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STATEMENT OF:

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ASSESSMENT OF SPACE COMMUNICATIONS TECHNOLOGY

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HOUSE OF REPRESENTATIVES
Committee on Science and
Astronautics
Subcommittee on Space Science and
Applications
Washington, D. C.
Thursday, December 18, 1969

The Subcommittee met, pursuant to notice, at 10:00 a. m. in Room 2325, Rayburn House Office Building, the Honorable Joseph E. Karth, Chairman of the Subcommittee, presiding.

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Mr. Karth. The Committee will be in order for the purpose of continuing our hearings on the applicability of satellites to domestic communications. I might announce at the outset that since the Committee did not have time, really, to hear completely Mr. Plummer, who is the Acting Director of the Office of Telecommunications Management, the Executive Office of the President, we will have him back tomorrow morning at ten o'clock, and we may also have back before us at that time Dr. Charyk, of the Communications Satellite Corporation.

The first witness this morning is Mr. Howard E. Hawkins, who is President of the RCA Global Communications, Incorporated, and, Mr. Hawkins, is there someone who you would like to have sit with you at the witness table?

Mr. Hawkins. I have my associates right here. They are right behind me.

Mr. Karth. Fine. If you find it necessary to have one assist you, I wonder if you would identify him at that time for the record.

Mr. Hawkins. Yes, I will.

Mr. Karth. Please proceed, sir.

STATEMENT OF HOWARD R. HAWKINS, PRESIDENT, RCA GLOBAL COMMUNICATIONS, INCORPORATED, AND PRESIDENT, RCA ALASKA COMMUNICATIONS, INCORPORATED.

Mr. Hawkins. Chairman Karth and members of the Subcommittee, my name is Howard R. Hawkins. I am President of RCA Global Communications, Inc., and also President of its wholly-owned subsidiary RCA Alaska Communications, Inc.

I am pleased to have been invited to meet with your Subcommittee to discuss the enormous potential benefits of space satellite research and development for international and domestic communications. Communications touches and concerns every group and individual in society and is one of the most technologically explosive areas of economic activity.

Communications satellites are among the most exciting and promising of the new communications technologies.

RCA's involvement in and commitment to satellite communications is long-standing, substantial and growing.

RCA Globcom, an authorized international voice/record carrier, has participated extensively in the development of satellite communications. It will increasingly use satellites

in providing global communications services. RCA Globcom is a joint owner of the six U. S. earth stations, and it is a major owner and the operator of the new Guam earth station. Today, RCA Globcom provides services via satellite communications facilities between the United States and 25 countries around the world, and it is rapidly expanding its global satellite facilities to serve Government and commercial customers.

RCA Globcom has a stock ownership in COMSAT. However, it has not sought and does not hold a directorship on the COMSAT Board.

As you know, on June 26, 1969, President Nixon announced the acceptance of RCA Globcom's proposal to purchase and operate the facilities and business of the Alaska Communication System. This acceptance followed many weeks of Federal and State evaluation of all of the competitive proposals and had the approval of the Air Force, the Department of Defense, the Department of Justice and the Governor of Alaska. RCA Alascom was organized as an Alaska entity to acquire the ACS and to operate as the long lines commercial communications carrier in Alaska. RCA Globcom and RCA Alascom are proceeding expeditiously to implement the transfer of the ACS, which is scheduled for July 1, 1970.

We believe Alaska will provide the crucible for important developments and implementation of satellite communications applications. RCA enthusiastically accepts the opportunity to

play a vital role in that development in providing commercial communication service for Alaska.

Robert W. Sarnoff, President of RCA Corporation, described RCA's purchase of the Alaska Communication System as "the culminating step in our long association with Alaska in the creation and operation of major communications projects for both civilian and military purposes."

Mr. Sarnoff also stated:

"As a company which has pioneered in electronic communications, we welcome this further opportunity to join our future to that of a pioneering people. All of the technological resources at our command will be available to give Alaska one of the most efficient and modern communications network ever devised."

RCA Globcom will purchase the ACS from the Air Force for $28.4 million. It has agreed to invest an additional $27.6 million over three years in expanding facilities and improving services.

There are, I might add, urgent and immediate requirements for improvement of service in Alaska.

RCA Globcom's commitment to the people of Alaska includes rate reductions averaging over 29 percent of interstate service, and nearly 40 percent for intrastate service. These reductions will save users about $40 million over the first three years of RCA operations and bring such Alaska rates on a par with those

in the "lower 48." It is estimated that the economy of Alaska, through implementation of RCA Globcom's commitments, will participate in public benefits amount to nearly $125 million over the next few years.

Communications satellites are, of course, expected to play a major role in the development of an efficient and modern communications network in Alaska. The State of Alaska is of immense size, but its population density is less than one-sixth that of Nevada, according to the 1960 U. S. Census, and less than one one-hundredth of that of the entire United States. Because of these facts, transportation and communications are frequently significantly less economical than in the "lower 48"; because of climatic and terrain conditions they are more difficult. Existing communications facilities are limited, often rudimentary, and in some remote areas non-existent. Thus, RCA and Alaska are confronted with a unique challenge and opportunity to construct the best and most efficient communications network for the State.

For all of these reasons, communications satellites promise to play a prominent role in Alaska communications services. In RCA Globcom's proposal to purchase the ACS, major emphasis was placed on the role of satellites in the development of interstate and intrastate telephone, data, television transmission and other services.

Since the ACS award last June, our engineers have been

working to refine the parameters of satellite communications for Alaska that will narrow the options and provide us with the basis for making technical and economic decisions. These decisions are necessary to determine the course of action that will best serve communications needs for the State of Alaska.

We have undertaken a special RCA Alascom project, which we have called Project Alsat, to develop a comprehensive satellite/terrestrial Master Plan for Alaska. This is intended to provide for the optimum communications system for Alaska considering technology, cost effectiveness, requirements and timing for the future. The study will seek to define possible uses for satellite communications in the State which are required and justifiable from an economic and service standpoint.

In addition to normal telephone and telegraph services, satellite communications can play a crucial and indispensable role in providing educational and commercial television services to all parts of the State.

The technology of a satellite system is available for serving Alaska. Provision for some or all of the following services should be considered:

Intercity telephone, telegraph and data circuits for both military and civilian use.

Telephone, telegraph, and data connections to the smaller villages.

Television transmission for entertainment and cultural

broadcasts, news, sports, special events and general education for adults and children.

Wideband data channels for rapid transportation of bulk information not possible with voice-grade facilities.

Broadcasting for entertainment, news, education and disaster information.

And, of course, aeronautical, marine and mobile-station communications.

Even though the FCC has not yet given its final approval to the purchase of the ACS, RCA Alascom has already initiated or joined in a number of projects designed to speed and advance the development of satellite communications in Alaska.

RCA Alascom has applied for FCC authority and committed itself to assume a major role in ownership and operation of the Talkeetna earth station. RCA Globcom was first to urge that construction of the Talkeetna station be advanced so that it will be available for urgent service requirements by July 1, 1970. Comsat has fully cooperated, and has agreed to this proposal, and construction is moving ahead on that schedule. RCA Alascom initially expects to operate 80 or more satellite circuits for expanded telephone service between Alaska and the "lower 48" in time to meet the summer peak season in 1970. It will also offer live television transmission, as well as other wide-band service.

Working with Federal and State Governments, RCA Alascom

is cooperating in the program to implement a trial of the use of satellite earth stations utilizing NASA's ATS-1 communications satellite. This program would demonstrate the feasibility of instructional television transmission for schools in daytime and for adults at night.

As part of this demonstration program, RCA Alascom has agreed to make available without service charge the RCA 42-foot transportable earth station now located at Guam, together with a supervisory technician for the test operation of the earth station in Alaska. COMSAT also has offered a similar 42-foot station, which I understand is now in the Philippines. These two earth stations actually are comparable in design.

In addition, we have undertaken the RCA Project Alsat mentioned earlier. Project Alsat is a major undertaking which, we believe, will have a substantial role in shaping the future development of satellite communications in Alaska and possibly in other areas.

RCA Alascom also is participating in other studies and analyses of the effective and optimal use of satellites in the State of Alaska. Governor Miller of Alaska has established a Task Force to study this problem, and RCA Alascom, together with Comsat, is a full participant. RCA Alascom, through its Porject Alsat and other efforts jointly with Comsat, will fully contribute to this important effort.

An intergovernmental committee under the leadership of

Dr. Clay T. Whitehead has also been established to study the orderly introduction of satellite communications into the communications network of the State of Alaska. RCA Globcom has made a presentation to the committee and is pleased to participate.

In our studies of satellite communications, it has become apparent that new techniques and system arrangements will be necessary in order to evolve the most cost-effective approach for Alaska. For example, the mere application of the present large earth station design with a 97-foot antenna, multiple carrier systems and complete redundancy will not lead to a cost-effective solution throughout Alaska. Instead, the matter can best be approached from an integrated system viewpoint which examines trunk requirements, growth, the existing and potential telephone plant and potential sites for earth stations. We can then determine on the basis of total circuit requirements the best trade-off between satellite and earth station configuration and size.

We need to consider the service potential and economics of the use of smaller lower-cost earth stations, spread through rural areas versus larger more complicated earth stations centrally located and connected by terrestrial facilities. Consideration also should be given to the use of new multiple access and demand assignment techniques to time-share circuit facilities among the lower volume users and to the use of small

unattended stations with minimum redundancy to optimize the combination of operating and maintenance costs and equipment costs.

A logical phase-in program will permit the orderly introduction of satellite earth stations in Alaska, while at the same time making maximum and cost-effective use of existing and potential terestrial facilities to fulfill the immediate and urgent communications needs of Alaska.

Here I should like to add that we have, RCA Alascom, as a long lines communications carrier in Alaska, has a twofold problem. It has an immediate near-term problem, as well as a long-term problem. We must provide quickly for the near-term communications requirements of the people of Alaska. We have to look towards immediate solutions to meet the immediate communications needs in the near term. While at the same time we are vitally concerned with the best, most cost-effective, long-term solution for the State of Alaska.

I might point out that the use of a satellite system impacts not only the transmission facilities but also the toll switching and other equipment. Satellite systems provide point-to-point capabilities which in some cases would by-pass the normal toll switching centers where not only alternate trunk paths are available, but also where the toll ticketing function normally takes place. It is therefore necessary to include in the satellite study alternate means for providing the

normal back-up routes and also to include alternate arrangements for providing the accounting information. Therefore, the Alaska long lines carrier is ideally situated to play a key role in planning and implementing satellite communications for the people of Alaska.

Further, I would stress that the communications needs of the State of Alaska can properly be viewed as an integrated whole of which satellites are an essential element of growing importance. The total Alaska communications network must be planned on an integrated, unfragmented basis.

I want to stress that all of these activities and many others are going forward now, even though the regulatory steps which must precede the purchase of the Alaska Communication System by RCA have not yet been completed by the FCC and the Alaska Public Service Commission. Time is extremely short. Under its purchase agreement, RCA Alascom will take over operation of ACS on July 1, 1970 -- less than seven months from now. Expedition is, therefore, essential.

At present there are attempts by entities which did not bid on the Alaska Communication System and business to fragment the System, and this question is before the regulatory bodies. Prompt regulatory decisions maintaining the integrity of the ACS and removing the uncertainities would most effectively promote the early and full implementation of a modern communications system, particularly including satellite

communications techniques, for the State of Alaska. I should like to add here that we understand and appreciate the problems of the FCC, as the regulatory agency, but we do hope that this matter can be expedited.

RCA knows from its own experience that satellite communications is efficient and economically justifiable in many applications. The number of such applications will increase. As we determine the scope and feasibility of satellite communications for Alaska, it is well of course to keep in mind the timing requirements for immediate improvements in service as well as the economics of satellite communications. We hope that satellites will play a vital role in meeting the telephone, educational and instructional television and other communications requirements of the State. They can best play their full and proper role through integration into a comprehensive and fully planned communications network which makes appropriate, efficient and economical use of various modes of communications.

The Alaska Communication System is one of the most exciting challenges RCA has ever undertaken. We share with the State of Alaska a deep commitment to provide the best, most efficient and most economical communications system for all of the people of the State at the earliest possible time.

We are anxious to get on with the Alaska job. Now, I understand that the record will be open for a few days, and if

there is any further information that may be helpful, I would be pleased to send it for the record.

Thank you.

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Mr. Karth. Thank you very much, Mr. Hawkins, for a presentation that I think gives this committee a better idea of where we are, and where we have yet to go.

Mr. Hawkins. Thank you.

Mr. Karth. Mr. Mosher.

Mr. Mosher. Well, Mr. Chairman, I am impressed with the vigor with which RCA seems to be moving to meet this crucial need in Alaska as evidenced in Mr. Hawkins' statement.

I know, Mr. Hawkins, on page 2 you say that Alaska will provide the crucible for more developments in the implementation. And throughout your statement in several places you emphasize the importance of an integrated system, that any use of satellites has to be integrated with other elements in the system, and at one point you expressed the hope that the system won't be fragmented.

Thinking of Alaska as a crucible, do you think of this as an experiment, and a demonstration where we can learn a lot about the use of satellites, in an integrated system, where we can learn a lot that can be transferred and made useful in the lower forty-eight? Are you thinking of this as a crucible and a demonstration that has a much wider significance?

Mr. Hawkins. We think of satellite communications in Alaska from three viewpoints. First, it gives us an opportunity for immediate improvement in service through the Talkeetna

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earth station. Here is an opportunity for us to immediately expand particularly the telephone service requirements, commencing next July 1.

This is a first immediate step that will be possible through the Talkeetna earth station, and use of the INTELSAT 3 satellite in orbit over the Pacific. That is point one.

Point two is that the demonstration program which is now under way, and which RCA is participating in, will provide opportunities for demonstrations with respect to satellite communications, and there we may well learn and certainly we expect to learn important information that may be helpful.

The third --

Mr. Mosher. You mean helpful in uses elsewhere?

Mr. Hawkins. Yes, helpful in Alaska and also uses elsewhere. The third --

Mr. Mosher. Including the lower 48.

Mr. Hawkins. Yes. And then the third point is that you will recall I made a special point in my testimony that in our studies of satellite communications, we believe, it has become apparent to us that it will be necessary to involve the most cost effective approach for Alaska, and I want to say we just couldn't build 97-foot earth stations throughout this large state, with its sparse population.

And these are the kinds of earth stations that have been

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built around the world today. Most all of them in commercial, virtually all of them in commercial service are of this size.

Now, my third point follows the foundation I have laid, namely, that here is an opportunity through logical developments to use smaller earth stations, perhaps 32 foot or less, and other technological developments to meet these unique communications service requirements and the experience here can be helpful and certainly we would expect it to be helpful in other areas, similarly situated.

Mr. Mosher. Well, the cost effective considerations in Alaska, I assume, might be very different than the cost effective considerations in the lower 48.

Mr. Hawkins. In some respects they would. But we do have, of course, in the lower 48, some rather sparsely populated areas. So while we do not have in Alaska a New York metropolitan area or Los Angeles or areas of that kind, there are some comparable situations in the lower 48, and indeed in certain other countries around the world.

Mr. Mosher. I assume that the use of satellites for the lower 48, the potential use there in communications, would also be only in terms of an integrated system. Considering the sophistication of the present system we have already in the lower 48, satellites still have possibilities, but you only consider them in terms of using them in connection with the other and integrating them with the existing system, is

onr3 1 that right?

2 Mr. Hawkins. Well, I think this is correct. I would
3 add by way of explanation that of course due to the excellent
4 work that has been done in the lower 48 over several years,
5 we have a much more advanced communications system in the
6 lower 48 today, because of the work that the Bell System
7 has done and other telephone and telegraph companies in the
8 lower 48.

9 So that here there are ways now to provide communications
10 to meet communications requirements in the lower 48, that
11 just aren't presently available in Alaska.

12 Mr. Mosher: On page 1 of your statement, you refer to
13 the realm of communications as being one of the most
14 technologically explosive. Are you suggesting that the
15 technology of communications at its present point is still
16 rather primitive, that this explosion is going to take us
17 into areas and uses and integrations that we don't even
18 contemplate yet?

19 Are we still in a primitive state in communications or
20 not?

21 Mr. Hawkins. I would answer your question by saying
22 that we have made very great progress in electronics and
23 communications in the last many years. But there are many
24 more opportunities ahead, as the technology evolves.
25 So while we are well advanced, there are many more

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opportunities ahead of us.

Mr. Mosher. Yes.

Mr. Hawkins. To apply communications techniques in the period of the 70's and in the 80's. And here you might almost look at this problem on a world-wide basis. We have a very -- by present standards around the world, the United States has a very davanced communications system. In many areas of the world they are less advanced. But technology certainly will provide great opportunities for all kinds of new developments in the period ahead.

Mr. Mosher. Well, you are talking about opportunities for the application of new technology, but do you anticipate that there is still a realm of new knowledge and still more advanced and sophisticated technology that we have heardly got into? Or can't you anticipate that?

Mr. Hawkins. I think we can anticipate further developments. Certainly we all know about the lasers and waveguides and things of that kind. But some of the greatest applications that are likely to come about in the foreseeable future are the new applications in combinations of electronics and communications through the computer satellites, and all other kinds of systems which are now -- have become technologically possible.

Mr. Mosher. At least the possibilities and the opportunities are so great that we should be vigorously

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pressing ahead?

Mr. Hawkins. Yes, we should.

Mr. Mosher. That is the burden of your statement?

Mr. Hawkins. Yes, that is right.

Mr. Mosher. Mr. Chairman. Thank you.

Mr. Karth. Mr. Symington.

Mr. Symington. Thank you, Mr. Chairman.

Mr. Hawkins, I wonder if you could amplify further the third paragraph on page 9, the suggestion that there are entities which are making attempts to fragment the system.

Mr. Hawkins. Yes.

Mr. Symington. What are those entities?

Mr. Hawkins. Yes, perhaps I could lay a little foundation for my answer to your question. Congress in 1967 passed the Alaska Communications Disposal Act. This was a comprehensive piece of legislation that provided for the sale of the Alaska Communications System.

It authorized the Secretary of Defense to go through a comprehensive competitive bidding process, in which all interested parties in purchasing the Alaska Communications System were given opportunities to respond to an RFO.

Now, this request for offers was released by the Air Force, to which the Secretary of Defense had delegated the authority, in the latter part of 1968, and all concerned were invited to bid on acquisition of the system and submit

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proposals by March 1, 1969.

RCA was one of the companies that decided to bid on the system. There were comprehensive public interest criteria set up in the legislation, basically the formula was the price for the system, the program for service improvement and the rate reductions to be offered the public.

This was a three-part formula together with a number of subsidiary points to be considered in the evaluation. Among those who bid on the system were General Telephone and Electronics, Continental, I believe Universal Telephone bid on the system.

When the evaluation process was completed, President Nixon announced his approval of the award to RCA at the end of June. This award was subject to the issuance of certificates of public convenience and necessity and radio licenses by the FCC.

Promptly what has happened, three entities entered the picture, none of which had bit on the Alaska communications system.

Mr. Karth. Would you identify those for the record, please?

Mr. Hawkins. Yes. One of them was the Western Union International, Inc., an international record carrier. The second one was the Matanuska Telephone Association, Inc., which operated in the Matanuska Valley area of Alaska.

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And the third one was the City of Anchorage, which operates a -- which owns Anchorage Telephone Utility.

A very basic and vital part of the program called for by the Air Force, RFO, was the construction of the microwave link to interconnect the earth station with the City of Anchorage. The earth station at Talkeetna is about 90 miles north of the City of Anchorage and it is necessary, of course, to have a high-capacity microwave system to connect with the City of Anchorage.

The RFO from the Air Force provided for construction of that link, because it is an essential element of the long-line system in Alaska. We of course have applied for that authority, but we are now confronted with competing applications by the Matanuska Telephone Association and by the Western Union International, who made no offer to acquire the system, of undertaking no financial commitments with respect to it.

The AC system has four basic toll center. The key switching centers, toll centers for the state. One is at Anchorage, one at Fairbanks, one at Ketchikan and one at Juneau.

The ACS has traditionally operated the toll center at Anchorage, which telephone calls now are handled by manual operators, who take the telephone calls and switch them manually either to the lower 48 or elsewhere throughout

the state.

As part of the program outlined by the Air Force and to which we responded in our proposals, we provided for extended direct distance dialing. This of course is well known to us in the lower 48. It is essential to improvement of service and it is also essential to encourage the development of additional telephone traffic with the reduction in rates.

For example, we have offered in our proposal to put in a one-dollar after midnight rate for telephone calls from Alaska to the lower 48. The City of Anchorage is now seeking, is now seeking to take away from the ACS system the Anchorage toll center and the DDD equipment.

Again, through regulatory proceedings before the Commission.

Mr. Symington. I would like to ask you another question, just to get the concepts more firmly in mind. Supposing in St. Louis, Missouri, if we had a satellite earth station, we could communicate with European countries. Is this the kind of service that you could provide, or a similar organization, through the use of satellite communications?

Mr. Hawkins. Yes. This is entirely possible technically. Now today, telephone services are, or transmission service, Telex service to Europe, are mainly routed through the Edam, West Virginia, earth station. This is a large new earth station which is the main earth station

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for trans-Atlantic and Latin American traffic.

Now, a call originating, say a Telex call or any communication originating in St. Louis is routed over land-line facilities into Edam, West Virginia, for transmission. Now, it is entirely possible of course with the technology to have an earth station which would transmit directly to the satellite from St. Louis and come down in London or Paris or anywhere else.

Though this is entirely possible from a technological viewpoint in sound system planning, consideration would always need to be given as to whether that is the most efficient cost effective way to serve St. Louis, or is it better to funnel that traffic over terrestrial links into Edam and put it out on satellite channels from that point.

But if you translate your question into Alaska, and I carry it the other way, we can foresee the time down the road where rather than coming from Anchorage, say, or Fairbanks, down through an earth station in Jamesburg, California, it may well be possible to come to an earth station not only in California but perhaps in the eastern part of the United States, and you eliminate the trans-continental terrestrial link.

This can be done from any area to which you can see the satellite.

Mr. Symington. Yes. But you have no opinion at the

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moment as to whether it would be cheaper to communicate from the Midwest to Europe via satellite than it is today, overland and then cable?

Mr. Hawkins. I don't have, I don't feel that I have studied the question sufficiently to give you an informed answer. It would be my anticipation that at the present levels of traffic with Europe, it is probably more efficient to continue as the service is now being handled, although I am sure Mr. Huff of AT&T can give you a very informed answer on that question.

Mr. Symington. Thank you.

Mr. Mosher. Will the gentleman yield?

Mr. Symington. Yes.

Mr. Mosher. Going back to this communications between St. Louis and the continent of Europe, via satellite, assuming there was a ground-based station in St. Louis, what would be the time elements in the transmission of voice communications? Could a person in St. Louis talk back and forth with someone in Paris --

Mr. Hawkins. Yes.

Mr. Mosher. Just as you would on the telephone in St. Louis to Webster Grove?

Mr. Hawkins. Yes. Actually, the round trip transmission time from the earth station and the satellite back -- you remember the satellite is 23 miles up in space.

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The round trip time is 6/10 second, as you know. So if you transmitted from an earth station directly in St. Louis to Paris, you would have the transmission time from St. Louis to Paris.

Now, actually a call being originated in St. Louis and switched into the earth station in Edam, the transmission time would be virtually the same, because there would be a small transmission time to Edam, but it wouldn't be significant.

Now, I would like to add another point here, that is of some significance to this question. When we talk about service, say, from St. Louis to Europe, or any other foreign country, we always must keep in mind the desires, position, independence of other foreign countries, who would have to agree to the manner in which the service is to be engineered and provided.

And they might find, for cost or engineering reasons of their own, the German Deutsche Bund, for example, might feel that it is more to their interest to see that the traffic from the United States goes through a single earth station in the United States.

Although from a technological point of view there is no problem.

Mr. Symington. You make a distinction today, I suspect, between what might be called domestic service and

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international service, in telephonic communications. Would the advent of satellite communications in any way change the concept of what is international service as distinct from domestic service?

Mr. Hawkins. I suppose I would say that technology alone doesn't change the question of whether a message is between two points within the United States, or between the United States and a foreign country, which makes it domestic or international.

But as the technology develops and we apply satellites, it does open up opportunities for handling international communications in different ways. It is possible, for example, to jump the gateway, so to speak, with satellites.

Mr. Mosher. It shrinks the earth.

Mr. Hawkins. It certainly shrinks the earth, yes. It certainly shrinks the earth, because you put a satellite over the Atlantic, it can illuminate a substantial area. But at the same time we have to keep in mind that we just can't put one earth station up and see everything in the world.

It takes roughly three satellites around the world, with properly positioned earth stations, to communicate everywhere. Like now today we have two earth stations on the East Coast and two on the West Coast.

Mr. Symington. Thank you, Mr. Hawkins. Thank you, Mr. Chairman.

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Mr. Karth. Mr. Hawkins, on page 1 you seem to wrap up a good deal of authority in one paragraph, and I would just like to explore more your understanding of what you really mean.

In the last paragraph on that page you say RCA Globcom is an authorized international voice record carrier, has participated extensively in the development of the satellite communications. You mean in cooperation with COMSAT?

Mr. Hawkins. Yes. I mean in cooperation with COMSAT, and also I meant by that to encompass the activities in which we have been involved, even prior to the creation of COMSAT in 1963. We have been very active in this field, from the beginning of satellite communications, and when I refer to being an authorized international carrier, I am using the term there in two respects.

I am using it as it is referred to in the Communications Satellite Act, and of course all of the satellite communications service that we provide today are of course authorized by the Federal Communications Commission, and when I say authorized by policies or decisions of the Commission, we are a carrier which is authorized to provide international voice record service.

Mr. Karth. But with the use of satellites?

Mr. Hawkins. With the use of satellites --

Mr. Karth. As COMSAT is authorized?

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Mr. Hawkins. COMSAT, of course, is a carrier's carrier. And COMSAT doesn't serve the public. COMSAT provides facilities to the carriers which they then use, integrated with their other facilities, to provide service to the public.

Mr. Karth. And that is the distinction you make here?

Mr. Hawkins. Yes, that is an important distinction.

Mr. Karth. Yes.

Mr. Hawkins. Of course, we jointly own with COMSAT the seven U. S. earth stations -- although in six of them, the four mainland and the one in Hawaii and the one in Puerto Rico, COMSAT is the operational manager of these stations and has 50 percent of the ownership.

The remaining 50 percent is divided among the carriers, mainly AT&T, ITT, Hawaiian Tel and Western International and RCA.

Mr. Karth. Do you feel that you have authority to be a carrier's carrier, on an international basis, with the use of satellites?

Mr. Hawkins. Well, we are not --

Mr. Karth. Under existing authority?

Mr. Hawkins. We are not now a carrier's carrier.

Mr. Karth. But do you feel under existing authority, or under existing law, that you have that right, that you are not legally restricted from being a carrier's carrier?

Mr. Hawkins. I would have to be rather careful in how

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I answer that, not to give you the wrong answer.

Mr. Karth. Take as much care as you want, but try to be specific.

Mr. Hawkins. All right. That is a fair bargain. Let me start out by picking up the Satellite Communications Act first. Here Congress specified in the Satellite, in the Communications Satellite Act of 1962 that COMSAT would be the authorized United States entity to participate in the establishment of the global system.

Therefore COMSAT is the U. S. entity that participates in the INTELSAT arrangement. With respect to ground stations, however, Congress also specified that ground stations should be authorized to COMSAT or the carriers as will best determine the public interest, convenience and necessity, and here I would answer your question by saying we could be authorized to provide and operate a ground station which in turn could be used by other carriers.

Mr. Karth. You could be authorized?

Mr. Hawkins. Yes.

Mr. Karth. But at the present time you feel that you are or are not?

Mr. Hawkins. We are authorized jointly, in other words, all of the carriers today are jointly authorized to own the six U. S. earth stations, and all of our joint ownership is available to all of the carriers, for such service to the

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public as the FCC may decide or may authorize.

Mr. Karth. I will have to read that in the record and see if I understand your answer.

Mr. Mosher. Mr. Chairman, may I interrupt?

Mr. Karth. Yes, Mr. Mosher.

Mr. Mosher. Is the present arrangement so satisfactory that there is no thought on your part or other corporations' part, as seeking the same franchise, essentially the same type of franchise that COMSAT has, to be a carrier's carrier in the satellite field?

Can you see any time coming when there will be competition with COMSAT from other entities?

Mr. Hawkins. Of course there is always that possibility, down the road. I would say that, to be more specific to your question, we do feel that we have a large measure of expertise, and have the capabilities of operating the U. S. earth stations on the mainland, and we think that we could do that at least as well if not better than COMSAT and more economically.

Mr. Mosher. You are talking about land.

Mr. Hawkins. Earth stations.

Mr. Mosher. Yes, earth stations. I am talking about satellites. COMSAT is a carrier's carrier, so far as the operation of the satellites is concerned. Is that correct?

Mr. Hawkins. That is correct.

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Mr. Mosher. Is the present arrangement sufficient and satisfactory? Or do you see any possibility that there will need to be competition up in the satellite area? That is, of course there could be competition from some other nation, I understand that. Russia, for instance. But is there any reason for Congress or the Federal Government to consider the authorization of a competing situation in the operation of satellites, that would compete as carriers' carriers, as a carrier for the carriers up there? I am not sure of my terminology.

Mr. Hawkins. I think I understand your question. Let me say, first, that in 1962 Congress passed the Act at the time it did because it was seeking to get on with the implementation and the new technology. And certainly the arrangement provided for by Congress has been effective. We do have an international satellite system operating.

The technology has certainly been developed over the last several years. And we do now have a global satellite communications system with earth stations being added around the world.

Now, your question, I think, raises the interesting possibility that as we look on into the decade of the 70's, and perhaps at the 80's, with the increased technological developments and opportunities for satellite communications, should we permit other than COMSAT to orbit satellites? And

onr18 1 certainly I would not today want to foreclose that
2 possibility. I think that is a possibility that should receive
3 appropriate consideration in due time.
4 Mr. Mosher. You think it is conceivable that an
5 organization like RCA or AT&T or ITT might want to get into
6 that business?
7 Mr. Hawkins. Yes.
8 Mr. Mosher. In competition with COMSAT, or supplementary
9 to COMSAT?
10 Mr. Hawkins. It might well be in the public interest,
11 conceivably, as we look ahead to the enormous developments
12 that will be possible through satellite technology.
13 Mr. Mosher. And would this perhaps be more possible
14 as a matter of public interest that there would need to be
15 competition in the operation of those satellites for
16 domestic communications, rather than international
17 communications?
18 Mr. Hawkins. Well, I think when we open up the domestic
19 problem, we open up a number of additional considerations.
20 I mean, here this is a matter now that has been receiving
21 extensive study among the interested agencies and departments
22 of the Government, and at this point in time it would appear
23 that the most expeditious way to get on with the domestic
24 satellite system is to at least get one system up operating
25 in orbit.

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There are then economies of scale to be achieved at that point. A domestic satellite with 12 or 24 transponders in it would certainly be more cost effective than a series of small satellites.

So that at this point in time, regardless of who owns it, whether it is owned individually or owned jointly, it would appear that the most effective solution for the moment at least would be to permit realization of the economies of scale that are possible at this point in time.

Mr. Mosher. Well, you say that would be the most effective solution at this point. Who would be the most likely operator of that most effective arrangement at this point in time?

Mr. Hawkins. Well, we have had suggestions from different ones that they might be the operator. COMSAT of course has been active in this area, and would certainly be a carrier that should be considered. But I would think that in reaching such a conclusion, the FCC as thelicensing authority would want to consider who else might want to come forward to make such a proposal.

Mr. Mosher. There might be a request for offers or bids from RCA, AT&T, and ITT, the whole --

Mr. Hawkins. This is certainly conceivable. You will recall that some years ago the American Broadcasting Company actually proposed that it be permitted to put up a dedicated

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satellite for television transmission.

Mr. Mosher. I am completely new to this. I am not aware of that at all.

Mr. Hawkins. That was some years ago.

Mr. Mosher. The American Broadcasting Company?

Mr. Hawkins. Yes.

Mr. Karth. ABC.

Mr. Hawkins. That was some years ago. And actually they proposed that it be permitted to orbit a satellite that would be used for video transmission and other television purposes.

Mr. Mosher. So this likelihood of competition for that type of franchise is very real and fairly imminent?

Mr. Hawkins. Well, I don't know that I could go so far as to say that it is either imminent or likely. But rather it is always a possibility.

Mr. Karth. Mr. Hawkins, by virtue of your answers to Mr. Mosher's questions, are you implying then that the 1962 Act does in fact restrict the use of satellites for domestic purposes to the COMSAT Corporation?

Mr. Hawkins. No. We do not read the 1962 Act as restricting the operation or ownership of domestic satellites to COMSAT alone. Though I do not have the Act in front of me, as I recall a section at the very front, it merely says that -- and I may not say this accurately,

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but the substance of it is that this Act should not be deemed to preclude the use of the system for domestic purposes, but it does not clearly spell out, in our opinion, any Congressional mandate that COMSAT alone has the right to own and operate all domestic satellites.

Mr. Karth. And you recognize that there might be a difference of opinion between your judgment on that point and COMSAT's?

Mr. Hawkins. Yes. I have read the COMSAT documents which take a different position.

Mr. Mosher. Well, Mr. Chairman.

Mr. Karth. Mr. Mosher.

Mr. Mosher. I suppose there would be some legislative history, too. You would think there would be some record of Congressional intent in this, too.

Mr. Hawkins. I might say this is a subject that has been rather extensively briefed in filings before the Federal Communications Commission by a number of entities in its inquiry on domestic satellite communications.

Mr. Symington. Mr. Chairman, or Mr. Mosher.

Mr. Karth. Just one minute. May I just pursue this one question?

Mr. Symington. Yes.

Mr. Karth. Who has the authority in Government circles to interpret the 1962 Act, so as to clarify that question

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and legally prove either RCA's judgment on this point right or that of COMSAT as being right?

Mr. Hawkins. Well, initially I would anticipate that such questions would arise before the Federal Communications Commission, and then whatever decision the Commission made would of course be subject to the usual appeals to the courts, and perhaps if necessary to the Supreme Court.

Mr. Karth. But you think FCC is the agency of government that would make the initial determination?

Mr. Hawkins. The initial determination, because it would be anticipated that such a question would arise as a licensing matter, and since it would arise as a licensing matter, then this question would initially be considered there, and it has of course been the subject of numerous comments filed with the Commission over the last year or two in connection with the domestic satellite communications matter.

Mr. Karth. There was some doubt in my mind that Mr. Plummer's organization, if I may call it that, might also have --

Mr. Hawkins. It could be anticipated that Mr. Plummer's organization would be involved in any such.

Mr. Karth. In determining policy.

Mr. Hawkins. Yes, certainly Mr. Plummer's organization, I would anticipate, would be vitally concerned with any such determination of policy, and no doubt the Commission would want to take into account two views or comments by Mr.

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Plummer's office or anyone else who could contribute.

Mr. Karth. If Mr. Plummer's organization established the policy, is that subject to the courts, the appeals, the same as if the FCC made that determination?

Mr. Hawkins. This starts to get us into a rather deep question as to the -- I would like to answer the question the best I can.

Mr. Karth. All right.

Mr. Hawkins. It starts to get us into the rather deep question as to what Congress really meant in the Communications Satellite Act. I think in that provision which gives certain authority to the President over the application of the policies in the Communications Satellite Act.

And I think I would not be alone in saying that there may be some disagreement as to just where these lines are drawn. But in any event it ultimately gets back initially, I think, to the FCC, because FCC is thebody which has to issue the license.

Mr. Karth. Yes, but if policy has been established, then they just go about issuing the license, and I assume once the license is issued, then at least to whomever it is issued they are legally entitled to move forward, and it may be subject to appeal, kind of in an after the fact fashion, as opposed to before the fact.

Mr. Hawkins. But you could foresee the possibility that

onr24 there could be a disagreement between Mr. Plummer's office and the FCC as to what authorization should be issued.

Mr. Karth. And if there was, whose organization would prevail?

Mr. Hawkins. Well, I guess at that point it would be probably have to ultimately be decided by the courts.

Mr. Karth. I see.

Mr. Hawkins. As the final interpreter of the act of Congress.

Mr. Mosher. The courts are accustomed to trying to figure out what Congress meant.

Mr. Hawkins. They are rather experienced at it.

Mr. Karth. Mr. Symington.

Mr. Symington. Mr. Chairman, correlating some of yesterday's testimony with today's has added to my confusion. We had Senator Gravel from Alaska yesterday, and he addressed himself momentarily to the COMSAT Act. And he seemed to feel that COMSAT was delinquent in providing domestic service, and that this was no fault of the Act itself, although he thought Congress minimized the importance of domestic service; but that there remained sufficient room in the Act to provide appropriate domestic service, but that lack of FCC authorization was impeding the service that he expected from COMSAT.

Never was the question brought up that he could have got it from another source, nor did we discuss yesterday the

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RCA interests and activities in this field in Alaska.

And I am wondering why he pins all his hopes on what COMSAT can do for him if in fact under the law and competitive opportunities, that other companies afford, he could have turned elsewhere. Can you explain that?

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Mr. Hawkins. Well, unfortunately I wasn't able to be here yesterday, so I don't know precisely what he had in mind there.

Mr. Symington. Well, may I ask you this? Is it your understanding that under this Act a competitive opportunity exists for a number of entities to make bids to provide domestic satellite communications services, and that Comsat is merely one of them?

Mr. Hawkins. I think the question would have to be broken down into two parts. If the Intelsat satellite system is going to be used to provide domestic service, then that is a satellite system that is owned jointly by Comsat and many countries around the world.

And therefore, it would be Comsat's role, to the extent that that satellite system is used to provide domestic service.

Mr. Symington. Is it your feeling that it was not the intention of Congress to provide Intelsat with such an opportunity, and responsibility?

Mr. Hawkins. No, I think that it is the other way. I think that the Congress intended to permit such a use for domestic purposes, but it did not foreclose the possibility of other means or other entities providing domestic only.

Mr. Symington. Dr. Charyk testified that Comsat has been ready and willing and even anxious to go forward with a domestic

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service system, that for the past four years they have wanted to do it, and he said the only obstacle was FAC authorization. I believe that is what he said.

It seems to me another obstacle would have possibly been the competition that you or colleagues of yours in that field might have provided, in an effort to get such authorization for themselves. Wouldn't you have thought that? Don't you think that that would be an obstacle to domestic service by Comsat? You are interested in providing it?

Mr. Hawkins. Well, except for the ABC application, I can't recall at the moment that any other applications have been before the Commission offering to provide a domestic system. And we do get back to the fundamental question that any domestic satellite system of course has to be authorized by the Commission. And while I can't here today speak for Comsat, I do know that Comsat has endeavored over the last couple of years to move ahead with the domestic satellite system, which, of course, is a development that it would naturally be interested in as a follow-on to the work that it has been doing through the Intelsat organization.

Mr. Symington. Well, have you been seeking, has your organization sought similar opportunities?

Mr. Hawkins. We have not applied for such authority.

Mr. Symington. And may I ask why?

Mr. Hawkins. Well, first, let me say that RCA Global

Communications, Inc., is an international carrier. It is engaged in international communications, and we are involved in that phase of the business, and we have not made application to the Commission for authority to operate a domestic satellite system.

Mr. Symington. Mr. Chairman, I think I have to cease and desist here until I learn a little more about this subject.

Mr. Karth. Thank you, Mr. Symington.

Mr. Hawkins, throughout your testimony here, you have talked at some length about your plans for the Alaskan communications system.

Mr. Hawkins. Yes.

Mr. Karth. And somewhat in line with the questioning that has gone on, as to authority to operate satellites for domestic purposes, do your plans, all of these plans that you made, or anywhere in those plans for developing the Alaska system, do you include the possibility of launching a satellite to enhance that system, COMSAT notwithstanding?

Mr. Hawkins. We included the possibility. We have looked at perhaps three possibilities. One, of course, is a dedicated satellite system for Alaska. Another possibility is some use of the INTELSAT satellite, a transponder, say, with a spot beam on Alaska. And of course the third possibility would be a portion of a domestic satellite that might be illuminated towards Alaska.

These possibilities have all been looked at; but here again, Mr. Chairman, being practical communications people, we would also have to look at the question from the standpoint of economics. And certainly the cost of a dedicated satellite for Alaska would greatly increase the cost of providing a system there, as compared to getting, say, one or two transponders in a 12 or 24-transponder satellite that might be used, and since it is our interest not only to provide the best possible service but also to provide it at the lowest cost to the public, we would naturally be very interested in what approach would best achieve that objective.

Mr. Karth. Well, could you cover the 48, plus Alaska, for a domestic system, with one satellite?

Mr. Hawkins. Well, a large satellite could, a large satellite can --

Mr. Karth. Within the present state of the art in technological development, could you do --

Mr. Hawkins. You could do one of two things. You could of course use a specific satellite with a spot beam on Alaska; or a properly positioned U.S. DOMSAT -- by "DOM", I mean the lower 48 -- could also serve Alaska. It gets to be a question of the position of where the satellite is placed in orbit, and where the antenna is directed.

Mr. Karth. Well, I think someone said yesterday that this could not be achieved with one satellite, and I was just

wondering what your judgment was about it.

Mr. Hawkins. I suppose what you are saying here is everywhere from Puerto Rico to -- way out in the Aleutian chain.

Mr. Karth. No.

Mr. Hawkins. That would probably not be possible.

Mr. Karth. I am talking about the lower 48, plus Alaska.

Mr. Hawkins. If we are talking about the --

Mr. Karth. The same as the satellite would probably cover the requirements of Alaska, the 48 notwithstanding. Could one satellite do this?

Mr. Hawkins. Well, I'd have to take a look at the exact calculations on this, but it is foreseeable it could get to be marginal between far out in the Aleutian chain and certainly the East Coast of the United States.

Mr. Karth. On page 3, you mention figures, the purchase of the ACS from the Air Force for 28-1/2 million dollars. What portion of that 28-1/2 million dollars was to be for the establishment of satellite communication system as opposed to existing terrestrial facilities?

Mr. Hawkins. The 28.4 million dollars does not involve satellite communications.

Mr. Karth. Pardon me?

Mr. Hawkins. The 28.4 million dollars covers only the existing ACS system, which does not include any satellite communications facilities.

Mr. Karth. Well, I know that.

Mr. Hawkins. Yes. Perhaps you are referring to the 276.

Mr. Karth. Maybe the 276, yes.

Mr. Hawkins. Yes. Okay. With respect to the 276, initially, of course, there is about 3.2 million dollars in there for a 50 percent interest in the Talkeetna earth station, plus the connecting microwave length.

Mr. Karth. Is any part of this 56 million dollars total considered to be monies for the purchase of the franchise, if that is the proper word, as opposed to monies to purchase facilities, existing facilities, and expanding facilities and improving services?

Mr. Hawkins. Well the entire 28.4 million dollars is for the purchase of physical facilities and plant. This includes toll switching centers. It includes certain microwave systems.

Mr. Karth. So you haven't really paid anything for a franchise as such. The word has been bandied about and that's the reason I ask the question. You paid 28.4 million dollars for existing facilities, that was judged to be worth 28.4 million dollars. Right.

Mr. Hawkins. The 28.4, in essence, was the price for all practical purposes fixed by the Air Force.

Mr. Karth. For existing facilities?

Mr. Hawkins. Yes. Now, in the bidding process, it was set up in a unique way, which said, in effect, you are going to

win or lose, depending on what you offer for the purchase.

Now, I couldn't say that there is any specific sum of money in there that you could identify as such for the purchase of franchise, because it doesn't work quite that way. But competition --

Mr. Karth. I was just wondering whether or not you felt you had purchased anything other than that which did physically exist there.

Mr. Hawkins. Oh, yes, definitely, and that's what I was coming to. We felt that we have purchased not only the physical facilities but the business, and I believe this is borne out by the legislation, because in the implementation of this program for service improvements, and rate reductions, we will be for the first few years of operation there will be no profit from the operation. In fact, the first few years we will probably be losing money. So to that extent you might say, Mr. Chairman, that you are being encouraged to make an investment for the future in acquiring a business.

Mr. Karth. But you don't feel that in that purchase price you have in fact purchased the exclusive use of the communications system up there? Other than the fact that you did pay for whatever existing facilities are there.

Mr. Hawkins. We feel that we have acquired the existing business, and facilities of the ACS, in Alaska.

Mr. Karth. But no exclusive right to involve yourself in

such business, other circumstances notwithstanding.

Mr. Hawkins. Well, the ACS is the only long-lines operator in Alaska today.

Mr. Karth. I understand that. But that is a physical facility.

Mr. Hawkins. It is a physical facility and also it is a business.

Mr. Karth. It is a business, yes.

Mr. Hawkins. It is the only one that's in the business. Now what we are saying here is that because of the nature of that business which was acquired and because of the economics and other public interest aspects of the business, it ought not to be fragmented or split up, at least at this point in time.

Mr. Symington. Mr. Chairman.

Mr. Karth. Mr. Symington.

Mr. Symington. Something is dawning on me now. If COMSAT got the authority to provide satellite service to Alaska, you would consider that a fragmentation of the communications system of which you have invested to date, right?

Mr. Hawkins. Not necessarily. It would depend on how it was done.

Mr. Karth. But you do have a reservation about your answer to that question?

Mr. Hawkins. Well, let me say it is a general question,

and it is kind of hard to answer it as a general answer. Take the Talkeetna earth station for example. In the Air Force RFO, the Air Force had already recognized at that point in time, and COMSAT had been authorized to go ahead with the construction of the earth station. But we certainly expect to have half the ownership of the earth station when this matter is resolved.

Mr. Karth. If the Act doesn't give COMSAT the exclusive interest they think they have, or for use of satellites in domestic communications, why would you feel that under any circumstances you would have this exclusivity?

Mr. Hawkins. I am not saying we should have the exclusivity.

Mr. Karth. In the State of Alaska.

Mr. Hawkins. In the domestic satellite field.

Mr. Karth. All right. That answers my question.

Mr. Symington. And it raises my next one, which is that in answer to my question "Why have you not asked for domestic authorization," you said that "We are principally international." You consider, then, but you have made and are interested in making further applications for Alaskan service. So do I take it that you consider that international in nature, as against domestic?

Mr. Hawkins. No, I wouldn't say that. I would say actually that most of the service out of Alaska is either between Alaska and the lower 48, and/or within the State of Alaska.

Mr. Symington. What kind of service is it between the lower 48 and Alaska? Is that domestic?

Mr. Hawkins. Well, about 80 percent of the business of the Alaska communications system is telephone business. And between Alaska and the lower 48, I believe this would be regarded as domestic communications.

Mr. Symington. So that in effect you are interested in domestic.

Mr. Hawkins. That's correct, yes.

Mr. Symington. And you would qualify your previous answer to me, at least insofar as it affects Alaska. I think the record will show that I did ask you why you had not made the same kind of domestic application that COMSAT had made, and you said because we are an international service, I believe.

Mr. Hawkins. I am not sure I said it was because we were. I think I said, instead, that we had not chosen to make such an application, and I merely added as a footnote after the fact statement. But I did not mean to infer that that was the basis on which we made the decision.

Mr. Symington. Mr. Chairman, I believe yesterday there was a statement that a single satellite could provide lower 28 service and a beam to Alaska, I think, was the expression used. I noted that earlier you said that there was testimony to the fact that more than one satellite would be needed.

Mr. Karth. It might have been in private conversation

that this point was made to me and I am not sure. But I do know that that statement was made to me, either on the record or in private conversation.

Mr. Symington. The reason I mention it is because I think it was COMSAT's position that they could provide what I think we can now call domestic service between Alaska and the United States, with a single satellite. And I take it that Mr. Hawkins agrees that that is possible.

Mr. Hawkins. Oh, yes, technically certainly you could provide domestic service between the lower 48 and Alaska with a single satellite.

Mr. Symington. Wouldn't a system that provides international satellite communications be more likely to be able to provide that kind of domestic service more cheaply, because of the -- well, just the unit cost.

Mr. Hawkins. Well certainly I think that's a good point, because we are in a technology where there are certain economies of scale that can be realized through larger systems.

Mr. Symington. I would say here, Mr. Hawkins, that I don't really know a great deal about your international service, or intelligence satellites, and the difference between their sizes, the opportunities they provide, so I am really asking these questions in a general way.

Mr. Hawkins. All right.

Mr. Symington. And I guess when I speak of an international

service, I speak of yours as well as theirs. But I am just anxious to learn as much as I can about how to provide service to American citizens at the lowest possible cost who want to communicate anywhere in the world, certainly with their fellow citizens and beyond as well.

Thank you.

Thank you, Mr. Chairman.

Mr. Karth. On page 3 -- and we have another witness, and I don't want to take up more time than is necessary, but I have some additional questions, and I may refer them to you by mail, Mr. Hawkins.

Mr. Hawkins. All right, fine.

Mr. Karth. And put them in the record. But there are one or two questions I would like to cover quickly. Also on page 3, you say RCA Globcom's commitment to the people of Alaska includes rate reductions averaging over a9 percent for interstate service, and nearly 40 percent for intrastate service. Does this suggest by innuendo or otherwise that the Air Force is overcharging the Alaskans for domestic service?

Mr. Hawkins. I wouldn't say that.

Mr. Karth. What does it mean?

Mr. Hawkins. First, let me say that traffic volume is increasing in Alaska, and we are looking towards improving the facilities, and we are anticipating a growth in traffic volume from the time we take over to a period that will justify these

reductions in rates.

Now, this has not always been the case in the Alaska system in the past. And indeed, the Air Force itself has just on December 1 of this year actually put into effect most of the rate reductions that we had proposed, and which we had scheduled for on the takeover date. So that the Air Force now is really applying these rates for all practical purposes in Alaska.

Mr. Karth. On page 5, you list a number of services, and you identify them by preceding them with a dot, and I think there are 6 broad general categories. Do any of those categories include the use of technology that would be direct broadcast in character?

Mr. Hawkins. No.

Mr. Karth. No?

Mr. Hawkins. No.

Mr. Karth. How long in your judgment would it take for that technology to arrive?

Mr. Hawkins. Well, this is one in which I believe the scientists and engineers can certainly disagree, but that direct broadcasting technology is certainly some years ahead in the next decade. I would find it difficult to be precise as to when that would occur, because if you look ahead it means such things as very powerful satellites, it means development of small antennas of the kind that a person could have in

conjunction with their own television set at home. So that development certainly is some years away.

Mr. Karth. But if you had direct broadcast to small communities as opposed to each individual receiver, that technology is not as far down the road, is it? And then use regular --

Mr. Hawkins. This is correct. In other words you come into --

Mr. Karth. Existing --

Mr. Hawkins. You could come into a distribution area, and then redistribute from there.

Mr. Karth. Yes.

Mr. Hawkins. Yes, that should come first.

Mr. Pettis. Will the gentleman yield?

Mr. Karth. Yes, Mr. Pettis.

Mr. Pettis. What does it take to translate the primary reception to the secondary receiver?

Mr. Hawkins. Well, it would take -- you mean locally?

Mr. Pettis. Yes.

Mr. Karth. Existing lines.

Mr. Hawkins. It would take existing cables or local distribution systems like CATC systems or something of that kind.

Mr. Pettis. But that technology exists today.

Mr. Hawkins. Yes.

Mr. Pettis. So actually you could do that in the community.

Mr. Hawkins. Yes.

Mr. Pettis. These people we listened to yesterday were talking about some of these communities, I think they said about a thousand, in Alaska, of over a hundred people, but fewer than a thousand. Now, you could have a primary receiver in some of those communities, of four or five or six hundred people, and then redistribute from there, could you not?

Mr. Hawkins. Yes. You could have, for example you could -- and this is a development down the orad a ways, but you could have a, say, a receive-only receiver there. That might be suitable for reception of television. And then some other arrangement for whatever small amount of ordinary telephone or telegraph service there might be required. But that certainly would be distinguished from a development that would mean that every house, every individual in that small community could have his own antenna and receiving set. I believe that was the question that the Chairman had asked.

Mr. Karth. Yes. The technology to broadcast to the community, and then using existing community facilities, whatever they might be.

Mr. Hawkins. That is right.

Mr. Karth. To transmit to individual homes, that technology is here today, would you say? Or at least are there any

technological breakthroughs required to accommodate such a system?

Mr. Hawkins. Now here again it is a question of economics and cost. And further development is necessary to develop the most cost-effective solution for that requirement.

Mr. Karth. But at any rate whatever technologies are required in either of those two instances we have talked about, they could be advanced considerably by the expenditure of greater amounts of funds on the part of the research and development agency of the Government, would you agree with that?

Mr. Hawkins. There is always opportunity for further development and advancement of the art.

Mr. Karth. Just one last question, and then I think we ought to get to the next witness.

On page 9, beginning of the second paragraph, you say you want to stress that all of these activities and many others are going forward now, even though the regulatory steps which must precede the purchase of the Alaska communications system by RCA Alascom have not yet been implemented by FCC and Alaska Public Service Commission. Time is extremely short, et cetera. You seem to express dissatisfaction with that, and I am just wondering how strong your dissatisfaction is, and what delays and by whom have caused you to be dissatisfied.

Mr. Hawkins. Well, we of course understand and appreciate the problems of the FCC and the regulatory agencies. Perhaps

my feelings might best be described as impatience, rather than dissatisfaction. We have a big job ahead, we are very anxious to get on with it, we are looking at a July 1 target date, and we know to achieve that target date we need to have the uncertainties removed so that we can go ahead with confidence.

Mr. Karth. Thank you very much, Mr. Hawkins. The Committee has been benefitted greatly by your testimony, and we are grateful to you.

Mr. Hawkins. Thank you.

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Mr. Karth. The next witness is Mr. Richard Hough, who is Vice President, Long Lines Department, American Telephone and Telegraph Company.

Would you, Mr. Hough, please proceed in any way you think it might be beneficial to this committee in answering the questions that we have as our effort to further implement the use of satellites for the purpose of communications.

STATEMENT OF RICHARD R. HOUGH, VICE PRESIDENT, LONG LINES DEPARTMENT, AMERICAN TELEPHONE & TELEGRAPH COMPANY

Mr. Hough. All right.

Well, I am very happy to have the opportunity to be here, and it is my objective to be as helpful and informative as I can.

I do have a short statement, and perhaps I should start by reading that.

It is important to keep the satellite as a communications medium in perspective. Communications satellites comprise a facility for transmission identical in function to microwave radio systems and coaxial cables. They have been proved to be an effective medium for transmission of intercontinental communications, as demonstrated by the extensive progress made in the implementation of the global satellite system.

However, there are no communications services which could

mm2 1 be offered by satellites which cannot now be offered over
2 terrestrial facilities. In recent years there have been other
3 new developments in communications which are also of great
4 significance in microwave radio and coaxial cables.
5 Looking to the future, wave guides and lasers also
6 appear to hold great promise for carrying large volumes of
7 communications at very low cost. Accordingly, a possible
8 domestic communications satellite system must be considered as
9 a part of a highly developed nationwide network and in
10 comparison with other attractive transmission media.
11 A communications satellite may be regarded as an
12 intermediate amplifier between two earth stations. It is
13 thus in effect a microwave radio relay station on a very
14 high tower. As such, it has some advantages, and some
15 disadvantages, in comparison with terrestrial microwave
16 radio facilities and coaxial cable systems. In like manner,
17 of course, microwave radio and coaxial cable have various
18 strengths and weaknesses when compared with each other.
19 Before comparing the characteristics of the different
20 types of facilities, it is important to say that in the Bell
21 System we feel strongly that it is highly desirable to use a
22 diversity of facilities to meet communications requirements.
23 In the international field, we have urged, and are continuing
24 to urge, that the provision of circuits by satellite and
25 by underseas cable be balanced so that service will not be

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catastrophically affected by the failure of a major facility and to insure continuing research and development work in both.

Similarly, in the domestic field, a diversity of facilities is also vital to insure service continuity. In the domestic network, there is at present a great diversity because both radio and cable systems are provided over many different routes. Nevertheless, the added diversity of facilities which would be offered by a domestic communications satellite system could be an attractive feature.

It should be pointed out that there are important differences between overseas communications and domestic communications which affect the relative attractiveness of different types of facilities. Overseas communications basically involve the transmission of messages over long distances, mostly over oceans, with no intermediate "drop off" points.

The domestic network, on the other hand, is an immensely complex system of interconnected cables and microwave routes, optimized as to cost and reliability, picking up and dropping off traffic at thousands of intermediate points across the country. In addition, the average length of haul of domestic messages is about 500 miles, which, of course, is far less than that of overseas messages.

In comparing communications satellites with domestic

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terrestrial communications facilities the considerations just outlined have a direct bearing on the question of costs. Since the costs of earth stations and of satellites are the same whether the earth stations are close together or far apart, the satellite is at a disadvantage at short distances.

Thus, the cost comparison most advantageous to satellites would be over a transcontinental route, such as New York to Los Angeles. At one time it appeared that the upcoming new generation of satellites now expected to be operational in 1971 or 1972, that is the Intelstat LV series, would offer some cost savings over terrestrial systems for traffic of transcontinental distances. However, more recently there have been dramatic advances with respect to both microwave radio and coaxial cable along with significant increase in satellite system costs which have changed the situation.

The upcoming Intelsat IV will have a capacity of about 9600 voice grade circuits. However, there is now in service the L-4 coaxial cable, which has a capacity of 32,400 voice grade circuits. And in the same time frame as Intelsat IV, there will be installed the L-5 coaxial cable, which will have a capacity of 90,000 voice grade circuits.

Even on transcontinental routes it now appears that the cost per circuit mile of the L-4 and L-5 cables would be

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substantially less than that of Intelsat IV satellites. As circuit requirements increase, L-4 routes can readily be converted to L-5 at even lower cost.

The high rate of growth of interstate messages plus the ability, with coaxial systems, to drop and pick up circuits at many points across the country and to reuse the same channel many times between different points have made economically feasible greatly increased use of coaxial systems.

With respect to microwave radio, within the past three years a method has been developed to double the capacity of TD-2 systems, the backbone microwave radio facility in the United States, so that a total of 12,000 voice grade circuits may be derived on each route. The cost of deriving the additional 6,000 circuits on the existing TD-2 network is very low indeed, and is very much less than the circuit-mile cost of satellite systems.

However, in spite of this cost comparison, we believe that there is a potential for the use of satellites in domestic communications. While the economics of satellites for domestic uses are not attractive at present, experience in the development of other communications systems indicates that with improvements in the art and careful integration in the network, satellites may also become an attractive facility for domestic use. Research and systems planning are

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continuing at the Bell Telephone Laboratories looking toward high capacity satellite systems operating in a range of frequencies as high as 30 GHz.

If the cost disadvantage can be minimized, there are certain operational advantages which could be gained by introducing satellites into the network on selected routes as an additional major type of domestic communications facility. Communications satellites are vulnerable to different types of failures than are terrestrial facilities and have different transmission problems, the problem of delay being an important one.

A satellite is a complicated piece of machinery located so no one can reach it if it develops trouble; but, on the other hand, unlike a cable, a satellite is not subject to being cut by a construction contractor, nor is a satellite subject to signal fading due to atmospherics and certain other transmission problems which affect microwave radio.

Thus, as stated above, satellites could provide desirable diversification of facilities. With new high capacity systems such as the L-5 cable being introduced, and with cable and radio systems of even greater capacity planned, it is important to have adequate capacity available for restoration should it be needed.

Furthermore, communications satellites could provide a flexible means for rearranging large groups of circuits.

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Assume that calling patterns developed so that the peak load between New York and Miami was evening residential calling, but the peak load between New York and San Francisco was day time business calling.

If the ground stations were appropriately located, large groups of circuits transmitting between New York and San Francisco in the day could be redirected to New York-Miami in the evening with relative ease. We are currently studying these possibilities to determine just how satellites might be advantageously integrated into the nationwide network.

I have tried briefly to give you our current views regarding possible uses of satellites for domestic communications. As you can see, there are some problems, principally the cost disadvantage associated with the use of satellites at their present stage of development.

However, as I have indicated, in the Bell System we have the question of the use of satellites for domestic communications under close study at the present time. Their potential as a part of the domestic communications network can only be realized through very close engineering and operational integration with this network.

We perceive no barriers, legal or otherwise, which would prevent us from owning and operating a satellite system for domestic communications, subject, of course, to the jurisdiction of the Federal Communications Commission. We intend to pursue

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our work in the satellite area with a view to integrating satellites into our network as soon as they will help us to achieve operational benefits for our customers.

We and others in the private sector are able and willing to provide whatever research, development and implementation are needed in the field of domestic communications, including communications by satellite. In view of this, the A.T.&T. Company believes the wisest public policy at this time would be to permit any organization or group interested in establishing and operating a domestic satellite system to apply for a license.

Authorization of such systems should be determined on the basis of the most appropriate usage, in the public interest, of the available frequency spectrum and orbital space, as well as other relevant technical and economic considerations. In addition, any grant should be made with the understanding that no segment of the communications using public would be forced to subsidize such a system.

Mr. Karth. Thank you very much, Mr. Hough, for your testimony before the committee. The Chair wishes to recognize Mr. Mosher.

Mr. Mosher. Mr. Chairman, if I understand Mr. Hough's testimony, he is saying that AT&T is very actively considering the use of satellites and does expect to be in the satellite business at some point. You lay a heavy emphasis

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on the fact that satellites must be considered as part of an integrated system.

Several times in your testimony you emphasized that satellites are only one other means, and there are microwave and cables and so forth, and that you are really interested in satellites at this point not so much in the potential economies that might result as the fact that ht helps to insure service continuity. You used that phrase at one point. And therefore, that to your mind, your prime interest in satellites is just one more element in the technology that insures continuity of service. At this point the economies through satellites are questionable.

Mr. Hough. Yes, sir.

Mr. Mosher. But you certainly are pushing in that direction.

Mr. Hough. Yes. And I am looking at things that can be implemented not and in the reasonable future..

Now, as Mr. Hawkins indicated, no one is sure what will be around the corner in the 1980's and beyond, and you can recall I mentioned that the laboratory was looking at some forward-looking types of systems, employing higher frequencies and much higher capacities than anything we have talked about.

So if I had to guess, I would say there would be some economically attractive possibilities for satellites, sometime

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in the quite forward-looking future, not in the immediate future.

Mr. Mosher. And looking to those possibilities, AT&T certainly reserves its right to put up its own satellites?

Mr. Hough. Yes, sir. As you have correctly indicated, in the near future it may very well be attractive to use satellites to provide this diversity of facilities and reliability, which is tremendously important to more and more communities, and the reliability is of critical importance to a lot of business and private operations in the country.

Mr. Mosher. YOu don't see much future for the use of satellites and ground-based stations without using them in conjunction with your cables and your microwave system?

Mr. Hough. No, sir. As a practical matter, of course, satellites alone provide no service. They must like with terrestrial facilities to connect to the ultimate user. So in any case there has to be some integration with terrestrial facilities, and it is important to study communications for this country as an overall integrated system, having the possibility of using all kinds of facilities, whatever they might be, and satellites certainly are one of these.

Mr. Mosher. No further questions, Mr. Chairman.

Mr. Karth. Mr. Symington.

Mr. Symington. When you say "this country," Mr. Hough,

mm11 would that include Alaska? For example, could terrestrial technology compete economically with the satellite service there?

Mr. Hough. Well, I would think in providing service to Alaska, terrestrial technology and satellite technology should be complementary, rather than competitive. And as Mr. Hawkins has indicated, and I fully support his view, that it is important that communications for Alaska be engineered and planned on an overall integrated basis, using all technology that is available.

Mr. Symington. But you wouldn't feel, would you, that an exclusively terrestrial service to Alaska would be feasible, given the state of the two arts?

Mr. Hough. Well, let me put it this way. I think the service needs to be integrated with the lower forty-eight. Terrestrial service is available to Alaska. And referring to the comments of Senator Gravel and Mr. Pollock yesterday, I was surprised when they indicated a shortage of circuits to Alaska, and I checked that yesterday and we have had no shortage of circuits to Alaska for some time.

So there is service between the lower forty-eight and Alaska.

I would suspect in developing a system for Alaska, satelliges would figure prominently in the consideration.

Mr. Symington. If your organization had the franchise

mm12 to provide intrastate terrestrial service in Alaska, would you feel it imperative that you would also control any satellite communication assistance to that system? Would you consider it awkward to have a split in ownership and control there?

Mr. Hough. Well, I think the important thing is to be able to do an overall, integrated planning and systems engineering job, so that you can lay out a system that will provide the best service at the lowest cost. Of lesser importance is exactly where you get those facilities, but you must have substantial control over them if you are going to be able to operate that system in an effective way.

Mr. Symington. You heard the testimony of Mr. Hawkins concerning any requests similar to that of COMSAT, for FCC authorization to operate a domestic communications service. Has AT&T made any such request?

Mr. Hough. We have made no formal application before the FCC. You will recall that the FCC had a domestic satellite investigation under way, and we made filings in that, as did a number of other interested organizations, and we are all awaiting the outcome of that, from the FCC. But we have no formal filing.

Mr. Symington. Mr. Hawkins, at least in a footnote to one of his answers, suggested that his organization was international in its emphasis. How would you describe yours?

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Mr. Hough. We operate both internationally and domestically, but of course by far the larger portion of our business is the domestic, and there just are more domestic communications.

Mr. Symington. Do you foresee the use of satellite assistance to your communication network?

Mr. Hough. As I indicated, we are studying that very hard, and we feel that satellites will have a part in our network. But to make them effective and justified, we are going to have to integrate them very carefully with the network as a whole, to optimize the overall service and cost factors.

Mr. Symington. Thank you.

Mr. Karth. Mr. Pettis.

Mr. Pettis. If I might turn, Mr. Chairman, to another facet of this, which we touched on very briefly yesterday, and that has to do with programming. One of the big problems we have in our society today is getting important educational material where it really belongs, whether we are talking about children, pre-school, Head Start,or even in sophisticated areas of, let's say, heart surgery. Many of the doctors of the world in many countries haven't the faintest idea about how to go about this. And I read yesterday of a team of American physicians that went to another country to teach the doctors of that country how to do heart surgery.

mm14 While they were there, they had closed circuit television, this was video taped, and they will continue to use this, and apparently it made a great impression on the people, but more than that, it helped the people of that country to upgrade its medical care.

And here we have this facility, apparently we are at least on the threshold of something that might be used educationally. Now to come back home to our own country, I am told by educators that one of our great needs is to find enouch teachers, say, in some of these states of ours, whether in the South or in the Northern area, where populations do not support strong educational programs. I am just wondering, dreaming a little bit, if there aren't some possibilities here for cooperation between organizations such as yours and the government, which is interested in the education of its people and upgrading this, and using some of these things like satellites, to help us in this program.

Now, I think we have proved that we can teach youngsters without having the live teacher there, if we can bring the audio visual thing in, and have the teacher somewhere else. We can accomplish a great deal. Now, maybe my question should be put this way: Don't satellites lend themselves, or won't they one day lend themselves to this kind of educational endeavor?

Mr. Hough. Well, they are one facility that certainly

mm15 can be used. I think satellites are attractive when you have one program that you want to distribute to a very wide area. Certainly they can look attractive there.

On the other hand, if you walk within a state, we have worked with a number of the states on their educational television programs, and some of them have rather extensive distribution networks. Some of the states own their own. We furnish service to some of the states.

I think you will find, if you look at the economics of it, for these situations, that terrestrial facilities are far more economical for this purpose than would satellites be.

The problem is that when you come down to earth to receive a program, it takes a pretty substantial receive only station. You can't afford to have one of those on every school or perhaps on every university, so you end up with a sizeable terrestrial network to distribute from the station, and by the time you add up all the costs, they become high.

But again I would emphasize that there is no service provided by satellites that can't already be provided by terrestrial facilities. So it is purely a matter of what is the most economical way of doing the job, and you have to look at each situation as a system.

Mr. Symington. Will the gentleman yield?

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Mr. Pettis. I yield.

Mr. Symington. Why do you suppose, then, that Senator Gravel put so much stock in satellite assistance to Alaska's communications network? Why isn't he equally interested in what your kind of technology could do?

Mr. Hough. Well, let me make two points there. First of all, I am talking mainly about the lower forty-eight, where much of the communication is between relatively short distances, and even when you communicate between points that are quite far apart, you want to drop off some of it along the way, so in effect you have that.

Now, when you come to Alaska, there are wide open spaces, and when you take communications long distances for a few people, small volume, the cost is high. The cost is high whether you do it by terrestrial facilities or by satellite facilities. But the technology is there to do whatever you want. It is just a question.

Mr. Karth. But it would be probably higher by one than the other.

Mr. Hough. It is just a question of what price you want to pay. I suspect that in some instances it will be advantageous to do it by satellite. In other instances, it will be advantageous to do it by terrestrial facilities, and any system you come up with must be a carefully thought

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out and engineered combination of both.

I also have the view that a satellite system for Alaska alone would probably be prohibitively expensive.

Mr. Symington. And you would agree, then, with the suggestion that satellites serving the lower forty-eight, with a beam to Alaska, would be the way to provide satellite service?

Mr. Hough. Yes. I would also caution, however, and I think Mr. Hawkins made this point, that in order to cover both Alaska and the lower forty-eight, there would have to be some sacrifice. In other words, in addition to having a separate antenna beamed in Alaska, the location of the satellite in orbit would be a compromise. So you would have something less than you like for the lower forty-eight, from the standpoint of signal strength and the number of circuits you can carry. But this would be the economic way of doing the job.

Mr. Symington. Nevertheless, in Alaska, a satellite serving Alaska alone would need other uses in order to, in your view, be economically feasible?

Mr. Hough. It would need other uses, and as I have indicated, for it to be economically feasible as part of our network in the U.S., it must be very carefully integrated with it, otherwise, the costs are going to be much higher than the costs of other facilities that could be made available.

mml8 1 Mr. Symington. Would you think, for example, if Canadian
2 systems were linked to it, that that might help lower the
3 cost?
4 Mr. Hough. I would like to caution one thing on the
5 Canadian system. Canadians have told me -- those participating
6 and knowledgeable in their proposed system -- that the
7 circuits they obtain through the use of their proposed satellite
8 system will cost them four times the comparable costs if
9 they obtained them through installing terrestrial
10 microwave facilities.
11 Mr. Karth. You mean getting to the same number of
12 people? The same localities, regardless of how far
13 separated they are?
14 Mr. Hough. The great volume of communications for
15 which that satellite is to be used will be trans-Canada
16 communications to the major population centers, and so this
17 is the bulk of the communications requirement, and terrestrial
18 facilities would cost them about a quarter the cost of
19 these circuits.
20 Now, when you talk about reaching these isolated
21 outposes in the Northwest Territory, terrestrial facilities
22 there would be very expensive. I don't know what the
23 comparison is, but in any case they will be very, very costly
24 communications.
25 Mr. Karth. And that obviously is what they are really

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talking about, isn't it?

Mr. Hough. That is one of the things they are talking about. But it is going to substantially increase the cost of the great bulk of their communications, if you see what I mean.

Mr. Karth. All right. I don't think there is any question about that. But it just seems to me for the same service, to the same people, irrespective of how diversely they are located throughout canada, that under those circumstances one doesn't cost four times as much as the other, does it?

Mr. Hough. No, I won't say that. But I suspect the satellite application would be more costly.

Mr. Karth. For the same service to the same number of people, spread all over the country?

Mr. Hough. When you think of them scattered all around, and when you are talking about a two-way communications service now, you need large major ground stations. These are costly. And when you start scattering substantial numbers of these around, the costs mount up very quickly.

Then you try to optimize by having fewer, and then you find yourself with substantial terrestrial facilities in order to interconnect.

But you have to lay out each particular situation carefully, and weigh it, to see just what the pros and cons

mm20 are, and then you add up the dollars and you see whether it is worth it to you or not. And the thing I urge very strongly is that to consider that you can't talk of a satellite system or a communications system. You have to look at your objective, and do a thorough systems balanced, systems engineering job in order to minimize the cost and maximize the service.

And you can't arbitrarily say one way of doing it is going to be better than another way. It is going to take a lot of ways to provide service to Alaska or Canada or any place you name.

Mr. Karth. And undoubtedly you can't have one to the exclusive use of the other and come up with any kind of a reasonable cost benefit ratio.

Mr. Hough. That is right.

Mr. Karth. In all probability, it is going to require a combination of the two.

Mr. Hough. That is right.

Mr. Karth. And with that combination of the two, in proper balance, you can then effect substantial cost savings, I would assume.

Is that a correct statement?

Mr. Hough. That is a fair statement. You get the lowest cost if you do that proper balancing job. And of course you have got to decide where you are going to chop off, how far out are you going to provide all these services. And

mm21 the further you reach, the greater the cost per unit. And it seems to me that has to be weighed along with all the other priorities for the use of dollars.

Mr. Karth. And I assume that in addition to Canada making that judgment, the same reasons are being used by France and Germany and the Soviet Union and other countries who are --

Mr. Hough. Well, I don't know of any serious consideration at the moment of domestic application within Germany and France, and as you know communications service in the Soviet Union are very limited.

Mr. Karth. I think we all agree they need something.

Mr. Hough. Yes, but France, for example, a satellite for domestic use within France would be very uneconomical.

Mr. Karth. Counsel points out that France and Germany, I think, as two countries, are doing it in conjunction with each other.

Mr. Hough. Well there has been talk of regional consortiums, but it would have to cover much more territory than just France and Germany to be an economical way of providing service.

Mr. Karth. Maybe they are even considering selling these services to some other European countries.

Mr. Hough. Oh, yes, and other European countries. I think the French at one time were talking about using it for communication to French Africa, which begins to make it look somewhat

mm22 1 more attractive. But this is sort of on the back shelf
2 at the moment and as you may know, the French have been putting
3 cables across the Mediterranean to Africa as a better way of
4 providing the service.
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Mr. Symington. Mr. Chairman.

Mr. Karth. I believe Mr. Pettis --

Mr. Pettis. No, I yield.

Mr. Karth. Mr. Symington.

Mr. Symington. Something you mentioned in connection with the problems of a single satellite serving Alaska and the lower 48 would seem also applicable to serving France and Africa -- namely, a compromise in the orbit. Would that be true?

Mr. Hough. Yes.

Mr. Symington. And I regret that we have had no testimony from some of yesterday's witnesses on this question, but if such a compromise is required, let's say between the lower 48 and Alaska, it would seem to me that some benefit might be derived from including Canada or portions of it within that compromise, so that more people would be served by the same system. Would that be logical?

Mr. Hough. Yes. Certainly the more you load a satellite, the more the unit cost goes down on the satellite itself. On the other hand, the more places you try to serve, the more ground stations you have, the fewer services you provide for ground stations, and so the cost goes up in that direction.

Also, the numbers of circuits that can be provided on the sorts of satellites that are in the development stage now are

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rather small compared to the circuit needs for domestic communications within the lower 48. And a compromise satellite system which would serve Canada and Alaska and provide some service to the lower 48 could very well result in the communications service for the lower 48 costing more than they would without it.

Mr. Symington. It would certainly be helpful, Mr. Chairman, sometime to get some testimony on this from, I should think, the INTELSAT witnesses, or a chart of some kind explaining what in their view would be involved in expanding the coverage of a system serving the lower 48 and Alaska, for example.

Mr. Larth. I think the gentleman is right. It may well be the judgment of the Committee that we should call additional witnesses and recall previous witnesses and go into some areas that we at that time had no thought of or contemplated as being important. I agree.

Mr. Symington. Thank you, Mr. Chairman.

Mr. Karth. Mr. Hough, on page 1 of your statement, about in the middle of the page, you say, "However, there are no communications services which could be offered by satellites which cannot now be offered over terrestrial facilities." And that is kind of an all-inclusive statement.

Mr. Hough. Yes, sir.

Mr. Karth. Certainly before this Committee has

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indicated some substantial disagreement with that statement. I suppose standing alone it may well be, and I am sure that you have given great thought to it, a very accurate statement. No communications service which could be offered by satellites, which cannot now be offered by terrestrial facilities.

There are no communications. But I think the broad capability offered by satellites in conjunction with the use of certain terrestrial facilities gives you broader capability. You can illuminate the nation, for example, using that combination, as opposed to using just one or just the other.

And it seems to me that it is kind of a catchy sentence when it is put in that context. Wouldn't you agree that a combination of these two systems, within the 48, for example, would in fact offer the opportunity for broader capability, for illuminating the nation, if you will, at one time, as opposed to transmitting, if you are using terrestrial facilities exclusively?

You can go from New York to St. Louis, there isn't any question abou it. You can go from New York to San Francisco. There isn't any question about that. But illuminating the entire nation, the broad capability that you get from a combinatim of the two, is something that you can't get by the exclusive use of either one at this time, is

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it?

Mr. Hough. I wouldn't agree with that, sir. What you are talking about, again, we keep confusing economics and service. And when I say there is no service, there would be no new service provided with this broad coverage. What you would hope is that perhaps you might make some of these services more economically viable in some places, where they may not now be economically viable. So we are not talking about providing any additional services.

For example, yesterday, as I recall, Dr. Charyk talked about the capability of the satellite that they proposed to develop for domestic purposes, to provide 50 megabit per second signal. And that is good capability. But the L-5 coaxial system, a single tube, will provide about five times that bit carrying capacity.

Mr. Karth. Is that for domestic service?

Mr. Hough. Yes. And so there are no new communications services. But what you hope by combining optimumally the various technologies is that you will be able to provide these services more economically, which means they can be afforded by more people and in more places for more things and that is the whole objective, is to provide more and better service for less money, and satellites provide a tool that need to have a good close look.

But at the moment, it is not clear at all that there

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will be any economies through this application. Even for the broad distribution that you are talking about, because down at this location where you want to use the signal, you have got to put in a pretty substantial installation. Maybe 250,000 to 300,000 for a receive only station.

Mr. Karth. But if it could effectuate some economies, that is a very laudable purpose in and of itself, isn't it?

Mr. Hough. That is the whole name of the game, as far as we are concerned. We are anxious to use everything we can lay our hands on to provide the best service at the lowest cost.

Mr. Karth. So with the capability that you feel coaxial cables provide or will provide in the almost instant future --

Mr. Hough. They are providing today. We have thousands of miles today.

Mr. Karth. Are providing today or will provide to an even greater degree in the near future, it appears to me that the AT&T there would have little if any objection to competition, because after all it seems to me from your statement you have no fear of it whatsoever.

Mr. Hough. We don't have any fear of competition as long as we are able to compete on the same basis. And as I have said in my closing statement here, and we have said before, we think that anyone ought to be permitted to apply for a domestic satellite system, if they think it

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can serve a good purpose in the public interest. And then let that specific proposed system be evaluated on its merits. We have had a great deal of talk about domestic applications and other applications, and what they will do. I think it is time that we got down to brass tacks and had some specific proposals, so that all can look at them and evaluate them in detail, for specific applications.

And we would expect at the proper time to have a proposal of our own.

Mr. Karth. Has that always been AT&T's position, that you have a mix of these two capabilities? The use of satellites in conjunction with terrestrial facilities?

Mr. Hough. Yes, it always has been our position that any application of satellites must be an integrated system with terrestrial facilities. We have always felt that.

Mr. Karth. The economics notwithstanding -- which is something, after all, that the public pays for -- you would oppose a direct broadcast system, for example?

Mr. Hough. No, sir. I think we would look at any proposal that was made on its merits, and we would comment on it at that time, as we saw it. As far as a direct broadcast system goes, none has been proposed as yet, and it looks a ways into the future.

But if that appeared to be an economically viable thing, that some private entity wanted to go ahead with, why, we

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wouldn't necessarily oppose it unless it was inhibiting our ability to provide other service, such as interference, use of frequency spectrum we need for service and things like that. All these things need to be considered.

Mr. Karth. Well, I don't feel that I want to get into that particular area, because your statement leaves enough loopholes, and my ignorance of the subject probably wouldn't allow me to get into it to any great degree of expertise with you, at any rate. But I think for the record, if we can have any kind of agreement between those who are involved in the communications business, or are interested in furnishing technological advancements of the communications business, that AT&T has no objections to a system, regardless of whether it is a combination competitive system or whether it is a direct broadcast system, that might sometime in the future be proposed by a company other than the one that you so ably represent.

Mr. Hough. Well, we would have no blanket objection to anything such as you mentioned. But again, we would want to look at each proposed system on its own merits, and evaluate it at that time. And I could conceive that we might object strongly to some proposals. Others we might not.

But we don't have any blanket objection to what you suggest.

Mr. Karth. In the second paragraph of page 2, you state

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in addition to the average length of haul of domestic messages, about 500 miles -- which of course is far less than that of overseas messages -- you refer here to toll messages, rather than all domestic messages?

Mr. Hough. Yes. Inter-city messages. Generally our toll messages are considered over 24 miles in length. We are talking about the inter-city service here. Not the local telephone calls.

Mr. Karth. Yes. On page 4, you conclude that the economics of satellites for domestic uses are not attractive at present. The statement appears to be, as I have already indicated, in some considerable conflict with testimony received befcre this Committee.

So I wonder if for the record, within the next five or six days, you could provide a paper with some appreciable justification of that conclusion.

Mr. Hough. I would be very happy to. It will be no problem at all.

Mr. Hough. And also, in the third paragraph of page 4, you state that communications satellites have different transmission problems than do terrestrial facilities.

Mr. Hough. Yes.

Mr. Karth. We assume that that is a very accurate statement. And so I would ask that you provide for the record on this conclusion an evaluation of the problem of the time

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delay for satellites, and the attendant problems therewith?

Mr. Hough. All right. I will be very happy to.

Mr. Karth. I recall that at one time -- I don't remember who -- but at one time, when communications satellites -- at least the 23,500-mile type was being discussed, it was said that at that time it would never work because of the voice delay, that you just couldn't accommodate that situation.

So I think that this time we would like to have some statement from you in justification of this.

Mr. Hough. I will be very happy to supply that.

Mr. Karth. Do you know how much your company spent on research and development in satellite communications prior to the 1962 Act?

Mr. Hough. I couldn't tell you offhand, but I would be very glad to get that number for you.

Mr. Karth. I would like if you could provide for the record, an answer to that, and also how much you spent since the Act.

Mr. Hough. You will recall, we developed and had launched, paid for the launching of the first communications satellite, Telstar, which was prior to the Act.

Mr. Karth. I would like for the record how much your company has spent in this area.

Mr. Hough. Very good.

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Mr. Karth. Both before and after the 1962 Act. And if you can, how these expenditures compare with the terrestrial expenditure that you have made.

Mr. Hough. Yes.

Mr. Karth. Over the same period.

Mr. Hough. One comment I would like to make there and will make it in the statement is that many of the areas in which we do research and development for terrestrial facilities are directly applicable to satellites. Solid-state work, transistors are certainly an example of that.

We wouldn't have satellites, communications satellites, without the transistor.

Mr. Karth. But we tried to build one once and it didn't work very well, as I remember.

Mr. Hough. Yes.

Mr. Karth. In the early days of communications satellites.

Mr. Hough. Yes.

Mr. Karth. Then also, to give this Committee a little better idea of what the mix might be, insofar as it pertains to Alaska, I wonder if you could provide for the record an answer to a question such as this, that if you were the communications czar of Alaska, for example, how would you propose to serve the needs as envisioned as a required by Senator Gravel and Congressman Pollock, who I assume were indicating people's desires as opposed to something else?

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Mr. Hough. Well, let me say first we were not, as you know, one of those who bid for the ACS system, and we have made r no study of communications in Alaska.

Mr. Karth. I see.

Mr. Hough. And this is a very major study to do any kind of a systems engineering job.

Mr. Karth. Well, you have drawn some rather illuminating conclusions, however, on that, and I was kind of surprised that you would not make a study.

Mr. Hough. Well, I am sorry to hear you call them conclusions. I would like to say I have given you some --

Mr. Karth. Statements of fact?

Mr. Hough. I hope helpful views in answer to some rather general questions.

Mr. Karth. I see.

Mr. Hough. And I think I have said over and over again that you can't really tell what the real pro's and con's of costs and service and therefore facilities usages are until you do this overall system engineering job. And this is a job of major proportions.

And so I am afraid we are just not in a position to give you an outline of what kind of a system we would put in Alaska. This is a very major job that we haven't tackled. I think RCA, who are tackling that job, are in a much better position to do this.

onr12

Mr. Karth. Fine. Well, if you feel you can't respond to it, I certainly will accept that judgment.

Mr. Hough. All right.

Mr. Pettis. Mr. Chairman, may I ask a question?

Mr. Karth. Yes, please do.

Mr. Pettis. And not just of Mr. Hough, but maybe of Mr. Hawkins. You know, I used to look forward a few years ago to General Sarnoff's prophecies, you know. He used to come out once a year with, in ten years we will have this and this and this.

I wish these two gentlemen could look downstream to 1980 and try and anticipate a hearing such as this, and then tell us what the world will be like for the next ten years. What I am really thinking is that probably in the R&D areas of these two companies, are some people who -- I know that is a temptation for management to be a little on the conservative side, in all of its projections, and that is probably very wise and prudent.

But there probably are some things that these men have been thinking about, and maybe speculating on for the next ten years, in terms of what we have been discussing here in these hearings this morning, that we haven't brought out because we don't know what questions to ask, Mr. Chairman.

Mr. Hough. Well, that is a pretty broad question. I would like to take a crack at it, though, for you.

onr13

Mr. Pettis. I would love it.

Mr. Hough. First of all, I think we must recognize in recent years, quite recently, there has been really a sharp upturn in the critical importance of communications to all phases of operation of this country, not only business but also on a personal basis.

And communications are no longer something that is helpful to business, or save them some money. They have become for many businesses something that is absolutely essential to their survival. They can't do business without it.

Some of them depend wholly on it. So that reliability of communications, importance of it, has really escalated. And the critical nature of some of the applications have made the quality of communications critically important, and I see that trend continuing, so we are going to have to continue to do a better and better job from the standpoint of reliability and immediate availability and quality of communications.

And because of this increasing importance in the growth and the need for communications, the number of messages, however you measure it, is going to continue at a very high level.

Residentially, a long-distance telephone call is no longer a luxury, it is a necessity, as far as the individual

onr14

person is concerned. So we see continued high growth.

And this means that we must continue to come up with facilities that will provide large capacity, and so I spoke of the 90,000-circuit coaxial cable. Now we have come along in the latter part of this decade, to meet the need, a waveguide system that will take about 250,000 circuits, a quarter of a million.

And then looking further we look forward to the laser in tubes, and something in the ball park of a million and three quarters, two million circuits. And then the switching must come along with that, because that provides a balance between transmission and switching, to get the lowest overall cost for the most flexibility.

Now, to be more specific, one of the areas that we are quite excited about is picture phone, and that will go into the first commercial service the middle of next year. And we think this is going to grow quite rapidly, and this has a demand for large chunks of the spectrum.

And by spectrum I don't necessarily mean that that is in the air, but can be contained in tubes, and whether they are coaxial or waveguide. And as that grows, the demands are going to be higher and higher for very high capacities.

This is why -- this large growth is why the terrestrial costs are going down so rapidly. And when we do use satellites

onr15

domestically, it will take whole satellites to just provide a small bit of service.

And if you look at picture phone, it provides a whole million-cycle, one megacycle or megahertz bandwidth, that by the end of this decade is going to be available on a dial basis over a major portion of the country.

And it can be used not just for picture phone, but a wide range of uses, some of those that you talked about, a wide range of kinds of terminal devices for visual displays and inputs and outputs, and really the hope for this whole broad spectrum of the kinds of uses that you, Mr. Pettis, were talking about, lies in a nation-wide integrated switched system, common user, that can be available on demand for a wide range of uses, and I think this is very exciting and the uses are just going to expand by leaps and bounds, and our objective is to make this switched network, whether it be the picture phone or 50-kilobit, as we call it, switched network, which we are just starting now, or the regular telephone network as flexible and as usable by as many people for as many different purposes, with as many different kinds of end devices as possible.

And that is the real challenge over the next ten years, and the thing that is really going to bring about all of these things that many people talk about, as being very desirable. And get it out all the places, way out in the boondocks as

onr16

well æ in close. And satellites are going to be a part of that, but an integrated part, and not a separate system in themselves.

Mr. Karth. You better be careful with this picture phone business. I often times answer the telephone dressed in somewhat less than an appropriate manner.

Mr. Hough. Well, we have a little button on there that takes care of that. So you push that and they can't see you.

Mr. Karth. The House is now apparently calling Mr. Pettis and the rest of us to attention. Just one last question, Mr. Hough, and we may want to submit some questions to you in writing for answers for the record, if you don't mind.

Mr. Hough. Not at all. Be glad to answer.

Mr. Karth. I think ABC and the Ford Foundation -- maybe NBC, too, although I am not sure -- have requested that we have a dedicated satellite system, and that it be authorized for television only. What would AT&T's position be on that?

Mr. Hough. Our position is that if they feel that one would be more economical than the way they are served at present, that they ought to prepare an application and file it and let all of us look at it on its merits. There are many public interest considerations that the Federal Communications Commission will want to make, and we will want to have a good

onrl7

look at it, too.

Mr. Karth. Has ABC filed?

Mr. Hough. They did file a number of years ago, and that was folded into this domestic communication satellite investigation of the FCC. And there is no pending application at the moment. We are sort of awaiting a policy statement.

Mr. Karth. Yes. Then also for the record, I wonder if you could supply us with your thoughts on the advantages and the disadvantages of open competition in domestic communications?

Mr. Hough. Yes, sir.

Mr. Karth. Are there further questions?

Mr. Pettis. No.

Mr. Karth. Well, thank you very much, Mr. Hough. You have been most helpful to the Committee.

Mr. Hough. You are welcome.

Mr. Larth. We may even want, in the foreseeable future, to call you back.

Mr. Hough. I will be very happy to do whatever I can.

Mr. Karth. Thank you very much. The meeting is adjourned.

(Whereupon, at 12:50 p. m., the Subcommittee was adjourned.)

WHITE HOUSE & SPECTRUM: White House, Budget Bureau & FCC last week rejected charges that Administration intends to run roughshod over independent agencies--particularly FCC--with proposed Office of Telecommunications Policy (OTP). However, Administration maintained it has authority to express views on "general policy issues" pending before agencies. Statements apparently satisfied Govt. Operations Subcommittee, which voted to approve President's reorganization plan which gives OTP authority to assign govt. radio frequencies (Vol. 10:7 p5).

Rep. Brown (R-O.) demanded White House explain published reports quoting Presidential Advisor Dr. Clay Whitehead as saying Administration "has no qualms" about influencing Commission. "I have made no statements to the press from which they could properly conclude that the White House intended any undesirable or improper influence on the FCC," Whitehead wrote Subcommittee. "That is not my view, and it is not the view of this Administration." He drew distinction, however, between Commission's policy issues & quasi-judicial cases. "It is our conviction that such open expressions [are] a proper part of general policy making dialogue among the FCC, the Congress & the Executive Branch," he said. [Brown has owned WCOM(FM) Urbana, O., is selling it, also owns Urbana Daily Citizen & 3 weeklies.]

FCC Chmn. Burch voiced "absolutely no fear of either a factual or possible undue influence by the White House on the Commission by virtue of [OTP]...We have consistently favored a strong, centralized entity to deal with telecommunications issues within the Executive." He said Commission was "duty-bound" to consider White House recommendations, used satellites as example. "But I don't suggest for a moment that we are the patsies who will take their suggestions and implement them without any thought."

"Commission will suffer by comparison," Rep. Rosenthal (D-N. Y.) told Burch, "in that their [OTP] research capacity will kind of overwhelm you, and because there will be this void in your own ability, you will be more influenced by them." FCC chmn. denied this, said recommendations would come from Policy Planning Office now being organized within Commission to consider long-range problems. "I think it would be unfair to say we don't have the ability to analyze anything that comes before us, because we do have that ability & we exercise it every single day." He cautioned, however, that resources & money given OTP "should not be at the expense of those allocated the Commission..."

Extent to which OTP could influence FCC through "more effective recommendations" sparked lively discussion between Brown & Asst. Budget Bureau Dir. Dwight Ink. "Does this reorganization plan affect the [FCC] flexibility," Brown asked, "or does it change in any way the procedures by which allocation of spectrum can be resolved?...Does 'more effective recommendations' mean they will listen to the OTP & decide the way the Office wants the decision made?...Is there a converse to [increasing resources of OTP] that such resources would be withered away in the FCC?" Prodding produced this statement from Ink: "The reorganization plan is not a backdoor step to affect the independence of the FCC. It is an effort to, among other things, be in a position to present more effectively the point of view for consideration by the FCC."

Whitehead also made public memo written by Presidential Asst. Peter Flanigan regulating contacts between White House staff & Commission. Memo warned staff to avoid "even the mere appearance" of interest or influence in Commission affairs, said all correspondence with independent agencies must be cleared by Flanigan.

Despite foregoing assurances, there are persistent reports that Administration is considering drawing hundreds of engineers, political scientists, statisticians, etc., from Bureau of Standards & other agencies, into Commerce Dept. & OTP--with technical power indeed capable of "overwhelming" FCC.

U.S. Domestic Satellite Costs Cited in Study

Washington–Study by American Telephone and Telegraph Co. shows a continental U.S. domestic satellite system would cost $41 million more to construct and $14.7 million more annually to operate than alternative terrestrial facilities.

House space applications subcommittee, headed by Rep. Joseph E. Karth (D.-Minn.), requested the company to furnish information supporting its testimony that the economics of satellites for domestic uses are not attractive at present (AW&ST Jan. 5, p. 20).

AT&T's figures were:

- Initial cost—$155 million for the satellite system compared with $114 million for terrestrial facilities.
- Annual operating cost—$48.9 million for the satellite system and $34.2 million for the terrestrial system.

AT&T said the types of service would be the two that satellites are best adapted for. These are: a heavy concentration of telephone circuits between two widely separated points, and television program distribution to many broadcasting stations, where a single satellite could transmit to the whole of the contiguous 48 states.

The components of the satellite system would be:

- Two major transmit-and-receive ground terminals near New York and Los Angeles, each equipped with 90-ft.-dia. antennas.
- Two Hughes Intelsat 4-type satellites, with 12 transponders each.
- 71 receive-only earth stations with 30-ft.-dia. antennas for television reception. These would be dispersed throughout the U.S. except for the northeast section where the density of broadcast stations, AT&T said, makes satellite earth stations clearly more expensive than terrestrial connections.

This is the general satellite system configuration that has been proposed by Communications Satellite Corp.

"In spite of the unfavorable economics shown in this study," AT&T said in its submission to the Karth subcommittee, "it is possible that a domestic satellite system closely integrated with the terrestrial network could provide offsetting advantages by providing circuits on a time-shared basis to relieve peak traffic demands or as a backup facility."

AT&T added, "It is also entirely possible that advances in the art might result in a more favorable comparison."

The company has already announced it will seek authority from the Federal Communications Commission to build satellites to supplement its terrestrial network.

The next development in the domestic satellite case will be the issuance of guidelines by FCC, implementing the policy statement Jan. 23 by the White House (AW&ST Feb. 9, p. 67). This project now has high priority at the commission.

"We would hope," AT&T said, "that FCC authorization would be granted or withheld, as the case may be, not on the basis of the medium's glamor, but rather on the basis of a realistic appraisal of the benefits and costs to the public of the projected service. This appraisal should include, among other things, determination of the most appropriate usage of the available frequency spectrum and orbital space. For . . . satellites can provide no services that cannot presently be provided by other modes of transmission.

"We also feel strongly that the common carriers—including AT&T—should have the opportunity to use and own communications satellites whenever it is to the public advantage they do so."

Comsat contends that the 1962 Communications Satellite Act gives the corporation exclusive authorization to own and operate satellites, domestic as well as international.

In December, 1966, AT&T proposed a $500-million domestic satellite system that would grow to a total capability of 83,000 voice circuits and 27 television circuits within 10 years (AW&ST Dec. 26, 1966, p. 24).

At that time, AT&T agreed that the space segment should be owned and operated by Comsat.

(4)

"Your lucky day. You will get a dial tone in the first phone booth you enter."

27

Aviation Week & Space Technology, January 5, 1970

AT&T Calls For Indefinite Delay In Domestic Satcom Inception

By Katherine Johnson

Washington—American Telephone & Telegraph Co. is now calling for indefinite postponement of establishment of a domestic communications satellite system.

Developments in terrestrial systems have made satellites comparatively uneconomical for domestic service, Richard R. Hough, AT&T vice president, told a House space subcommittee headed by Rep. Joseph E. Karth (D.-Minn.)

For the long term, Hough said a few very high capacity satellites may be justified eventually as backup for the terrestrial network and to add some operational flexibility.

Hough's presentation marks a reversal from the past position of the dominant telecommunications carrier. In 1966, AT&T proposed a $500-million domestic program to the Federal Communications Commission (AW&ST Dec. 26, 1966, p. 24). The program would be initiated with Hughes Intelsat 4-type satellites, each with about 9,600 circuits, and grow to a total system capacity of 83,000 voice circuits and 27 television circuits by 1976.

If satellites are integrated with the land-based network at some future date, AT&T wants to own them. "We perceive no barriers, legal or otherwise, which would prevent us from owning and operating a satellite system for domestic communications," Hough said.

This reflects another position change by AT&T. In its 1966 proposal to FCC, AT&T said Communications Satellite Corp. would own and operate the space segment and AT&T would own and operate the ground facilities.

FCC was on the verge of issuing a decision in the four-year-old domestic satellite case last summer, but withheld action at the request of the White House so that the Nixon Administration could make a 60-day policy review. The 60 days expired Oct. 1, 1969, but the review, under the direction of Clay T. Whitehead, a presidential assistant, has not yet been completed.

Hough told the Karth subcommittee:

"At one time it appeared that the upcoming new generation of satellites now expected to be operational in 1971 or 1972, that is the Intelsat 4 series, would offer some cost savings over terrestrial systems for traffic of transcontinental distances. However, more recently there have been dramatic advances with respect both to microwave radio and coaxial cable along with a significant increase in satellite system costs which have changed the situation."

He listed two developments that have made a system of 9,600-circuit satellites uneconomical for domestic service. These were:

- A coaxial cable with a capacity of 32,400 circuits is now operating. By 1971-72, a cable with 90,000 circuits will be installed.

"Even on transcontinental routes it now appears that the cost per circuit mile of [these two] cables would be substantially less than that of the Intelsat 4 satellites," Hough said.

- A method to double the capacity of the backbone domestic microwave system to 12,000 circuits has been developed within the past three years.

"The cost of deriving the additional 6,000 circuits on the existing [microwave] network is very low indeed, and is very much less than the circuit-mile cost of satellite systems," Hough said.

AT&T's Bell Telephone Laboratories is now pushing research and systems planning on an advanced satellite with far greater capabilities than the Intelsat 4 which would use super-high frequencies in the 18-30-gc. band.

"If the cost disadvantage can be minimized, there are certain operational advantages which could be gained by introducing satellites into the network on selected routes," Hough said.

One would be a backup.

"A satellite is not subject to being cut by a construction contractor, nor . . . subject to signal fading due to atmospherics and other transmission problems which affect microwave radio," Hough said. "It is important to have adequate capacity available for restoration [of terrestrial systems] should it be needed."

The other satellite use would be for flexibility. For example, Hough said, a satellite could be used partially to meet the daytime New York-San Francisco peak load and then be used nighttime to handle peak New York-Miami traffic.

Hough anticipated that the demand for telecommunications within the U.S. will soar over the next decade.

By the late 1970s, Hough said, AT&T plans transmissions by waveguides with 250,000-circuit capacities. These will be followed by laser tubes with capacities up to 2 million circuits.

"When we do use satellites domestically, it will take whole satellites just to provide a small bit of service," Hough said.

Domsat – Karth hearings
12/16, 17, & 18

Wednesday 12/3/69

5:45 Charlie McWhorter called.
Wanted you to know that he received word today that Cong. Karth is having hearings on December 16, 17, and 18 . Said they wanted AT&T to have a witness and Comsat and RCA will also have someone; also someone from NASA, he thought.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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EDWARD B. CROSLAND
VICE PRESIDENT

Washington Office
2000 L Street, N. W.
Washington, D. C. 20036
202 466-5571

December 24, 1969

The Honorable Clay T. Whitehead
Staff Assistant
The White House
Washington, D. C. 20500

Dear Tom:

In accordance with our discussion, I am forwarding herewith a copy of the transcript of the testimony by Howard Hawkins of RCA Global Communications and Dick Hough, Vice President, AT&T Long Lines Department, before the Karth Subcommittee on December 18. I believe you will find their statements of interest.

It was most kind of you to call me last Saturday, and I greatly enjoyed talking with you. As I mentioned, I still have some grave misgivings regarding your proposal with respect to governmental structure for determining communications policy.

As you suggested, I have procured a copy of Peter Flanigan's memorandum from the Space Subcommittee and I am most anxious to discuss the matter further with you. I would be most appreciative if you would contact me upon your return from your vacation.

I certainly hope that you have a wonderful trip and a delightful holiday. My best wishes and warmest personal regards.

Sincerely,

Ed

American Telephone and Telegraph Company
195 Broadway
New York, N. Y. 10007

Edward B. Crosland
Vice President

Washington Office
2000 L Street, N. W.
Washington, D. C. 20036

January 23, 1970

Dear Tom:

In accordance with our discussion of yesterday, I am transmitting a copy of Mr. Hough's letter to Congressman Karth in response to his request for additional information concerning questions which were raised at the Committee hearings.

I enjoyed seeing you Thursday and look forward to meeting with you again soon.

My warmest personal regards.

Sincerely,

Ed

The Honorable Clay T. Whitehead
Staff Assistant
The White House
Washington, D. C. 20500

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

32 AVENUE OF THE AMERICAS

RICHARD R. HOUGH
VICE PRESIDENT

NEW YORK, N. Y. 10013

AREA CODE 212
393-5131

January 6, 1970

The Honorable Joseph E. Karth, Chairman
Subcommittee on Space Science and Application
U.S. House of Representatives
Washington, D.C.

Dear Mr. Chairman:

During my appearance on December 18, 1969 before your Subcommittee on Space Sciences and Applications of the Committee on Science and Astronautics, you requested additional information for the record on four subjects. The following is in response to those requests:

Economics of Domestic Satellites (Tr. p. 307)

The types of services for which satellites appear to be best adapted are:

1. A heavy concentration of telephone circuits between two widely separated points.

2. Television program distribution to many broadcasting stations, where a single satellite could transmit to the whole of the contiguous 48 states.

Accordingly, the satellite system studied was configured to provide these two types of service. It consisted of two transmitting and receiving earth stations in the vicinity of New York and Los Angeles, respectively, each equipped with two 90 ft. diameter antennas; two satellites of the Intelsat IV type, each providing 12 transponders; and 71 receiving only earth stations equipped with 30 ft. diameter antennas for television reception, spread throughout the United States except in the northeast section where the density of broadcast stations makes satellite earth stations clearly more expensive than terrestrial interconnections.

Two of the 12 channels in each satellite were assigned to New York-Los Angeles telephone transmission (regular and protection) and the remaining 20 channels assigned to television. Even this number falls somewhat short of meeting requirements during football weekends when the networks are split into many sections carrying different

games and different commercials. The receiving only (R. O.) earth station locations were selected so as to minimize costs by hubbing several broadcasting stations from a single R. O. station when the proximity of several broadcasters made this less costly than additional earth stations.

Based upon the present state of the art, the economic comparison favors terrestrial facilities as follows:

	First Cost	Annual Charges
Satellite System	$154.9M	$ 48.9M
Terrestrial Facilities	114.0M	34.2M

In spite of the unfavorable economics shown in this study, it is possible that a domestic satellite system closely integrated with the terrestrial network could provide offsetting advantages by providing circuits on a time-shared basis to relieve peak traffic demands or as a backup facility. Further studies are being made to explore these possibilities. Also, it is entirely possible that advances in the art might result in a more favorable comparison.

The Problem of Time Delay with Satellite Circuits
(Tr. pp. 307-308)

Because of the distance of about 50,000 miles (up and down) traversed by the electrical impulses sent over a synchronous satellite, the time taken between the origination of a signal at one end and its appearance at the other is about three-tenths of a second. This long transmission delay affects both data and speech transmission over satellite circuits.

With respect to data, the long delay affects the efficiency of transmission when normal error detection and correction techniques are employed. In most error control systems a block of characters is sent to the distant end, checked there for errors, and a signal is then returned to the originating end, telling it either to repeat the last block or to proceed with the next. The usual transmission time of a block of characters over a voice band data channel is two to three seconds. The additional six-tenths second required for the error control process on satellite circuits reduces the overall efficiency of transmission by 20-30%. More sophisticated error control

methods could be used to prevent this loss in efficiency. Two possibilities would be the use of more complex terminal equipment, with increased memory and buffer capacity, or the use of "forward acting" error correction techniques. Either of these would be more expensive than normal error correction arrangements.

The satellite transmission delay affects telephony because telephone systems all over the world operate on what is known as a two-wire basis: that is, the links to the customer's telephones consist of a single pair of wires which carries speech in both directions. Long distance facilities are generally "four wire"; that is, a separate channel is used in each direction of transmission.

At the junction of the four-wire and two-wire circuit facilities a reflection of electrical energy takes place which causes some of the incoming speech energy to be transmitted back in the opposite direction. On satellite circuits, if preventive measures were not employed, this reflection would cause an "echo" of his own speech to be heard by the speaker, delayed by six-tenths second (the round trip transmission time) from the time he spoke each word. An echo with such long delay seriously degrades "talkability", often throwing the speaker completely off stride.

To reduce the effect of such echoes, devices known as "echo suppressors" are employed at each end of the circuit. The function of the echo suppressor is to recognize the presence of speech from the distant end of the circuit and to insert a block to transmission in the outgoing direction, which is held long enough for the echo from the receiving telephone to die out. Echo suppressors are also used on terrestrial long distance circuits, but the extremely long delay time of satellite circuits (on transoceanic cable circuits one-way delay time generally runs to about 30 milliseconds or one-tenth that of satellites) presents some further difficulties. It is quite possible, and even normal for customer A to say something and for customer B also to make a sound in the three-tenth second interval before A's speech reaches and operates the echo suppressor at B's end of the circuit. The result is that the energy from B's sound goes through to the echo suppressor at A's end of the circuit and operates it, thus interrupting A's speech. This causes what is known as "clipping". Considerable time may be lost in back and forth transmission of bits of speech sounds as each customer tries to gain control of the circuit. With the type of echo suppressors available prior to 1965 this undesirable effect was very pronounced.

However, special types of echo suppressors have recently been designed to reduce the effects of clipping, principally by reducing the loss introduced by the echo suppressors when "double talking" takes place, so that each customer becomes aware that the other is trying to speak. Other means are under study. One of these is possible use of special "echo cancelling" devices in addition to echo suppressors but these are still in the laboratory stage. Any such devices, as well as the special echo suppressors, add to the cost of providing service, and since they must be applied on each individual telephone circuit, their cost multiplies directly in proportion to the number of circuits in use. These extra costs may be of little significance to transoceanic satellite circuits, but they are indeed significant in the domestic telephone field where thousands of circuits may be involved and the cost of competing terrestrial circuit facilities amounts to only two to three dollars per mile.

Even with the best known corrective measures that may be applied to satellite circuits, there will still be some inherent disadvantage resulting from the long transmission delay as compared with terrestrial circuits.

One further complication to the use of satellites domestically, is the fact that two satellite hops in tandem - such as might be encountered in connecting a cross-country satellite circuit to a satellite circuit to some overseas location - results in an overall round-trip delay in excess of one second, which is generally agreed world-wide to be unacceptable for commercial telephony. This is a further illustration of the need for the closest possible integration of satellite circuits into the planning and engineering of the overall communications network. Satellites simply cannot be dealt with in a vacuum and isolated from network planning if they are to be used effectively for telephony.

Research and Development Expenditures (Tr. pp. 308-309)

Bell System research and development expenditures specifically related to satellite communications have amounted to approximately $79 Million through 1969. Of this amount, about $62 Million was spent through 1962, the year the Communications Satellite Act was enacted. An additional $17 Million has been spent since that time. This work has been of substantial significance in the advancement of the art of communications by satellite and the application of satellites to the communication requirements of the Bell System.

Since World War II, the Bell System has spent a total of about $2-3/4 Billion on research and development. It should

be understood that this figure includes research, systems engineering, exploratory development and, by far the largest item, the specific development of equipment for manufacture by the Western Electric Company and use by the Bell System Companies. Much of the research and exploratory development expenditures have been in fields equally essential to satellite communications and other communications media. These include work on such things as transistors, solar cells, thin film and integrated circuit techniques, pulse code modulation and basic microwave transmission research.

Competition in Domestic Communications (Tr. p. 316)

With respect to your request for my views on the question of competition in domestic communications, let me assure you that the Bell System does not seek arbitrary immunity from competition.

On the contrary, where it can be demonstrated that competition would result in actual benefits to the public - not merely the theoretical benefits of competition for competition's sake - we feel it should be encouraged. And, as I stated before your Committee, we feel that the existing common carriers should be allowed to compete under the same ground rules which would apply to any new or prospective entrant in the communications field.

Recently a number of proposals have been advanced by organizations seeking to provide - some in competition with one another - communications services along selected routes already served by common carriers.

We believe that each of these proposals ought to be examined on its specific merits. The paramount consideration in any such determinations must be the long-run interests of the general users of communications services - the public at large - which includes due consideration to any jeopardy to the benefits to the communications using public known to flow from the time-tested common carrier principle.

The same principles should apply in the case of satellites. We believe there is a potential for their use in domestic communications and that any private organization or group interested in establishing a domestic system for its own use should be permitted to seek authorization to do so. We would hope, however, that such authorization would be granted or withheld, as the case may be, not on the basis of the medium's glamour, but rather on the basis of a realistic

appraisal of the benefits and costs to the public of the projected service. This appraisal should include, among other things, determination of the most appropriate usage of the available frequency spectrum and orbital space. For, as I stated before your Committee, satellites can provide no services that cannot presently be provided by other modes of transmission.

We also feel strongly that the common carriers - including AT&T - should have the opportunity to use and own communications satellites whenever it is to the public advantage that they do so.

In conclusion, we believe that competition which serves the broad public interest is constructive and should be welcomed. On the other hand, competition which is artificially introduced or which may serve some special interest at the expense of the broader interests of the communications using public should be carefully avoided.

I hope that the foregoing will be helpful to your Committee in its deliberations and that you will call upon me at any time I can be of further assistance to you.

Respectfully,

R. E. Haugh

Attachment