain contractor and asking for a proposal on a certain type of satellite is better than a competition?

MV: Yes.

TMS: Has that been borne out in COMSAT's experience--say with the MARISAT satellites and with the COMSTAR, both of which, as you point-out, are very closely based on the INTELSAT IV?

MV: Well, MARISAT is based on an upgraded INTELSAT II really. But, what Hughes said at the time of the MARISAT proposal is, "INTELSAT II is really too small, but we are going to a new standard Hughes spacecraft that we are going to make for everybody that wants it. It's going to be twice as tall and will have this much power, it will be mechanically despun...it's going to be great, you guys are going to really like it. It's going to be our standard design." If you look at it, you'll find that the MARISAT spacecraft was a standard that was then used for some thirty spacecraft. So, they did

indeed come up with a new design, they did use it as a standard, and they sold a lot of spacecraft that size with a lot of similar characteristics. So, I think it is not necessarily true. I think it is definitely not true, but its always best to write yourself a set of requirements and issue an RFP and have a competition. Because, if you put down in your requirements something that was 10% greater than he can do on his standard design, he is going to have to propose a special design that would cost you a lot more money. So, I think both the MARISAT program and the COMSTAR program are a clear demonstration of the case when you do have enough information to decide whether the price is reasonable without going into competition, and both of those programs have been highly successful.

TMS: And yet, COMSAT for its, well, COMSAT for the INTELSAT V satellites Ford Aerospace was chosen and not only was a new company but a radical new design--a three axis satellite instead of the spinner--why? If things were going so well at Hughes and the arrangements were as comfortable as they were and the confidence not only in the design that Hughes was proposing but also in the kind of cooperation and team work that had been built up between COMSAT and Hughes over a period of time, why the departure on INTELSAT V?

MV: Well, as COMSAT bought INTELSAT I, INTELSAT II from Hughes and INTELSAT IV from Hughes, soon, by the time we were halfway through the INTELSAT IV program it was easy to say, "We've had good satellites from Hughes, we've had bad satellites from TRW." That's not a realistic criticism of TRW. I mean if three out of eight launched were failures, you can't blame TRW for that. But, there were people who said, "Good satellites from Hughes, bad ones from TRW, let's just stay with Hughes." That same philosophy went through the minds of the Hughes Aircraft Company people. If we had gone back to Hughes for an INTELSAT V that was an upgraded INTELSAT IV and no competition, the price would have been high. Hughes is in it to make money, they are not a benevolent organization. If there is competition they will give you a low price, if there isn't why they will make more profit. So, I think it was important to have competition on INTELSAT V because it was going to be a very big program; $250 million dollars for the spacecraft alone. That's important enough and there's enough money in it that the exercise of the competition is worthwhile. So, it was planned in plenty of time that INTELSAT V would come at the appropriate time after INTELSAT IV so there was no reason for not doing a competition. In the evaluation of proposals on INTELSAT V, the Hughes INTELSAT V was a spinner, the best technically, and Ford Aerospace was the low bid. It was only lower by two million dollars. So, the question is, are they

both satisfactory technically? The body stabilized satellite you said is a radical new design. No, body stabilized is a new design, new to INTELSAT. But a lot of people have been flying them prior to that time.

TMS: That's what I meant, thinking that the operations people had their experience with spinners and the way they perform, for COMSAT and INTELSAT the Ford design was a departure.

MV: Not an important departure, because people had already flown lots of spinners to prove that spinners are okay and we know how to operate them. Other people have flown lots of body stabilized designs and there was no argument as to whether you could fly a body stabilized design and provide good service. So, we took the low bidder. I think Ford has done a competent job in building the satellites, and they're flying and they provide good service. The spinner versus body stabilized design is a poor item for lengthy discussion. A lot of people get into that, but I am not one of them.

TMS: And yet it is back to Hughes and a spinner for INTELSAT VI. What's behind that? As you say Ford seems to have come across with a good satellite.

MV: Some of the people who used to talk about the advantages

of body stabilized satellites used to suggest that body stabilized satellites are easier to design, easier to build and after you build them it's easy to add more stuff to them.

TMS: A couple of more solar panels?

MV: Yes, you can just put solar panels out and you get more power. If you want another box in it, you put it in. They say well you can't do that on a spinner because you put a box in here and then it's not balanced anymore. You have to have an equal box on the other side because it always has to be balanced. The idea that a body stabilized satellite is suitable for expansion and growth or more suitable than a spinner, I think, is really kind of baloney. You'll find that the body stabilized satellites are launched in a spinning mode. They are usually in a spinning mode for the transfer and drift orbit, or the transfer orbit anyway and the apogeemotor firing. So, you have to balance them just like a spinner. You can't get there without a balanced satellite in a spinning mode. It's not easy to expand a body stabilized satellite, because even adding solar panels and trying to put more transponders in has a redesign problem.

In fact, on INTELSAT V, when they put the MARITIME package on the later models and then INTELSAT wanted to go for an F9 and an F10 in the original mode without the MARITIME package,

Ford said that it would cost more money to go back to the old design than it would to go ahead and put in the MARITIME package and fly it. Well, the more money they are talking about is to redesign back to the conditions that they had in F1 through F4. So, it is not all that easy. Spacecraft design is still a discipline that requires that you look at all the characteristics of a satellite as you make a change. You look at power, you look at weight, you look at balance and you look at thermal conditions and any time you make a change you have to look at all of those and all of that takes redesign money.

So, the idea that you couldn't get spinners big enough to go into the INTELSAT V category might have been true for an Atlas-Centaur size satellite, an INTELSAT IV diameter. But, when you go to the [Space] Shuttle and you can then use a 16 foot diameter instead of a four and a half foot diameter you have the opportunity to get a lot more solar power and still have the spinner. So, the [Space] Shuttle brought new life to the spinner program. Rosen and the Hughes Aircraft Company were quick to jump on that bandwagon and show how they can do INTELSAT V in a large diameter still staying with a spinner.

Now, one advantage that spinners still have over body stabilized satellites is that if you have an outage, a despin outage, where the antenna instead of pointing to the Earth starts to spin--we had those frequently with INTELSAT III's-it used to take 45 seconds to get the antenna re-pointed to the

Earth and then you would resume communications. On the body stabilized satellites that ESA built for INMARSAT, when such an outage would occur, the satellite would rotate away from the Earth and it would take as much as nine hours [to relocate it]. Because the process for relocation of the satellite in the Earth-pointing mode was first you rotate it and lock on the sun, then you wait until the line between the sun and Earth was ninety degrees from the line to the Earth and satellite, then you roll about the sun line until you pick up the Earth and then you lock on. Spin stabilized satellites don't require this nine hour period and the outages can be substantially shorter.

So, body stabilized satellites have some advantages, you can get more power for less weight and spin stabilized satellites have advantages. It's important that everybody look at what it is you really trying to do and decide whether you can do it either way or both ways. The answer has been both ways on all of the programs so far. The selection of body stabilization for INTELSAT V with Ford was based on price, not based on stabilization. So, either one can be worked with, you know, you can have a three wheel car or four wheel car or two wheel motorcycle.

TMS: Is the same true of the decision to go with Hughes again for INTELSAT VI? A matter of price more than characteristics

of the various satellites?

MV: That's a little more complicated to answer and I wasn't there for the proposal evaluation on that. I was in London, at the time, but from what I heard the dollar figures swung it to Hughes. The decision wasn't based necessarily on the initial buy, but on the projected additional satellites--the options, that INTELSAT could exercise at a later date. When those options run out to say, seven, or eight years or ten years beyond the contract, the inflation factor that you apply to that has a big impact on what they ought to cost. So, I think Ford lost it on the cost of the options. But it was a cost factor that did it.

Charyk's management of this system, with his technical ability has always been outstanding. He has the ability to find the proper way out of confusing situations where he sits at the table with fifteen guys around the table and there are two or three strong ideas being proposed and you can only pick one of them; he seems to find the right way out. COMSAT, I think has done quite well. In beginning from scratch in 'sixty-two or 'sixty-three and setting up the system that provides the revenue that it does now. It's done most of that or almost all of that on the international monopoly. I think COMSAT did a good job of adapting to the monopoly environment and making the most of it. I think they did that without being

greedy. COMSAT gave a lot away.

TMS: Such as?

MV: Well, the entire international system, they said, "We are going to have this international system, would you like to participate," and everybody got on board.

TMS: But that was in the mandate, as I understand it, that this would be a joint international effort.

MV: Yes, but there are different ways to run joint international arrangements. The arrangement of the INTELSAT system and the way INTELSAT operates is one where the INTELSAT members are part owners and they get to participate in the decisions of how to operate it now and what to plan for the future. There were other people who thought it would have been better if COMSAT had worked more the way AT&T does. AT&T planned the US telephone communication system, and then, when they wanted to put a cable in, they go talk to one country; they would have a bilateral system arrangement for that country. COMSAT threw the whole thing open to international management. I think that was the right to do, because I think that the INTELSAT system is now a good example of how international cooperation can provide an expensive system for

international service and still be viable, still make a profit.

TMS: Did INMARSAT use INTELSAT as a model essentially?

MV: Oh, a lot of the INTELSAT experience has been rolled into INMARSAT. The international delegates who would come to an INMARSAT early meeting were the same people that had been to INTELSAT meetings, so they knew how INTELSAT worked. They knew what worked good and what didn't work the way they wanted, so they knew what they wanted to change. About the only thing they changed was the headquarters, it's now in England instead of the US.

TMS: As COMSAT has grown over the years, and it's grown considerably both with regard to its size and the diversity of the kinds of satellite services it's offered, how has it changed as a company, the style of its management, just about anything you could say about a company really?

MV: I can't really comment much on that because my work was almost totally in the international monopoly area and as COMSAT generated additional programs and went into competitive businesses there were other parts of the company doing it, I wasn't involved in it.

TMS: But it didn't really affect COMSAT's participation in the international side--in its rate regulated [activities]?

MV: I don't think so. No, that work went on without interruption, while new groups were established to do the new work. The group that was doing the international management of the international system under COMSAT was transferred intact to INTELSAT to become their operating group. So, the group that was doing the operation of the monopoly they are now INTELSAT employees.

TMS: Over time, what would you say COMSAT's major achievements have been? Which do you think have been most important?

MV: That's hard to say. I don't know, I don't have a response to that.

TMS: Let's approach it in a somewhat different manner. Let's talk about COMSAT as a success. What are the internal and external factors that you think have most greatly promoted COMSAT's success? Why has it flourished?

MV: Having the monopoly on international service is certainly the key. I think it is the key factor for the financial success of COMSAT. The satisfactory characteristics of

synchronous satellites is another important element. Had they turned out to be unsatisfactory, COMSAT's financial picture would be vastly different. When COMSAT issued the stock offering, they went for two hundred million dollars. That was the cost that was estimated for developing, launching and beginning the operation of the first medium altitude satellite system. The Early Bird, I think the Early Bird program was about twenty million dollars. So, rather than spending two hundred million dollars in order to begin to provide international service, COMSAT spent twenty million dollars and began to provide international service. That left a lot of financial margin for COMSAT to have as they went on to look at subsequent satellite programs and further accomplishments.

TMS: Well, let's turn it around a little bit then. What have been the major challenges that COMSAT has faced? We talked a little a bit about the factors contributing to success. Now, one problem, at least, is going to grow out of the possibility that COMSAT will lose its monopoly in international telecommunications. That is, being challenged more and more frequently in various ways, by not only the international carriers, but also other satellite companies now. What do you see as challenges in the future? By extension, what are the major challenges that occurred while you were there and how did COMSAT meet them?

MV: Well, one of the major challenges that COMSAT had while I was there, was the definition of the arrangements with INTELSAT as INTELSAT went from an interim committee to the definitive arrangements; where INTELSAT would become a permanent organization. COMSAT had to work as the US representative in the negotiations with the other committee members to establish those in a manner that would make INTELSAT a viable concern and also make sure that COMSAT didn't get in a bad financial position in the transition process. That was worked out with I think a four or a six year transition period where COMSAT operated as manager and was paid by INTELSAT on a cost plus fee basis to do that work. I think those were challenging from the standpoint of international negotiations and I think COMSAT came out of that fairly well. The transition to INTELSAT operating the system was done quite smoothly by transferring the entire organization to INTELSAT to do it. All the COMSAT employees who were involved in that work went along with the transition, too, it was done in manner that was suitable to them. So, it was suitable both to the employees, to INTELSAT and to COMSAT.

I think COMSAT has set the standards for good satellite procurement. I think COMSAT's practices in buying satellites have been more orderly and more well controlled than either NASA or the military have been used to. Many other commercial

outfits have used the COMSAT specifications as a beginning point as they develop their own.

TMS: Why is this so? What is the foundation of COMSAT's leadership here?

MV: Mostly Sig Reiger, who was the first Vice President-Technical, who decided that we would use only one kind of specification--that's performance specification. We wouldn't have design description specs. With the performance specs we'd have a good set of terms and conditions that would pay the contractor the required money as he went along, but make sure COMSAT had control; had enough money held back that we did have leverage if it didn't meet the requirements after it was launched. I think it was his guidance on it that made that come out that way.

TMS: Well, Reiger was really the man behind the particular philosophy in satellite acquisition for COMSAT, you said that it was his idea.

MV: I think so.

TMS: And that this has become a model for private commercial satellite companies and COMSAT still functions that way?

MV: COMSAT is not buying any satellites these days.

TMS: Yes, I am aware of that. I meant more in terms of say with the SBS satellites.

MV: INTELSAT is slowly drifting away from those practices, because some of their people have different philosophies. I don't know how the satellite television company is working for their procurement. I would guess that they know what COMSAT has done before, but they may do things differently. I don't know.

TMS: Do you think this could be a problem for COMSAT in the future, if they go back to a more design specification approach?

MV: Oh, yes if they go to design specs they will have trouble. Because you can't control both the design and the performance. If you are going to control the design then you can tell him what you want the design to look like and once he makes that design, its yours. If it doesn't perform that's your problem, it's not his.

TMS: How did COMSAT prevent things like cost overruns and that sort of thing which has been a problem for the military, since

you bring that up?

MV: First, by making sure your list of performance parameters that you use in fairly complete. Second, by making sure that you specify the overall performance of the spacecraft, not performance of little parts inside. Third, by not changing your plans once you have signed the contract.

TMS: And this was all standard COMSAT practice?

MV: Well, no it developed. Maybe the fourth item is have a good contractor; have a contractor that is used to commercial practice and no changes during the contract. If you have a contractor that is used to making changes all the time and getting those changes paid for as an extra item, why its hard to change the contractor during the course of a contract. If he is steeped in that philosophy you will be stuck with paying for changes.

TMS: This approach, that is to say, the relations that you build with your contractor and the way you prevent cost overruns, was it something that COMSAT pioneered in the commercial areas as well?

MV: I think so.

TMS: Well, let me change gears for just a moment. Your involvement has been more on the international side and I think anybody who looks at COMSAT can see that COMSAT's domestic programs and its international programs are in many ways quite separate, apart from the financing, which the FCC specifies be separate. The profitability, the management has in some instances been quite different as well. Since you were on the international side, it suggests a couple of things, a couple of issues that you run into occasionally, that is COMSAT's relationships with the international common carriers and also COMSAT's problem (if you want to call it a problem) with the threat of substitute technology, by that we mean cable, for the most part. Let's start with the buyers, that is the international common carriers. You know, they've enjoyed an unusually strong position with respect to COMSAT, from the very beginning. In your opinion, how has this affected COMSAT's growth, COMSAT's ability to compete in what is becoming an increasingly crowded and competitive industry?

MV: I can't comment much on that. I know that in the early days we had to give up half of the ownership of each of the Earth stations to one carrier or another. But I think that merely meant we had to sit down and have committee meetings on each Earth station from time to time to talk about the progress

on development, what additional things have to be put in, how much more money each would have to contribute to do that, and so forth. I think that was managed quite well so that having it a joint ownership had no serious impact on the technical characteristics or the operational characteristics of the Earth station. We merely had to share the profits from Earth station ownership and operation. I was in the space segment part of it, so I didn't get involved in the Earth segment part of it.

TMS: The international carriers didn't have any indirect influence, say on the design of satellites or the ability to sell satellite capacity, given that they had already considerable investment in undersea cable and they were the ones who would buy half circuits from COMSAT and there is a certain relationship between the satellite that you design and your ability to sell that satellite capacity into a very limited market?

MV: They made Early Bird look as if it wasn't very important for a long time.

TMS: How did they do that?

MV: It was a two hundred and forty channel satellite, which was small, however, they only used sixty channels of it. And

we only got paid for sixty channels for a long time; must have been a year. We had expected they'd begin with sixty channels and as soon as they had confirmation that their users weren't complaining about time delay, why they'd go ahead and put additional circuits on. But they kept the loading on the Early Bird very low for a long time. It probably didn't reach 240 channels until about in the second or third year. So, that was an outward sign that AT&T had control over how much traffic they put on it. We had no way to increase the traffic, when they decided to keep it low. They were putting it on the cables, they owned more of the cables than they did the satellites; for them it was more revenue. But, you know, we just had to wait that out.

TMS: And it is something that changed? What about with INTELSAT II?

MV: The general traffic level in the world increased to the point where the satellite traffic had to be increased to carry the demands. There were also some meetings with the FCC and discussions as to how you allocate traffic between the cable and the satellite. COMSAT, AT&T, and the FCC had to sit down. I think we finally reached an agreement that caused an increase in satellite traffic. The FCC then directed the loading share between satellite and cable and then this traffic on the

satellite increased. So, it was something that was manageable, even though it looked like AT&T had all the controls, we used the regulatory process to bring satellites to where we thought they ought to be.

TMS: Have satellites, any of the generations of satellites, ever really been used to capacity? That is to say, all circuits working. I know that the international carriers, AT&T in particular, continue to build submarine cable, in part as a function of the improvements in cable technology. But also, as you rightly point out, there has to be some business aspect to it as well. In fact, that they own the cable and it's theirs, whereas they don't own the satellites. Have any of the satellites been used to capacity to the best of your knowledge, has that had an indirect impact on the way COMSAT has done its business?

MV: Yes, I think that from INTELSAT IV on, the first INTELSAT IV on, the satellites have been used to capacity and there has been a lot of work from the communications, operations, and from the research standpoint to figure how to get more capacity on the existing capability. "How I can I get more channels on the satellite?" The satellites have been fully utilized since 1972. I don't think we can say that somebody is putting too much traffic on the cable and not enough on the satellite.

It's been very difficult to work out the satellite design characteristics to meet the capacity that appears to be required and then they do get fully loaded, say in the mid-range of their lifetime.

TMS: Looking forward a little bit, do you think that this is something that is likely to change as cable continues to develop, for instance, we stand on the brink of what could be a cable revolution with fiber optics. How do you think COMSAT will respond to that as a challenge?

MV: I think that there will be a need for satellites, even if fiber optic cables are implemented. I don't think anybody will decide we are not going to put any more satellites up because now we have cable. I think the fiber optic cable is an opportunity for a lot of additional channels, but I don't have any good ideas as to what COMSAT ought to do in order to be more competitive or be more advantageous than cables in lieu of fiber optics.

TMS: Why do you have this faith that people will continue to put satellites up? Let's assume that the next generation of cable is a tremendous advance, that fiber optics is everything that they say it's going to be. You, nonetheless, are confident that satellites will continue to be put up and

satellite circuits will continue to be utilized for international telecommunications. Why?

MV: Well, if you put a fiber optic cable in between the US and Europe you can then connect US, Canada to a dozen countries in Europe. The satellite system ties together a hundred and fifty-three nations and putting one cable in doesn't connect all those people. The flexibility that you have in adding new locations to the satellite system is a substantial benefit that you can't get with the cable. If you want to communicate to New Zealand on a cable you've got to run a cable down there. If you've got a satellite system up there and you want to communicate New Zealand you put an antenna in New Zealand, so that's a substantial advantage that leads me to believe that satellites will always be there. Cable will come along with new improvements, but the satellite system will continue to provide a viable alternative. I think we need both.

TMS: Thinking back to your personal involvement in COMSAT can you think of one particular event in which you were directly involved that really was in your opinion critical for the history of COMSAT. Could you relate that for us in some detail?

MV: Critical and good or critical and bad?

TMS: Either I hear a lot of what's good, I wouldn't mind hearing a little of what's bad.

MV: Well, I don't really want to tell you what's critical and bad and I don't want to blow my own horn. No, I think I was glad to be a part of COMSAT at the time that I was. I was lucky to be in the very early stages and it was a very interesting experience.

TMS: Well, take yourself out of it for a minute then. You just had to think back in general what do you think was an event that really made a difference. I'm not sure that in an operation as large as COMSAT has become you can point to one that was particularly exciting or particularly important, there are probably many, but can you think of one that really deserves being remembered?

MV: No.

TMS: Okay. Do you have any further items that you would like to put on the record?

MV: No, I don't think so. Hope its been helpful.

TMS: Yes, I thank you very much.