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Dr. Clay T. Whitehead
Presidential Staff Assistant
The White House
Washington, D.C.

RCA

Howard R Hawkins
President

Dear Dr. Whitehead: October 17, 1969

I appreciate the opportunity afforded by your letter of August 19, 1969, to submit current ideas and information on the timely introduction of domestic commercial satellite communications.

RCA Global Communications, Inc., an authorized international voice-record carrier, is keenly interested in further applications of this new technology. It has participated extensively in the development of satellite communications since 1960, and it will increasingly use satellites in providing global communications. RCA Glōbcom is a joint owner of the six U.S. earth stations. It is a major owner and the operator of the new Guam earth station.

RCA Alaska Communications, Inc., the new subsidiary of RCA Glōbcom which was organized to acquire the Alaska Communication System, will be operating in an environment where satellite communications offers unprecedented potential for the future. It is an intended joint owner and extensive user of the earth station under construction at Talkeetna in Alaska. An in-depth RCA satellite communications study and proposal for interstate and intrastate services in Alaska is enclosed. This proposal was prepared in connection with RCA Glōbcom's offer to purchase the Alaska Communication System, and it covers many areas referred to in your letter with respect to Alaska.

Public Benefits

It is clear that the technology is available and a public need exists for the establishment, as promptly as possible, of a United States domestic satellite system for multi-communications purposes

A multi-communications satellite system will offer many advantages of efficiency, flexibility and economical expansion of services—especially for remote or distant geographical areas.

Such a domestic satellite system could make available numerous services for wideband communications by all users. These would include channels which are necessary to interconnect computer systems on a real-time efficient basis and to provide other wideband record or voice services. High-speed data capability at economical costs would make it feasible to establish for example large storage facilities which could be readily interrogated from great distances by the medical profession, law enforcement officials and similar groups. Beyond this, a domestic system might be used for the transmission of facsimile or electronic mail.

Public benefits from the establishment of a domestic satellite system also would include the expansion of present educational television facilities to encompass the entire nation, particularly in isolated communities. A domestic system of broad bandwidth would allow for a wide expansion of services to job training areas, including the training of teachers, advanced education and similar services.

Wide-scale use of combination voice and video services could become economically feasible with an advanced satellite system. At present, this type of service requires the use of approximately one mHz of bandwidth per one-way transmission. The extensive development of such services depends on the availability of low-cost broadband transmission facilities accessible from all parts of the United States.

Communications services presently offered which may become more efficient by satellite technology are in the area of broadband transmission requirements for large users for video and wideband data services.

A satellite system using the proper transponders in the VHF frequency band could be used for mobile communications services.

In considering the non-technical aspects, it is well to recognize that communications satellites are mere repeaters of electronic information in space. They can serve whoever may be their users without distinction and for whatever purposes. Major economies of scale can be realized for users by development and operation of larger multi-communications satellite systems.

The entities that should be authorized to participate in ownership and operation of satellites and the earth stations comprising such a domestic system should be those entities which can demonstrate that their participation will effectively serve the public interest. In our view, eligibility for participation should be determined on the basis of all relevant factors. These should include efficiency and economy of service to the public, the opportunities for development of new and innovative services, efficiency in frequency utilization, contributions to the prompt and efficient establishment of a domestic system, the ability or willingness of authorized communications carriers to provide adequate and economical service, and related public interest criteria.

The Communications Satellite Act of 1962 was enacted for a specialized purpose. We believe that it should not be extended beyond the intent of Congress in the establishment of a domestic satellite system. There is no indication in that Act of an intent to govern domestic systems. Instead, the Act was passed merely to provide the framework for the establishment of a global communications satellite system and creation of the Communications Satellite Corporation.

The Communications Satellite Act refers to "domestic" communications services but only to make clear that there was no Congressional intent to preclude the use of the global system for domestic communications services (see Section 102(d)). It does not set forth a Congressional mandate that a particular entity will be the exclusive owner and operator of a domestic satellite system.

Authorized communications carriers should have the right to own both satellite and earth station facilities for domestic communications services wherever they can demonstrate that their participation in the system and ownership of facilities will serve the public interest. This policy will enable and encourage the authorized carriers to introduce this new technology in their service offerings to the public wherever they can provide more economical and efficient services. Communications carriers have a direct and immediate responsibility to serve the public efficiently, and they should be allowed to own and operate the most modern facilities that are available to discharge their public service responsibilities.

There are policy questions that go beyond authorized carrier ownership and operation of domestic satellite systems. There is a question whether sufficient experience exists to determine now the ultimate pattern for additional ownership and operation of a domestic satellite system. It does not appear that any present requirement exists to withhold the potential of this new technology in order to resolve complex and controversial questions of such additional ownership, operation and control of a domestic satellite system. These questions can be preserved for future determination by retaining flexibility to adopt changing patterns of ownership based on future developments and needs.

Problems and Possibilities

A domestic satellite system should be designed to serve large-scale users and also provide communications for remote communities and small-scale users. To this end, additional research and development will be necessary, and an experimental system should be established. Three areas require further study: earth station design, satellite design and system design.

For a small-scale user or for a remote community, it is essential to provide an efficient, reliable and easily maintained earth terminal utilizing a small antenna and an uncooled receiver. The large-scale user would probably be able to support earth stations similar to those now used with the Intelsat system. If the large earth station can be located near population centers, this will avoid the added complexity and cost of a connecting microwave system. This would be possible if the U.S. submission to WARC is adopted as stated in the FCC Fifth Notice of Inquiry (Docket #18294), which would set aside certain discrete frequency bands above 15 gHz exclusively for satellite communications. Present frequency allocations in the 4 and 6 gHz shared bands do not allow earth stations to be located within or near population centers because of existing terrestrial microwave systems. The advanced design of small stations and improvement of the large stations should be a major goal of an experimental system. In addition, an experimental program would allow for the development of computer systems that would effectively control the traffic of earth stations and satellites.

Present satellite systems utilize an access system that requires each earth station to be equipped to receive a carrier from each earth station with which it desires to communicate. This type of access could become impractical for a large domestic system. A multiple user communication access system is desired which would allow many small low traffic stations to share a common carrier or frequency band. A different technique will have to be applied for high traffic stations and broadband user requirements. Special users—such as mobile ground, air and ship stations—should be provided with suitable means of accessing the satellite system and conversely the satellite system should be provided with suitable means of addressing, locating and communicating with mobile users.

The control of traffic flow in a common user system, the control of frequency allocations and channel selection are major new system problems which will require substantial development. Terrestrial systems normally operate in a grid configuration, routing traffic through a series of switching points arranged in some formal pre-set sequence. A domestic satellite program should provide for a hubbing concept to be developed which will permit point-to-point traffic flow and allow for the elimination of switching centers. However, this will require extensive computer control for distribution and accounting of traffic.

Further areas requiring study include power to be radiated by earth stations and satellites, modulation techniques, and compatibility between the domestic and the international systems. One of the major problems which will result from the use of domestic satellites in conjunction with international satellites is the excessive delays that would be encountered in end-to-end satellite transmissions. Delays of the order of one second in each direction could result from a two-hop satellite connection. In voice services, two-second round trip delay may be unacceptable as a general means of voice communications. It may be necessary to adopt a method of insuring that traffic arriving in the U.S. via the international satellite system is routed domestically via cable or microwave system, while traffic originating on the domestic satellite system destined for overseas points is routed overseas via submarine cables. In respect of data transmission, the situation is similar so that special terminal equipment which can accommodate these long delays will have to be developed. Some means will be required to adapt real time on line computer/communications systems to operate with these delays in domestic/international satellite systems.

Work also needs to be continued to determine the most efficient combination of satellites in orbit, number of transponders per satellite, numbers and types of antennas per satellite, means for inter-transponder communications and orbital locations. The possibility of including telephone and message switching equipment within the satellite on a channel or group basis requires study and possibly further research and development.

Such questions can best be resolved by a combination of Government support study programs and privately supported research and development in hardware areas such as antennas, parametric amplifiers and multiplex techniques. An experimental system would serve to demonstrate the capabilities of such a system and be useful in obtaining the necessary economic and marketing information to make the needed decisions before designing an operational domestic system. An experimental system also would serve as a test bed for hardware developed under Government and private research programs and would allow for several alternative technical solutions to be tried under controlled test conditions before major investments and commitments are made for a domestic system.

National security considerations must be weighed in conjunction with a domestic satellite system. The vulnerability to destruction by hostile powers of satellites needs careful consideration. The possibility of erecting space stations with ability to reach synchronous satellites from the space stations suggests that a domestic satellite system should only supplement and not replace domestic terrestrial systems which are and can be hardened facilities.

In considering a land mass like the United States with its extensive networks of microwave and cable systems, and despite the many advantages of satellite communications, it may not be economically sound in certain instances to supply satellite services which merely duplicate what could be done just as well by terrestrial systems.

Incentives and Regulation

We believe that the most desirable regulatory policies are those that will insure a blend of private forces and public intervention. The FCC has developed regulatory policies for overseas satellite communications which have fostered innovation and expansion while protecting the public and insuring uniform and non-discriminatory access to the system. Private forces represented by the communications common carriers—if they are permitted to participate in ownership and operation of a domestic satellite system under effective regulation by the Commission—will bring to the American public a domestic system which is efficient and economical and to which the public will have equal access.

We therefore submit that government policies which will most effectively promote the development of new communications services and markets are policies which will permit participation in ownership and operation of the domestic satellite system by authorized communications common carriers. This will encourage the carriers to apply their technical know-how and unique experience to insuring the most economical and efficient operation; it will assure maximum use of the satellite system; and it will serve as an incentive for the development of new services. Authorized carrier ownership of earth stations and submarine cable systems has encouraged the carriers to make increased use of these systems to expand, develop and improve their services and to provide new alternate voice/record services.

In regard to technical regulation—such as spectrum utilization, interference and service standards—every effort should be made to protect both the domestic satellite system as well as external satellite and terrestrial systems from interference that could substantially degrade service.

Effective regulation therefore should be imposed to guard against deviation beyond prescribed limits. The most important parameters dealing with an earth station/satellite system are as follows: (1) uplink frequency to the satellite station, (2) downlink frequency to the earth station, (3) effective radiated power from the satellite station transmitter and (4) effective radiated power from the earth station transmitter. In each of these areas regulation should protect both the domestic satellite system and other communications systems from interference. Regulation should minimize possible earth station transmission to a satellite of another system, and earth station reception of a transmission from an unwanted satellite. Also, when an earth station terminal and terrestrial terminal are operating in the same frequency band, interference, including that due to forward scattering caused by precipitation, must be considered.

We believe that regulatory policies with respect to satellite communications should be consistent with regulatory policies developed for terrestrial systems. A domestic satellite system should be properly integrated with the common carriers' communications network in order to provide the public with the most efficient and economical total communications system.

It is gratifying that progress is being made on the establishment of a domestic commercial satellite communications system. We shall be glad to cooperate in further efforts by the White House Staff.

Cordially,

H R Hawkins

RCA Global Communications, Inc.

1 March 1969

Offer to Purchase
Alaska Communication System
Commercial Communications Network

prepared for

Department of the Air Force

Headquarters, Air Force Communications Service

ACS Sales Management Office

Scott Air Force Base, Illinois

RCA Global Communications, Inc.

60 Broad Street, New York, New York

COMMUNICATIONS SATELLITES

I. INTRODUCTION

The Request for Offers states that the offeror must consider the possibilities of using satellites for both interstate and intrastate purposes. RCA has studied all aspects of both uses and is proposing the following action:

- Proceed promptly with plans for a ground station in Alaska to handle interstate and international telephone and telegraph traffic and television. Full and expanding use of the complete system involving the satellite itself and a ground station in the lower 48 is an integral part of this bid.

- Get agreement of all parties involved to proceed with a domestic system for the State of Alaska along the lines of the Phase I proposal made subsequently in this section. Phase I provides for ground stations for telephone and television at 49 points in Alaska with appropriate connections to the lower 48 states.

It is the opinion of RCA that the use of communications satellites to interface with the Alaska Communication System is required for enhanced future sociological, educational, economic, and political advancement of the region. Further, it is the belief of RCA that full exploitation of communication satellites offers the largest single potential advance in Alaskan communications capabilities. However, the form of implementation of a full system dedicated to Alaskan communications is dependent upon many factors beyond the control of RCA and these preclude a final decision on the total form of satellite utilization.

It is possible, however, to outline the major elements of such a program. The first phase of involvement with satellites in the ACS would be to interface with the existing Intelsat satellites as soon as possible. RCA agrees with the principle of establishing a large Intelsat-approved station in Alaska. RCA is prepared to invest in at least 50 percent ownership of such a station and up to 100 percent if authorized by the FCC.

A natural growth of satellite involvement would be to make available a more powerful satellite which could bring television and telephony to terminals in the small villages as well as the major cities. RCA in this section proposes a specific arrangement of such terminals and a satellite. The proposed system arrangement would make full use of the large station mentioned above (herein identified as Talkeetna) and would also handle the links between Alaska and the lower 48 states.

This system would make available satellite service over the vast reaches of Alaska, which has an area approximately one fifth that of the lower 48 states. The problems of such a region are not unlike those one faces in a domestic satellite system in Canada or the lower 48 states. RCA has studied both these proposed systems extensively -- most recently conducting a study for the Canadian Government -- and makes the present proposal for an Alaskan Domestic Satellite System with the experience and expertise gained in previous space communications work and documented in later in this section.

While this is not a detailed firm proposal, it is a blueprint system for Alaska capable of being expanded in time. RCA is willing to finance up to 100 percent of the cost of implementing such a system provided that firm plans can be made for the annual financial support of the cultural and educational TV and other government services that will permit recovery of proper costs and capital under an appropriate rate structure.

II. INTERSTATE SYSTEM

RCA's belief in the desirability of a ground station in Alaska is best expressed by a quotation from a letter to the FCC of January 15, 1969 in response to Comsat's proposal of December 6, 1968.

"RCA Global Communications, Inc. endorses the establishment of satellite communications for Alaska. It has consistently supported the development of satellite communications and believes that the introduction of this new technology for Alaska will be beneficial and in the public interest. Satellite communications should bring new and improved and expanded communications systems for Alaska, and can also substantially contribute to education and public safety. Further, the development of improved communications for Alaska should promote industrial growth for our largest state."

Studies of the telephone and telegraph requirements alone indicate sufficient justification for the building of the satellite link without the additional possibilities of live television. Following are general conclusions which are supported in more detail later on:

1. The proposal of the Communications Satellite Corporation dated December 6, 1968 to build an earth station near Talkeetna, Alaska, to provide service between Alaska and the lower 48 states, Hawaii, Japan, and other Pacific area locations should be implemented. The technical characteristics of the December 6 submission to the FCC are adequate for the interstate traffic and with minor additions should also serve for the RCA-proposed Alaskan domestic system working with Intelsat IV.

2. Comsat's application to the FCC estimated that without unusual weather conditions, the construction of the station would require approximately 22 months after agreement. Since agreement appears to be some months away, it has been assumed in this offer that the earth station would not be finished until late in fiscal year 1972. Accordingly, circuit requirements for growth in fiscal 1972 and prior years must be provided by other means than by satellite.

3. The ground station at Talkeetna will be used exclusively for traffic within Alaska and between Alaska and the lower 48 and the rest of the world. This exclusive

use is necessary for the initial service for interstate business, and it will be even more so when the domestic system is implemented. It is RCA's view that the ownership, operation, and maintenance of the ground station should be the responsibility of the organization providing the communications in Alaska. RCA is prepared to furnish the capital to construct, and the resources to operate and maintain the station if it is authorized to do so. A general policy in this matter has not yet been established by the U.S. Government; so in the meantime RCA has adopted the position for the purposes of this offer that it will own 50 percent of the Talkeetna station.

A. JUSTIFICATION OF SATELLITE NEED

1. Projections of Future Requirements

Using the projections of future growth in circuit requirements outlined elsewhere in this bid, it is apparent that the primary need for the satellite earth station is to provide relief for the presently overloaded Anchorage-Seattle, Fairbanks-Seattle, and Juneau-Seattle circuit groups. Requirements estimated by RCA are as follows:

	Fiscal Year			
	1968	1971	1972	1973
Anchorage-Seattle	45	100	126	153
Fairbanks-Seattle	15	31	39	47
*Juneau-Seattle	17	30	37	47
Total	77	161	202	247

*In the period before the availability of the domestic satellite this point would connect to Talkeetna by terrestrial facilities.

The RCA proposal assumes that about 90 of these circuits would be placed on the satellite in 1973 and that this would grow to about 200 in 1976. Demand for circuits to Hawaii and the Far East would add to these requirements but to an insignificant degree in the period covered.

The use of the satellite for interstate traffic would provide for growth within Alaska by removing the burden from the facilities which carry traffic to the border. These circuits would then be broken up and adapted to the intrastate requirements.

2. Economics of Satellite Channels

Comsat's view of rental rates for two-way circuits between Alaska and the lower 48 states is outlined in its proposal to the FCC as follows:

$4200/month per circuit - First Year

$3800/month per circuit - Second Year

$3000/month per circuit - Third Year

The economics of providing circuits via satellite versus conventional terrestrial facilities can be considered by a comparison of the cost of satellite channels versus renting circuits at $2.50 per air mile per month from the Government. The following table gives a broad picture of comparative annual costs for different mileages:

	One Satellite Channel	One Terrestrial Circuit* Miles			
		500	1000	1440	2000
First Year	$50,400	$15,000	$30,000	$43,200	$60,000
Second Year	45,600	15,000	30,000	43,200	60,000
Third Year	36,000	15,000	30,000	43,200	60,000

*At $2.50 per airline mile per month.

From this table it can be seen that in the first year the costs are about equal for 1700 miles. In the second year this becomes about 1500 miles, and in the third year 1200 miles. The air line distance from Anchorage to Seattle is 1440 miles and from Fairbanks to Seattle 1525 miles.

The conclusions from this table are as follows:

1. On a theoretical basis the satellite channels will be economical for traffic flowing from the Anchorage-Fairbanks area to Seattle and beyond, particularly beginning with the third year.

2. In the practical situation the rental rate per mile in parts of the terrestrial route is higher than $2.50 per mile per month. As shown in Section VI of Part E of the Request for Offers, the rate for the American Telephone and Telegraph Company cable facilities between Ketchikan and Seattle is $3.90 per mile per month.

3. Another factor is that circuits from Anchorage to Seattle via Tok Junction and Canadian National Telecommunications facilities to the Canada-USA border will require rental of about 300 miles of facilities in Alaska plus 1454 miles through Canada for a total of 1754 miles.

4. All message groups from Anchorage, Fairbanks and Juneau are routed today over Canadian facilities. In the case of Anchorage, the total annual rental per circuit would be $57,000 (assuming 300 miles in Alaska at $2.50 per mile and 1454 miles in Canada at $2.76 per mile). On this basis the satellite circuits would be cheaper even in the first year.

5. Another factor in favor of satellite circuits is that after 3 years of operation it should be possible to obtain additional satellite circuits at less than the $3000 rate. By that time additional circuits could be added by providing relatively inexpensive equipment.

B. TERRESTRIAL CONNECTIONS

The earth station equipment proposed at Talkeetna is as follows:

	Transmitting	Receiving
Message Carriers	2	3
TV Video Carrier	1	1
TV Audio Carrier	1	1

Each message carrier is to be equipped to carry a maximum of 132 voice channels, and each TV carrier is to be equipped to carry one TV channel and the equivalent of 24 voice channels. These 24 channels would be used for TV order wire, program, and cue purposes and for possible circuit restoration.

Multiplex equipment would be used to interface the satellite circuits at voice frequencies or on a group basis. In either event the microwave high frequency lines between Anchorage and Talkeetna would consist of one two-way line capable of carrying up to 960 voice channels, one TV line in each direction, and one spare line in each direction which would automatically be switched in place of the regular message or TV line in case of failure of either one.

The Comsat proposal mentions the possibility of extending the planned Anchorage-Talkeetna microwave system to Fairbanks in order to provide a direct connection to that area. At the present time there is a standard TD-2 microwave system with a spare high frequency line between Anchorage and Fairbanks. It would be extremely desirable to provide a third high frequency carrier in this section and then equip this section with an automatic switch which would switch either the message circuits or the TV to the spare facility in case of a failure. This line could be increased to provide four TV channels if later demand made it necessary.

III. ACS INTERFACE -- INTELSAT

At the present time satellite communication to and from Alaska could be established via Intelsat II (on station at 176° W Longitude) if an earth station were available. However, the limited capability of Intelsat II (240 two-way telephone circuits or one TV channel) would prohibit its dedication solely to ACS except for a portion of its telephone capability when the satellite is in that mode. Intelsat III, now coming into service over the Pacific, would greatly increase the available channels (1200 conversations or four TV channels). Intelsat IV expected to become operational in 1971 would provide a further increase in channels and presumably the opportunity to have channels dedicated solely to ACS services. However, it should be noted that Intelsat IV would provide a nominal 26 dbw per transponder on earth coverage, or 37.7 dbw ERP if the spot beams could be directed at Alaska.

Antennas at the earth stations operating with the Intelsat series of satellites are usually of 85-97-foot diameter, and approval by the Intelsat organization is required. Presumably smaller receive-only stations would be allowed, but, of course, would involve only certain classes of service, and at much higher rates for the satellite charges. Based on presently available data regarding recommended satellite spacings (about 7^{o}), even receive-only stations would require antennas a minimum of 28-30 feet in diameter. However, one would expect that satellite spacing might be somewhat greater over the Pacific, and smaller antennas might suffice. In the longer term, the receive-only antennas, unless appropriate to the satellite spacing ultimately used, would be subject to interference from adjacent satellites. An antenna diameter greater than 30 feet would be required for high quality color TV reception unless the Alaskan coverage approached that of the Intelsat IV spot beams, i.e., 37 dbw. Thus, Intelsat III cannot provide TV to the bush communities.

The initial role of an ACS/Intelsat interface of "approved" configuration would be interstate in nature, increasing the telephone and related narrow-band services; a secondary role would be the introduction of live two-way television capability to those sections of Alaska interconnected to the terrestrial TV distribution system. Using smaller "non-approved" receive-only ground stations, multidestination one-way traffic, such as broadcast or TV service, could be provided to some locales only later as Intelsat IV becomes available or when the domestic system is implemented.

IV. ACS/U.S. DOMESTIC INTERFACE

A potential ACS/U.S. domestic interface is not unlike that with Intelsat IV discussed previously inasmuch as the satellite EIRP and operating frequencies are similar. In particular, the present Comsat proposals for a pilot domestic system describe a 12-channel spacecraft similar in design to Intelsat IV with a 37 dbw beam center EIRP, but having lower 48 beam coverage. Further, the orbital positions presently proposed for the pilot domestic system are centered on 100^{o} W Longitude. Thus, in order to also provide ACS domestic service, the Comsat domestic system satellite would require a different antenna configuration (potentially decreasing the power available) and a shift to a more westerly orbital position.

An advantage of interfacing the ACS with the proposed pilot domestic system, should such a system be approved, is that it is permissible to operate with smaller ground stations having a transmit capability, i.e., 42-foot antennas for moderate capacity and 28-30-foot antennas for TV receive-only and special TV transmission. This is considered analogous to using Intelsat IV and the later comments apply to both.

V. ALASKAN DOMESTIC SATELLITE SYSTEM

Whereas in either of the previous alternatives the satellite services would be rented from other corporations, it is quite feasible to consider the economics of a satellite dedicated to the ACS. Two basic approaches are available. In the first, use would be made of the presently available frequency assignments in the 4 and 6 gHz bands, and consequently the system would be under the same constraints as the Intelsat or pilot domestic systems with respect to maximum signal strength. In realization of this approach three general sizes of spacecraft can be assessed in terms of the traffic requirements. First it is doubtful if the traffic in telephony or the extent of TV distribution would permit the economic full utilization of a large spacecraft similar to the Intelsat IV. The principal economic factor is the high launch cost rather than that of the satellite itself.

A spacecraft having communications capability more commensurate with the Alaskan requirements would be based on the Thor-Delta series of launch vehicles. One design study recently completed for the Canadian Government by RCA Limited used the DSV $3L^2$ vehicle and a transfer orbit capability of 965 lbs. to give six TV or equivalent channels of operation at 38 dbw EIRP on Canadian coverage (nominal $4^{o} \times 8^{o}$). Inasmuch as this design is compatible with the Intelsat and Comsat frequency plans, it is readily adapted to the ACS through antenna redesign.

A slightly lower capability satellite could be derived from the Intelsat III, possibly on the lines of the III-1/2 proposals. However, extensive redesign of the transponder would appear desirable in order to obtain the newer frequency plan and provide sufficient EIRP for the smaller ground stations to be feasible.

The second basic alternative available in regard to a satellite dedicated to ACS is to shift operating frequency allocations to a region of the spectrum where the CCIR recommendations to ITU regarding maximum flux density do not apply. For example, by shift to an appropriate portion of a lower band, an increase in EIRP would be allowed, easing the ground station requirements. However, it must be noted that the total spacecraft-generated RF power is directly related to the spacecraft prime power, i.e., usually the solar array. Without substantial increase in the satellite antenna area, the total EIRP cannot be increased. A shift to higher frequencies results in less efficient generation of RF power and increased atmospheric absorption. Substantial reductions in EIRP, i.e. satellite communications capabilities, would be reflected in proportionate increases in rates for a given general class of satellite. Therefore this approach is not recommended.

VI. SATELLITE CAPABILITIES AND IMPLICATIONS

The general characteristics of the previously discussed satellites are summarized in figure 1. It is apparent that they fall into four groups on the basis of operational possibilities.

(It may be noted that the discussions are restricted to equatorial synchonous satellites to avoid the cost of trading capabilities for the ground stations.)

A. INTELSAT II & III

These satellites must be worked by large antennas except for high priority traffic which may be permitted to transmit from a smaller antenna. It is assumed that ACS would make use of these satellites only through a standard Intelsat antenna such as that proposed by Comsat for construction at Talkeetna. Such operations would complement other arrangements for transmission to the lower 48 states. It is further assumed that although television capabilities would be available through Talkeetna, these would be used only for special events. It is suggested that these satellites would not be available on a daily scheduled TV service nor are their capabilities such as to allow television service to small villages.

B. INTELSAT IV

Although Intelsat IV is generally under international control the extra capacity and power (in the spot beam) make it possible to consider it as having more extensive application to the ACS. However its international aspects as well as the special ACS

Satellite	Year	EIRP per Transponder dbw	Frequency Bonds: Up GHz	Frequency Bonds: Down GHz	Available Channels: TV	or	Available Channels: One-Way Telephone	Ground Station Antenna Diameter in Feet: Standard Master	Ground Station Antenna Diameter in Feet: Telephone Service	Ground Station Antenna Diameter in Feet: TV Receive Only
Intelsat II	Available	16	6	4	1		480	85-97	N/A	N/A
Intelsat III	Available	22	6	4	4		2400	85-97	N/A	N/A
Intelsat IV	1971	24 37	6	4	12		12000	85-97	N/A	N/A
Pilot Domestic (per Comsat proposal)	est. 1972-73	37	6	4	12		12000	42	42	32
ACS Domestic I (based on Canadian design)	est. 1973-74	38	6	4	6		6000	42	32	32

Figure 1. Satellite Capability Comparisons

requirements suggest that it should be used only as a pilot system or test bed for development of an ACS domestic system. The operating possibilities of Intelsat IV are similar to those of the domestic system discussed next, provided the spot beam could be directed at Alaska.

C. ACS DOMESTIC I

The ACS domestic system discussed here may be achieved using either a portion of the proposed U.S. pilot domestic system capabilities or a separate satellite dedicated to the ACS. Using a spot beam of the former makes its channel characteristics comparable to the possible ACS design, and thus they are discussed together. Aside from the difference, in capacity, the primary distinction is that the Pilot Domestic system is likely to be stationed some 30° of longitude to the east of an ACS allocation and thus may be in a region of closer satellite spacing with consequently more stringent interference limitations. In the absence of information regarding allowable spacings for either position, recommendation for about 7° orbital spacing has been assumed for both cases.

VII. IMPLEMENTATION OF THE RCA PROPOSAL FOR A DOMESTIC SATELLITE SYSTEM IN ALASKA

A. GENERAL

The previous discussion states RCA's position as to the desirability of proceeding promptly with an earth station at Kalkeetna. It also lays the groundwork for a description of an Alaskan domestic system. This domestic system should provide communications of all types to respond to the varied needs of metropolitan areas and isolated communities and to special military and industrial requirements. It should encompass and provide all of the following:

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

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

- Television for the following purposes:
  - Entertainment and cultural broadcasts, taped or local in origin.
  - Live broadcasts of news, sports, special events, and standard programs from the lower 48 states.
  - General education of adults and children.
  - Instruction for adults and children in all school grades from kindergarten through at least the junior college level.
  - News and disaster information.
  - Live broadcasts to the lower 48 states to disseminate news and to encourage tourists and new business.
  - Wideband data channels for rapid transmission of bulk information not possible with voice-grade facilities.
- Radio broadcasting for entertainment, news, education, and disaster emergency.
- Aeronautical, marine, and mobile-stations communications.

It is RCA's proposal that the total requirements for the above services be matched against Alaska's needs and that a program for serving those needs be agreed upon and implemented. The following discussion describes a three-phase program to achieve this objective. Phase I will be a comprehensive application of satellite technology to typical communications needs in Alaska. Phases II and III will extend the initial effort to the entire state, based on the results obtained in the first phase.

A description of the proposed system and complete details of Phase I follow:

B. SYSTEM DESCRIPTION

1. Technical Services

A domestic satellite system for Alaska must serve cities, large towns, small towns, villages, airplanes, ships, military sites, and mobile installations (lumber camps, oil and mineral exploration, etc.). The technical services to be offered are covered by the following classifications:

- Telephone and Telegraph
- Terminating TV
- Originating TV
- Originating and Terminating TV
- Other Broadband Transmissions (above 10,000 bits per sec.).

2. Communities to be Served and Present Service

There are about 2100 communities listed in Attachment D of the RFO. The communications service available to these places breaks down as follows:

POPULATION	NUMBER OF COMMUNITIES	NUMBER HAVING LOCAL DIAL SERVICE	NUMBER HAVING TOLL STATION SERVICE	NUMBER HAVING BUSH SERVICE
Over 50,000	1	1	1	
10,000-50,000	1	1	1	
1,000-10,000	23	15	13	
500- 1,000	16	7	8	
300- 500	30	8	8	13
100- 300	152	14	16	68
50- 100	120	5	11	25
25- 50	134	1	6	18
Under 25	187	0	6	17
No pop. info.	1,447	0	35	159
Total	2,111	52	105	300

The service available can be summarized as follows:

. Service available 24 hours a day	52
. Service available 9 to 5 (largely toll stations)	105
. Service available on call (largely bush stations)	300
. No service	
- Communities over 100 people	175
- Communities between 25 and 100 people	65
- Communities under 25 people (incl. those with no pop. info.)	1,414
. Number of communities Total	2,111

The provision of 24-hour telephone and telegraph service to 141 of the small communities is proposed elsewhere in this Offer. This program will cost about $4.5 million. The service will produce revenues far short of meeting operating requirements, and the expenses must, therefore, be made up by income from other telephone and telegraph services. The advent of a domestic satellite program would open a new facility for extending this service and for bringing the full range of TV possibilities to a large segment of the population.

3. Program for Implementation

A detailed study of how this might be done has been conducted. The assumption is made for the purposes of describing the program that all elements except the ground station at Talkeetna are provided especially for the Alaskan system. Possible cost reductions by combinations with facilities of others, both international and domestic, are also discussed. Phase I would be considered a pilot application.

Phase I

- Use the master ground station at Talkeetna. Orbit a a single satellite having the characteristics of Intelsat IV, which can illuminate Alaska on a spot-beam basis and cover the lower 48 states with flood-type transmission and reception.

- Select 50 locations, including military points and mobile stations, and provide a variety of ground stations with different services in order to gain experience with the full range of possibilities, so that the succeeding steps will provide the best answers. The size of the communities to be served would range from 25 people up to, say, 10,000. The military posts and mobile stations would be selected to represent special situations. The varieties of service might be as follows:

  (a) Two-Way Television - Telephone and Telegraph

  4 Locations - Talkeetna, Juneau, Ketchikan, and one in the lower 48 states.

  (b) Receive-Only Television* - Telephone and Telegraph

  10 Communities - Commercial service.

  10 oil fields, lumber camps, vessels at sea, airplanes, military posts - Commercial service.

  2 special military locations for back-up service or other needs

  (c) One-Way Television - Receive-Only*

  20 Bush communities

  4 Military posts

(*) The building housing the ground station would be a community center and classroom. Distribution of any local TV to homes or businesses would be implemented by wire.

- Satisfy requirements outstanding for intercity trunks of the ACS within Alaska and to the lower 48 states by using satellite circuits rather than by building new plant of the conventional type. Relieve existing shortages by using satellite circuits for the long hops and breaking up the terrestrial links for the intermediate distances.

Phase II

- Orbit a second satellite of the generation after Intelsat IV.

- Provide service to all communities of over 100 population (probably 200 to 300 in number by that time). The type of service to be provided would be in accordance with the results of the pilot application (Phase I).

- Provide all growth in commercial and military communications by additions to the satellite system. Provide Alaska with the same TV service as given in the lower 48 states.

Phase III

- Complete the provision of required services to all of Alaska.

4. Network Statistics in Phase I

The map (figure 2) shows the locations proposed for the satellite ground stations and identifies the type of service which is proposed for Phase I. Selection of the specific towns to be served was made to give broad coverage of all varieties of service. Alternates will no doubt be wanted by government, military, and industrial organizations. These can readily be substituted or added as requested.

Figure 3 is a complete list of all locations designed for ground stations, indicating the number of telephone and television channels proposed. These statistics are for Phase I and represent conditions about 1973, when the system might be put into service if the word "go" is given by mid-1970. A summary follows:

Figure 2. Proposed Satellite Services and Ground Station Locations (Phase I)

TRANSMIT AND RECEIVE - TELEPHONE, TELEGRAPH, AND TELEVISION

A. Master Station

Site	Location	CHANNELS: Equivalent Telephone	CHANNELS: Television Transmit	CHANNELS: Television Receive
1. Talkeetna	Alaska	200	4	4

B. Major Stations

Site	Locations	CHANNELS: Equivalent Telephone	CHANNELS: Television Transmit	CHANNELS: Television Receive
1. Juneau	Southeast Alaska	100	4	4
2. Ketchikan	Southeast Alaska	100	4	4
*3. Lower 48 States	To be selected	200	4	4

*If a dedicated domestic satellite is used.

Figure 3. Satellite System, State of Alaska, Phase I (Sheet 1 of 4)

TRANSMIT AND RECEIVE - TELEPHONE AND TELEGRAPH. RECEIVE ONLY - TELEVISION

A. Community Stations

	Site	Locations	CHANNELS Equivalent Telephone	Television Transmit	Television Receive
1.	Elfin Cove	Southeastern Alaska	4	0	2
2.	Point Lay	Northwest coast	4	0	2
3.	Arctic Village	Northeast	4	0	2
4.	Umiat	Northern slope - central	4	0	2
5.	Wiseman	North Central	4	0	2
6.	Eagle	Extreme East of Fairbanks	4	0	2
7.	Livengood	East Central	4	0	2
8.	Attu	End - Aleutian Chain	4	0	2
9.	Kashega	West - Aleutian Chain	4	0	2
10.	Ikatan	Mid - Aleutian Chain	4	0	2

B. Oil Field, Lumber Camps, Government and State Owned Post Stations

	Site	Locations	CHANNELS Equivalent Telephone	Television Transmit	Television Receive
1.	Pipe Line Company - Anaktuvuk (Atlantic-Richfield British Petroleum and Mobile Pine Line Corporation.)	North Central Alaska	4	0	2
2.	Eagle River Scout Camp	Southeast Alaska	4	0	2
3.	Little Port Walter U.S. Bureau of Commercial Fisheries	Southeast Alaska	4	0	2
4.	Spee River U.S. Army Engineers	Southeast Alaska	4	0	2

Figure 3. Satellite System, State of Alaska, Phase I (Sheet 2 of 4)

B. Oil Field, etc. (continued)

Site	Location	CHANNELS Equivalent Telephone	CHANNELS Television Transmit	CHANNELS Television Receive
5. Lost River Munz - Northern Airlines	Northwest Alaska	4	0	2
6. Solomon Bay	Near Nome	4	0	2
7. Canyon Village U.S. Geological Survey	Northeast Alaska	4	0	2
8. Thorne Bay	Southeast Alaska	4	0	2
9. Chicken	East Central Alaska	4	0	2
10. Fish Bay Timber Contractors Inc.	Southeast Alaska	4	0	2

C. Special Military Locations

Site	Location	CHANNELS Equivalent Telephone	CHANNELS Television Transmit	CHANNELS Television Receive
1. Wales - U.S. Navy	Northwest Shore	4	0	2
2. King Salmon - U.S. Air Force	Aleutian Chain	4	0	2

Figure 3. Satellite System, State of Alaska, Phase I (Sheet 3 of 4)

RECEIVE ONLY - TELEVISION

A. Bush Communities

	Site	Location	CHANNELS Equivalent Telephone	Television Transmit	Receive
1.	Point Hope	Northwest Point	0	0	2
2.	Kotzebue	Northwest Area	0	0	2
3.	Gamble	St. Lawrence Island	0	0	2
4.	Shungnak	Northwest Central	0	0	2
5.	Nome	Northwest	0	0	2
6.	Tanana	Central	0	0	2
7.	Unalakleet	West Central	0	0	2
8.	Tok	East Central	0	0	2
9.	Stony River	West Central	0	0	2
10.	Bethel	Southwest Area	0	0	2
11.	Glennallen	East Central	0	0	2
12.	Valdez	South Central	0	0	2
13.	Cordova	South Central	0	0	2
14.	Seward	South Central	0	0	2
15.	Port Alsworth	Southwest	0	0	2
16.	Skagway	Southeast	0	0	2
17.	Dillingham	Southwest	0	0	2
18.	Petersburg	Southeast	0	0	2
19.	Kodiak	South Central	0	0	2
20.	Chignik	South Central	0	0	2

B. Military Bases

	Site	Location	CHANNELS Equivalent Telephone	Telephone Transmit	Receive
1.	Barrow	North	0	0	2
2.	Ft. Yukon	Northeast	0	0	2
3.	Tatalina	West Central	0	0	2
4.	Atka	Aleutian	0	0	2

Figure 3. Satellite System, State of Alaska, Phase I (Sheet 4 of 4)

- Channels to and from the Lower 48 States

-	Telephone	200
-	TV Channels-Transmit	4
-	TV Channels-Receive	4

- *Channels Between Four Large Cities

-	Telephone	100 each
-	TV Channels-Transmit	4 each
-	TV Channels-Receive	4 each

- Channels to Bush Communities and Special Stations

-	Telephone - 22 Places	4 each
-	TV Channels - Receive Only - 46 Places	2 each

5. Technology Available

All of the technology needed to provide a domestic system in Alaska is available. The conditions which must be met are known and hardware is available or can be developed. The principal area in which more research and development is needed pertains to the acquisition of the most economical system which will give good service and provide for estimated expansion.

RCA has much work in progress in this area and is listing the system characteristics which it would expect to employ (subject, of course, to later improvements) and is providing a preliminary estimate of the costs. Should the project be implemented, a major assignment of effort would be made to further improve both the technical picture and the costs.

The following paragraphs give the present view of the system characteristics:

a. Satellites

In view of the mixed character of the traffic through the satellite and the requirements for growth, it is considered

(*) Terrestrial links from Talkeetna to Anchorage and Fairbanks must be expanded.

desirable to examine a design specifically reflecting ACS requirements. The types of service anticipated in terms of channel requirements are summarized as follows:

Available Channels	4	5	6
Multiple Access Telephone	1	1	2
TV - Entertainment	2	3	3
TV - Education Services	1	1	1

In order to provide the flexibility required for expansion purposes, it is proposed to standardize channel capabilities in terms of bandwidth and EIRP. Further, it is highly desirable to achieve a satellite design capable of handling the channels predicted for a period in excess of 5 years, so that two procurements from the same design are feasible, and the development costs can thus be amortized over the longer period. It is also desirable that the satellite transfer orbit weight be matched fairly closely to the launch vehicle capabilities. The Thor-Delta launch family represents a typical "middle" weight capability. The DSV $3L^2$ has a transfer orbit weight of 965 lbs. (1005 - 40 lbs for adaption), which offers the possibility of a spacecraft intermediate in capability between Intelsat III and IV designs.

A concept suitable for the domestic ACS service is summarized in figure 4 and is shown in a cutaway drawing (figure 5). Estimated costs are also included.

b. Ground Environment

Figure 3 shows the proposed arrangements of terminals and circuits and further classifies ground stations by capability. Stations are identified as master, major, and minor. All master and major stations have 42-foot (diameter) antennas and are capable of originating and/or receiving four TV channels simultaneously. The master station differs from the three major stations. The master station has the full Intelsat characteristics and contains more communications capability in order to implement a heavier link between Talkeetna and the lower 48 states. It would also contain the necessary additional equipment for satellite control, namely the telemetry, tracking, computing, and command

Launch	Vehicle	DSV $3L^2$
	Transfer Orbit Capability	965 lbs.
	Satellite weight - initial on station	503 lbs.
Orbit	Synchronous Equatorial	
Stabilization	Body Spin	

Communications

Freq. - receiver		5.9 - 6.4 gHz
transmitter		3.7 - 4.2 gHz
Channels - daylight		6
	eclipse	3
	useful bandwidth	36 mHz
	channel spacing (center to center)	80 mHz

Transponder - Single Translation all r.f.

Antenna Pattern	5° circular
Beam pointing accuracy	$\pm 0.5^{\circ}$

Power	Solar Cells	Nickel-cadmium cells
	Energy Storage	

Positioning & Orientation

Monopropellant Hydrazine Thrusters
Velocity Increment 1150 ft/sec

Telemetry & Command

Either end of 5.9 - 6.4 gHz band
Tracking Beacon 136 mHz
Provision for ranging.

Figure 4. Communications Satellite Characteristics*
(Sheet 1 of 2)

(*) Derived from the Canadian Domestic Satellite Study performed by RCA Limited for the Canadian Government.

Injection Motor

Total impulse — about 110,000 lb-sec

Thermal Control — Passive

Livetime — 5 years

Reliability — 0.7 probability of full 6-channel operation at end of 5 years

General Configuration

Spinning cylindrical body 55" diameter 6 ft. high
Despun circular antenna 4 1/2 foot diameter

Space Segment Costs

Approximate development costs	$25 M
Approximate cost per satellite	6 M
Approximate launch costs	6 M

Figure 4. Communications Satellite Characteristics (Sheet 2 of 2)

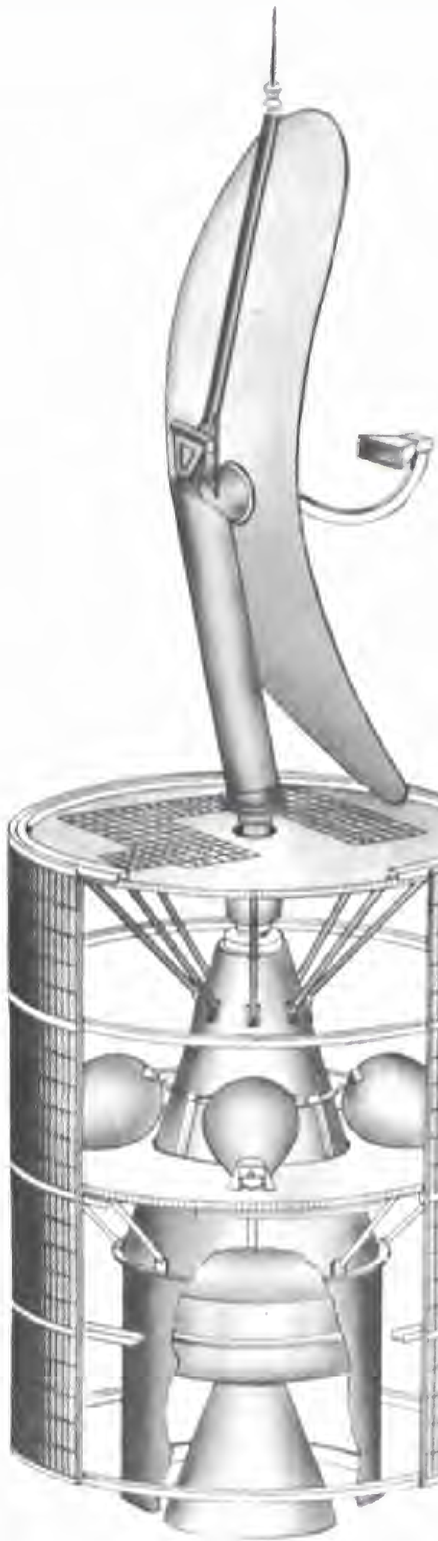


Figure 5. Cut Away Drawing of Proposed Spacecraft

equipment. The one master and three major stations provide the bulk of the communications through the satellite by interconnecting the largest cities and the lower 48 states. Figure 6 shows the technical characteristics and cost.

The next class of terminal (minor) has a 32-foot (diameter) antenna (figure 7), which has a transmit/receive capability for telephone and telegraph but a receive-only capability for television. These stations will bring communications to the 10 communities indicated and to the 12 selected camps and other sites. While only four simultaneous telephone circuits are planned at each of these sites, they will have access to one another, to the major cities, and even directly to the lower 48 states. They would also be equipped to receive two TV channels simultaneously, but would be capable of selecting any two of the four available, and, of course, each site could make its own selection independently. Figure 7 shows the technical characteristics and cost.

The third class of terminals, also called minor, is the TV receive-only type. These are a stripped-down version of the class just discussed, leaving out the telephone and telegraph equipment. Twenty-four sites are listed in figure 3 to have this service. Once again the two TV channels can be any of the four channels, provided that these are specified in advance or that someone at the site is trained to operate the equipment.

(1) Telephone and Telegraph -- Master and Major Stations. These stations will operate with a single multiple-destination carrier to be received by each of the other three stations, demodulated and separated. The fourth receiver is to permit self-monitoring of transmission. They will each have the capability of originating any or all of the four TV programs, and of receiving all four of them. Talkeetna and the lower 48 states will be equipped to handle 200 channels to accommodate the traffic between Alaska and the lower 48 states. However, circuits from Juneau and Ketchikan can go directly to the lower 48 states, within the limit of their 100-channel allocation.

To accommodate frequency assignments and all four TV channels plus the telephone circuits, a wideband high-power amplifier is required.

G/T	30 db/^{o}K
Receiver	Uncooled Paramp
Transmitter	Wideband (TWT)
Capability	. 4 TV Channel Transmit . 4 TV Channel Receive . 4 FDM/FM Carriers Rec'd for Telephone/Telegraph . Transmit one multi-destination carrier (100 or 200 channels) for Telephone/Telegraph . Transmit and receive 88 channels of demand access traffic to/from 32-foot antennas
Cost	. $4.0 million (installed, including civil works)

Figure 6. 42-Foot (Diameter) Antenna Terminal

G/T	27 db/^{o}K
Received	Uncooled Paramp
Transmitter	Narrowband, Lowpower, single channel per carrier*
Capability	. Receive 2 TV channels . Transmit 4 carriers (Single channel) telephone* . Receive 4 single channel carriers . Receive two video sound program channels
Cost	. $750,000 (installed)**

Figure 7. 32-Foot (Diameter) Antenna

* For those sites having telephone/telegraph using single channel per carrier.

** Less $100,000 in the receive-only case.

These carriers will be processed through one transponder, giving four carriers through one traveling-wave tube in the satellite.

The stations will also accommodate the single-channel per carrier traffic from the 32-foot terminals when such traffic originates or terminates on terminals of a major station. This traffic will generally be assigned to the second of the telephone transponders.

The Talkeetna station or the one in the lower 48 states would be equipped to handle any master station role which might be required for channel assignment or monitoring.

Other approaches to handling traffic from the smaller users are feasible. A two-hop system, where a small user is routed to his destination through a switching system at the master station, can be used. Here, each small user is assigned a fixed carrier and receiver frequency pair. Traffic to the lower 48 states would not be two-hop, especially if the control is placed at the station situated there. While such two-hop traffic can be satisfactorily handled on the small scale contemplated in this proposal and while the international and lower 48 traffic would be single hop in any case, the merit of the alternate demand access scheme is such that it may well be preferred. COMSAT has been developing this technique, and serious interest exists for implementing this approach for small Intelsat users.

The capability of the transponder and major ground terminal combination can be characterized as 64 db, including the EIRP and the G/T. The Intelsat III operating into a large terminal such as Talkeetna (41 db G/T) has a capability of 63 db. The bandwidth of a transponder in Intelsat III is 225 mHz., while the proposed transponder here has only 40 mHz. This bandwidth limitation will place restrictions on the number of telephone circuits. The proposed number with four carriers should prove feasible. However, it may be necessary to place some of these carriers into the second transponder and split the demand access load, also, in order to achieve most effective utilization of the two transponders.

(2) Television -- Major and Master Stations. The proposed link parameter of 34 dbw EIRP and 30 db for G/T, or 64 db total, compares to a parameter of 61 db, which is generally accepted as sufficient for good color television with adequate margin.

Thus the color reception will be better at these major sites than usually required. However, the station capability is required for telephone, and the transponder capability is required to work the lesser terminals. This is still appropriate since there will undoubtedly be further ground distribution of the signals from the major terminals, and the higher quality will be useful.

The program sound will be carried in the same transponder as the video. There are several choices for handling the sound. The use of a separate carrier restricts the bandwidth available for video and leads to problems of power level control. While the transponders and links proposed could support this, a better approach would be one which is bandwidth-compatible, such as interleaved (notched-video) sound or pulse-modulated sound using the sync pulse. These systems are being seriously considered for standardization and represent a good solution to the problem.

The amount of signal dispersal required for 38 dbw of EIRP is attainable for restricting the flux density on the ground to the recommended level of -152 dbw/4KHZ. Therefore, this should be no problem.

(3) Telephone and Telegraph - Minor Stations. These stations are designed to bring a satellite capacity to isolated communities. They are planned initially for those sites which will need a few telephone circuits to meet their communications needs. In figure 3, there are 22 sites listed, varying from small community to oil camp, lumber camp, and military post.

The major stations will be equipped to work with these terminals; also, they can communicate directly to each other through the satellite, and they can communicate directly to the lower 48 states.

The basic cost quoted is that for erecting a 32-foot antenna, developing a site to provide shelter for power generating equipment, and all the electronics. The station will include a transmitter and a tunable power amplifier capable of handling several carriers at the same time. The cost indicated includes receiving and demodulating equipment for two video chains. The costs are higher than comparable systems quoted for the U.S.

domestic systems. However, the costs are consistent with microwave relay costs experienced in Alaska and Canada.

The equipment to encode/decode the voice/data signals for transmission on the SCC demand access is included in the price. This with the transmitter and the reduction of prime power capability represents a saving of $100,000 when going to the receive-only terminals for video.

A single transponder operating into these stations can easily handle the 88 circuits required to give four channels to each site.

(4) Receive Only TV. These terminals are almost as expensive as those instrumented for voice communications. It would be feasible to reduce the antenna size and accept a lower grade of picture, such as TASO grade 3. This would lower the antenna cost and reduce the cost of installation. Something like a 15-foot diameter seems feasible. To achieve this would require a nonstandard signal in order to meet threshold with the lower capability. This would make inefficient use of the transponders in the satellite, since duplicate signals (standard and nonstandard) would be required. Also, the cost saving would be small compared to the total station cost.

The 32-foot antenna will permit upgrading at a later date to add the telephone capability, whereas the 15-foot antennas would not readily have this capability. Thus, the terminal will be capable of receiving the full-quality color signals with reasonable margin. The link having a parameter of 61 db (ERP) (G/T) represents a signal-to-noise ratio of 17 db with the 40 mHz bandwidth. This gives adequate performance, both as to margin and final peak-to-peak to rms noise.

C. COST OF DEDICATED SATELLITE SYSTEM

1. Satellite and Launch

A satellite development cost of $24 million is estimated for the size proposed. Three satellites are planned. One would be placed in orbit, one would be considered lost to failure (either a launch failure or to replace an in-orbit failure), and one kept as a spare. Thus, only two launches are scheduled. It is also assumed that were such a satellite developed it would have other applications, such as TV for South America or as a domestic system for some other country. The development cost would be split among the users, and only $12 million is assigned to the Alaskan system.

The cost of a single-flight-qualified satellite is estimated to be $6 million. For three of them a total of $18 million would be required. The total cost, including the pro-rata development, would then be $30 million for three satellites.

The launch costs are estimated to be $6 million apiece. Two launches are estimated to ensure against failure, thus $12 million would be required.

The total space segment investment would therefore be $42 million.

2. Ground Terminals

The three 42-foot terminals are estimated at $4 million each, or a total of $12 million. The 22 32-foot terminals, estimated at $750,000 each, will cost a total of $16.5 million. The 24 terminals for receive-only TV will total $15.6 million.

The total ground cost to be added for implementing the dedicated domestic system would be $44 million. The cost of the master station at Talkeetna is not included, since it would be incurred in an earlier phase.

D. RECOVERY OF COSTS

1. Total System Costs

The total system cost, in millions including Talkeetna, which is estimated at $6.3 million, would be as follows:

Space R & D	$12.0
Satellites	18.0
Launches	12.0
Ground terminals	44.1
Talkeetna	6.3
Total	$92.4

The annual revenue requirements for a system of this type would be approximately one-third, including operating costs, capital recovery, profit, and taxes. Thus, the yearly requirement would be approximately $31 million, assuming a 5-year satellite life.

Since six channels are used, this would represent about $5.15 million per channel as the annual cost of the system.

2. Cost for TV

The proposed system would serve both television and telephone needs. To determine the revenue needed for the TV alone, an estimate has been made of the potential revenues which might be credited to the system as a result of telephone usage. These would come from four sources: the traffic back to the lower 48 states, the traffic between the four major cities, the traffic between minor cities, and the traffic to the bush Communities. For 1973 these are estimated to be:

Lower 48 states	$7 million
Major Communities	2 million
Minor Cities and Bush Communities	1 million
Total	$10 million

This would leave an annual requirement of $21 million to pay for the TV services to 49 communities.

VIII. ALTERNATE APPROACH INTELSAT IV

An alternate approach to providing the service in a dedicated system would be to use the Intelsat IV spot beam and to rent six channels of the total 12 available in the satellite. In this case the terminal in the lower 48 states would already be available and used for other services as well. Only a pro-rata share of its cost would be charged to Alaskan service. This is estimated at one-half the annual requirement or $1 million.

COMSAT, in its July 26, 1967, Response to FCC Docket #16495, shows a revenue projection for its proposed pilot domestic system. This would utilize a satellite with a capability similar to that required for the Alaskan domestic TV system. The average revenue requirement per year per channel based on this reference is about $2 million. For six channels the average rental is assumed to be $12 million for the space segment.

The cost for using the Intelsat IV approach is estimated to be:

	Capital	Annual
Ground (Including Talkeetna)	$46.3	$15.4
Satellite	0	12.0
Lower 48 states (Ground)	0	1.0
Total	$46.3	$28.4

IX. RCA CAPABILITIES AND EXPERIENCE IN SPACE COMMUNICATIONS

A. SUMMARY OF RCA SATELLITE CAPABILITY

RCA's major center for design, manufacture, test, and integration of spacecraft is the RCA Astro-Electronics Division at Hightstown, New Jersey, one of the world's prime space electronic plants, which has as area of 315,000 sq. ft. and employs 1800 personnel. One of the features of this center is a complete environmental test facility for spacecraft. RCA's second space center is at Montreal, Canada, where over 100 scientists, engineers, and technicians are engaged in design and supply of scientific satellites for ionospheric measurements. At the end of this section are illustrations of several of the space vehicles and tracking antennas which are a result of these efforts.

RCA is a leader in the supply of different types of spacecraft. Furthermore, NASA statistics rate RCA first with life-in-orbit achievement and lowest cost-per-pound of any current NASA satellites. RCA's satellite achievements stem from April 1, 1960, when the world's first weather satellite, TIROS I, was launched. In the following 9 years, RCA has been engaged in eight major unclassified spacecraft programs and several classified ones.

The unclassified ones are as follows:

NAME OF PROGRAM	TYPE OF SATELLITE	NO. OF SATELLITES
1) TIROS	Weather	10
2) ESSA	Weather	8
3) RELAY	Communications	2
4) RANGER	Deep space TV	4
5) SERT	Ion engine	1
6) NIMBUS	Weather	2
7) LUNAR ORBITER	Moon Mapping	5
8) ALOUETTE/ISIS	Ionospheric measurement	3

Other RCA space programs cover satellites for navigation and earth surveillance.

The 10 RCA TIROS satellites and eight ESSA satellites were launched in the period from April 1, 1960, to December 15, 1968 (18 successive RCA weather satellite launchings with no failures). These 18 weather satellites have, to date, provided over 1,030,500 pictures for the meteorological services of the world.

The NASA Relay satellites, which pioneered the era of global satellite communications was a collaborative effort of RCA's two satellite centers at Hightstown, New Jersey, and Montreal, Canada. The RCA Montreal center, with its background in wide-band microwave systems, furnished the transponder system to RCA Astro Electronics, which had complete spacecraft responsibility. Following Relay, RCA was a major contender for the Intelsat III global satellite and provided the design of a six-TV-channel, 503-lb medium-sized satellite for domestic telecommunications coverage of Canada.

B. SUMMARY DESCRIPTION OF MAJOR RCA SPACECRAFT PROGRAMS

Following is a summary description of the eight major commercial satellite programs that involved the launching of 32 satellites:

- TIROS. The first TV and infrared meteorological observation satellite. RCA role: prime contractor, design, fabrication, and test of 10 spacecraft and four ground support stations.

- ESSA. Part of the TIROS Operational System (705), the world's first operational weather satellite system, providing daily world-wide weather data from two satellites (AVES global read-out to USA and TOS automatic picture taking (APT) TV read-out to 300 stations located throughout the world).

- RELAY. Medium-orbit active communications satellite, 2 gHz transmit, 4 gHz receive. RCA role: prime contractor for design, fabrication, and test of three satellites (two launched, 1961 and 1962).

- RANGER. First successful deep-space live television transmission. First closeup photos of moon, involving 17,200 pictures. Picture resolution 2000 times better than earth telescope. Four satellites:

two in 1964 and two in 1965. RCA role: design, fabrication, and test TV system and associated communications equipment on spacecraft and on ground.

- SERT. First operation of an ion engine in space. RCA role: design, fabrication, and test of vehicle, including ion engine, and ground support equipment (launched July 20, 1964).

- NIMBUS. Experimental meteorological satellite. RCA role: Major contractor to NASA for design, fabrication, and test of advanced TV system, tape recorders, solar cell power supply, and ground station equipment.

- LUNAR ORBITER. Spacecraft TV mapping of the moon's surface for Apollo landing sites. RCA role: Major contractor to Boeing for communications and power supply; spacecraft system design and testing support.

- ALOUETTE. First Canadian satellite. Ionosphere research and data collection. Alouette I launched September 28, 1962, still operational after 6-1/2 years; Alouette II launched November 28, 1965, still operational after more than 3 years. RCA Montreal role: prime contractor for Alouette II, equipment supplier for Alouette I.

- ISIS. International satellite for ionospheric studies, carrying 10 sophisticated scientific experiments, launched January 28, 1969. RCA Montreal role: prime contractor for design, fabrication, and test and launch support. Next satellite in series, ISIS "B" being fabricated in RCA Montreal for 1971 launch.

C. SUMMARY OF RCA EARTH STATION EXPERIENCE

RCA's commercial earth station facility center is located at Montreal. The work at Montreal covers the design and supply of earth stations and Canadian satellites and is known as RCA space systems. It employs over 250 scientists, engineers, and technicians. RCA Montreal commenced its work in earth stations in 1959 with the design of Cassegrain feed systems for deep-space tracking antennas of the Jet Propulsion Laboratory in the Mojave Desert. Six successive programs were performed for JPL, leading to the preliminary design of the 240-foot (diameter) antennas for deep-space probes.

RCA has been engaged in over 30 programs in the field of communications satellite earth stations, valued in excess of $25 million. Major programs have been:

1. Mill Village No. 1 Station

This was Canada's first commercial satellite communications terminal for trans-Atlantic satellite communications. RCA performed design, manufacture, and test and put the station into operation. Completed in 1965, the Mill Village station is one of the pioneer earth stations, along with Goohnilly, Andover, Plumeur Badou, and Raisting. The station used an 85-foot (diameter) radome-enclosed antenna operating in both the autotrack and program track modes. RCA pioneered in Mill Village No. 1 the use of a wideband, cooled, parametric amplifier for the low-noise receiver. Cooled parametric amplifiers with 500 mHz bandwidth are now standard with all global earth stations. Mill Village No. 1, with a capacity of 600-voice channels, has the highest reliability, as of 1968, of all stations in the global satellite network.

2. Thailand Transportable Earth Station

RCA installed and put into operation a 42-foot transportable earth station and rearward microwave communications link for the Government of Thailand.

3. Mill Village No. 2 Station

RCA completed Canada's second earth station at the Mill Village site in February 1969. The station immediately went into service, carrying trans-Atlantic telecommunications via Intelsat III. The station uses a 97-foot (diameter) exposed antenna with a special pond heating system to prevent formation of ice on the antenna surface. The station has facilities for reception of 10 RF carriers. The station has a stable equipment room of 225 sq. ft. behind the main reflector. This room, moving only in an azimuth, houses the Cassegrain feed system, parametric amplifier, test translator, and communications and tracking down converters; it is accessible by an elevator. The station uses an all-RF waveguide interfacility link between the antenna and Control Building, such as to enable all RF signal processing down to baseband channels to be done at the Control Building location.

4. India's First Commercial Earth Station

RCA is prime contractor to the Atomic Energy Department of the Government of India for the supply of India's first commercial earth station. Located at Roona, 120 miles southeast of Bombat, the station will be almost identical to Mill Village No. 2.

5. Panama Earth Station

RCA provided to Page Communications an RCA 4/6-500 feed system and checkout of G/T performance to ICSC requirements.

6. Brazil Earth Station

RCA provided to Hughes International an RCA 4/6-500 feed system and RCA 2200 series telecommunication system for Brazil's earth station.

7. Argentine Earth Station

RCA provided to STS SPA and RCA 4/6-500 feed system and checkout of G/T performance to ICSC requirements.

8. NASA Advanced Technological Satellite (ATS) Ground Stations at Rosman, North Carolina, and Mojave and Toowoomba, Australia.

RCA performed design, manufacture, test and installation of a 1200-voice-channel, solid-state AM and PM receiving system.

9. Comsat Telemetry and Command Stations at Fucino, Italy and Tanay, Philippines

RCA designed and supplied solid-state, double-conversion upconverter and downconverters.

10. Morocco Earth Station

RCA supplied TV demodulators and a test translator.

11. Kenya Earth Station

RCA supplied to Marconi Company an RCA 4/6-500 feed system and single-channel, solid-state tracking system.

D. RCA DEVELOPMENT PROGRAMS IN SATELLITE EARTH STATION TECHNOLOGY

RCA's earth station facility conducts sustained development activity to bring about improvements in cost, reliability, capacity, and maintainability of earth stations. Current development activity is aimed at low-cost earth stations for domestic satellite communications. Earth stations for television reception only will be unmanned and have a stationary main reflector.

Prominent in the comprehensive development program for application to earth stations and microwave relay systems is the development of digital communications techniques, direct microwave power sources by application of bulk effect in semi-conductors, and operations at 12 and 18 gHz in recognition of the use of millimeter waves for future communications systems.

E. CANADIAN DOMESTIC SATELLITE SYSTEM

1. Relevance of System to Augumentation of ACS with Space Communications

Canada is expected to commence implementation of its plan for a domestic satellite system by mid-1969 to enable pilot operations to begin before the end of 1971. The fully developed system will be composed of several medium-sized satellites, each with a capacity for six TV channels, stationed in a synchronous orbit 22,300 miles above the equator at a longitude approximating that of Winnipeg, and three basic forms of ground stations. Large ground stations with parabolic antennas having a diameter of about 60 feet will be used for heavy route transmission and reception of television and telephone. These will be located at major population centers. Smaller, light route stations will be used for light telephone requirements in remote locations and will be equipped for the additional facility of television reception. The largest group of stations will be for TV reception only, serving areas not served by a terrestrial TV link, as well as areas presently covered by the national TV network.

RCA Space Systems, Montreal, Canada's foremost space electronic company with the only Canadian facility for design and supply of spacecraft, and earth stations for global systems, will be heavily engaged in implementation of the Canadian satellite system, both for the Space Segment and the supporting ground stations. The ground station designs originated by RCA Space Systems in association with the user agency would have direct application to any domestic satellite ground station program for Alaska, since the climatic conditions of Alaska are similar to the extremes of Northern Canada for which the Canadian stations will be designed.

2. Canada's Need for a Domestic Satellite System are Considered to be Approximately the Same as Those for Alaska

Canada has a great need for a satellite system to illuminate with wideband telecommunications its vast territory of 3.6 million square miles. Wideband microwave systems, of which Canada has over 10,000 route miles, mostly in its southern reaches, cannot compete with satellite distribution for such an area, most of which is sparsely populated and has climatic conditions unfavorable to terrestrial systems. It is a need that will persist for a very long time into the future, notwithstanding continued growth of high-capacity, reliable, and low-cost microwave terrestrial systems and cable and waveguide systems. These systems will complement, not compete, in the growth and development of an integrated communications service of greater coverage, capacity, speed, flexibility, and reliability.

X. SUMMARY

If RCA is the successful bidder for the ACS system, it is prepared to proceed as follows:

1. It wants to proceed with the earth station at Talkeetna and is prepared to assume 100 percent ownership and operation of the station or any portion thereof which the Government decides is an appropriate allocation.

2. Subject to appropriate governmental authorization and the arrangements referred to below, and it is prepared to research, finance, build, and operate a domestic system for Alaska described in this bid as Phase I. The preliminary estimates of costs on this basis are $92.4 million capital - $31 million annual. There

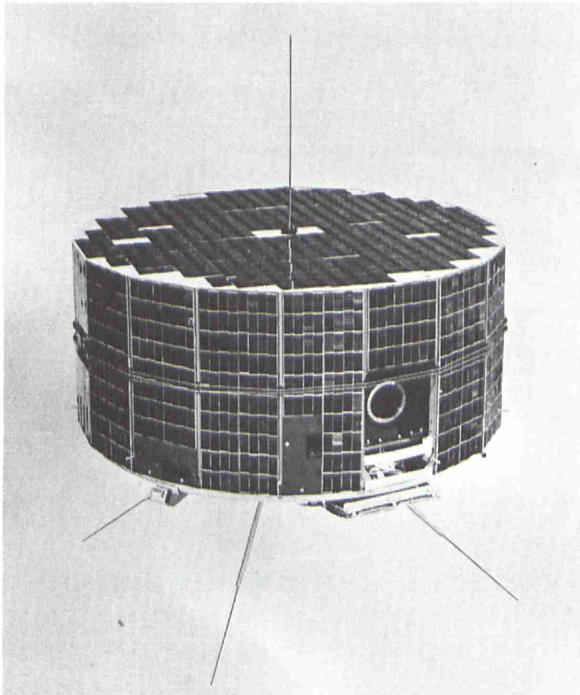
are alternatives which must be considered. It seems evident that cost efficiencies and probably time can be gained by a combination with the talents of other organizations. Such action is clearly in the public interest and is recommended by RCA. Under this concept, the annual costs of Phase I are estimated to be in the order of $28 million. Further refinement of these estimates and cost reduction work would have the highest priority if the project is authorized.

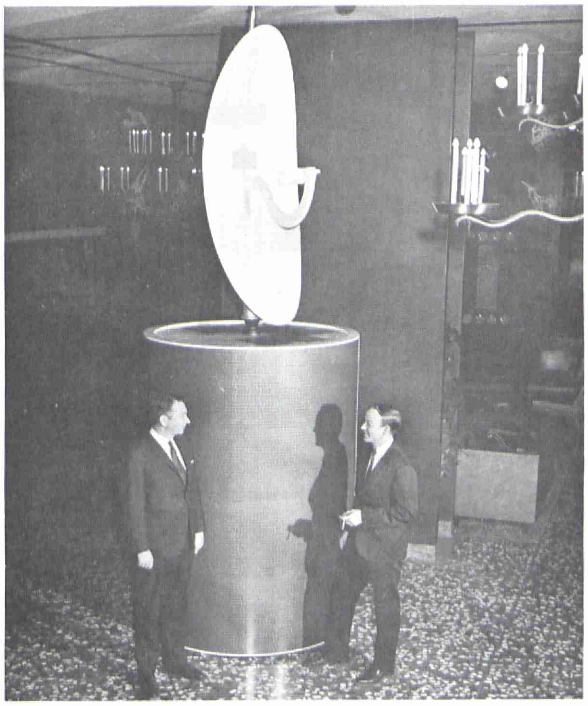
3. RCA, if authorized, can complete all or its part of the work on the domestic system and have the Phase I complex in service 3 years after agreement is reached by all concerned and the word "go" is given. It believes the other parties should have no difficulty in meeting this schedule.

4. RCA would use the domestic system for regular intercity telephone and telegraph purposes to the extent practical. This use will pay annual carrying charges estimated for 1973 at about $10 million. It assumes the Government would lease from RCA sufficient facilities to provide for the public services, including TV and radio broadcasting, telephone, and telegraph (for government purposes) and pay rental rates which would produce a fair rate of return on the total net investment not covered by the contribution from revenues of the commercial telephone and telegraph services. Agreements would also have to be negotiated as to appropriate life spans or termination charges, which will make the operating company whole should rentals be discontinued.

5. While RCA has the capability to design, manufacture, and install the complete satellite system, it would anticipate that whatever entity had responsibility for procurement would put the major elements up for competitive bidding.

6. Phase I will make the possibilities of TV available to at least 80 percent of the population of Alaska. In 1973, this could be around 400,000 people. On the basis of net cost to government for the public services of $18 to $20 million per year, it would amount to $50 per person. It is RCA's view that this is a modest cost for the extension of such universal service to almost an entire state.

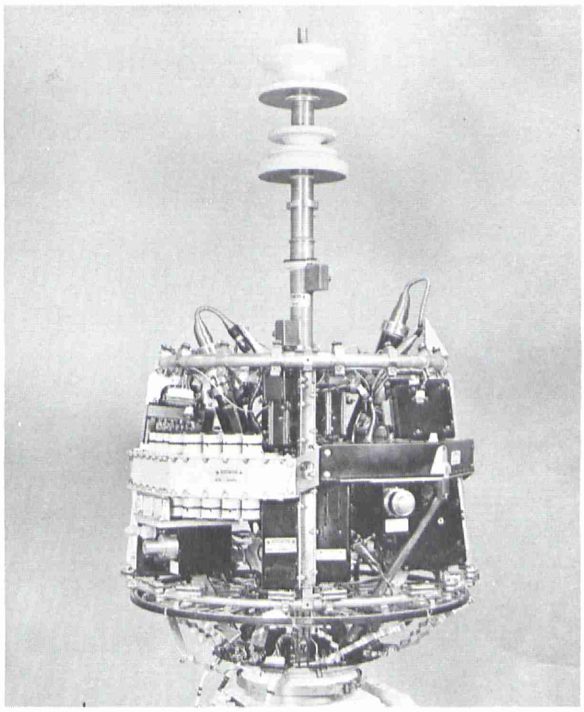




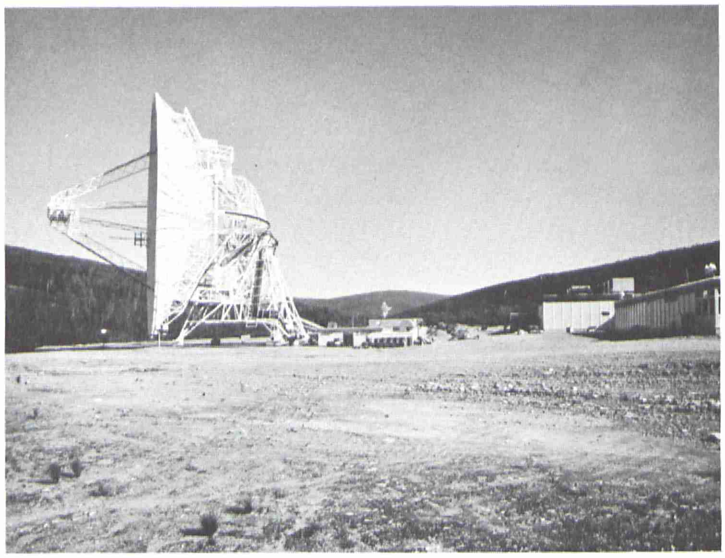
(Above) RCA TIROS Operational Satellite for World-Wide Weather System

(Above right) RCA Proposed Spacecraft for the Canadian Domestic Satellite System

(Right) Cut-away of RCA Relay Satellite Launched for NASA in 1962. Relay ushered in the System of Global Satellite Communications.

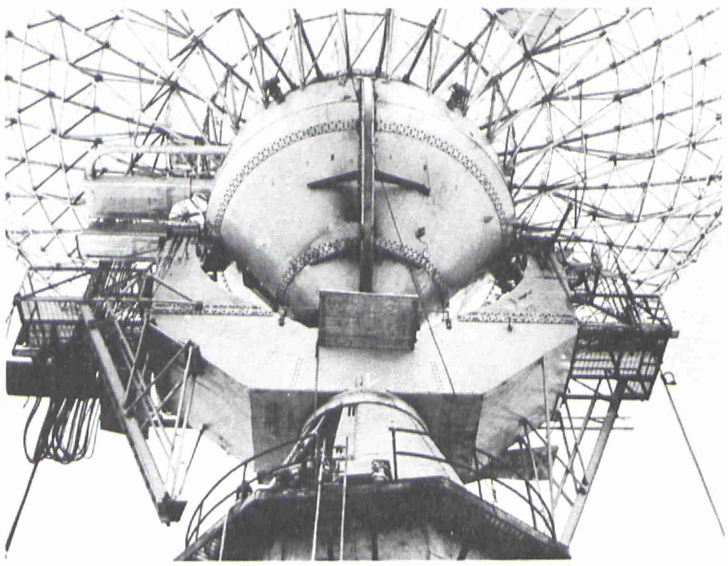


Canada's 2nd Satellite Communications Earth Station at the Mill Village Site. Completed by RCA in February 1969.



NASA Satellite Tracking Station Operated and Maintained by RCA at Rosman, North Carolina.

Canada's First Satellite Communications Earth Station at Mill Village N.S. Completed by RCA in 1965



Rear View of the 85 Foot Antenna of the RCA Satellite Communications Earth Station at Mill Village, N.S. Canada.

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Swell
9/29

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

AREA CODE 212 393-1000

EDWARD B. CROSLAND
VICE PRESIDENT

September 23, 1969

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

Dear Dr. Whitehead:

This is in further response to your letter of August 19, 1969, requesting our comments on the introduction of satellites to domestic communications.

We suggest that the wisest public policy at this time would be to permit any organization or group interested in establishing a domestic satellite system -- either common carriers or noncommon carriers -- to apply for a license to establish and operate such a system. However, authorization of any domestic satellite system 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.

This approach, we believe, would allow flexibility and incentive for creative private initiative, and would provide the most appropriate means for an orderly development of domestic satellites.

Our views are set forth in greater detail in the attached memorandum.

Sincerely yours,

Edward B. Crosland

AT&T COMMENTS ON DOMESTIC SATELLITE COMMUNICATIONS

Economic and Service Potential

It is generally agreed that communications satellites have proven their technical feasibility. This has been clearly demonstrated by the use of satellites in overseas communication.

However, there are major differences in the economic characteristics of international satellites and satellites for domestic purposes. International satellites offer an efficient means of quickly reaching many nations in various regions of the world to which communications facilities are now relatively unavailable. The same situation does not exist within the United States, where all sections of the country are already served by an advanced communications network, and the distances involved for most communications are much less.

Satellite transmission, of course, is just another form of transmission similar in function to microwave radio systems and coaxial cables. Indeed, there are no communications services which could be offered by satellites which cannot now be offered over terrestrial facilities.

Our recent studies indicate that satellite costs may be less favorable compared with terrestrial costs than had previously been indicated by earlier studies. In fact, there may be a cost penalty associated with the use of satellites, as compared with using terrestrial facilities to yield the same grade of service.

We believe, however, that there is a potential for the use of satellites in domestic communications. While apparently not now competitive with terrestrial facilities in terms of cost, experience in the development of other communications systems indicates that with improvements in the art they may become so in the future. Accordingly, we feel strongly that the common carriers should be able to consider the use of satellites along with other technologies in systems management planning for an integrated communications network. In other words, the common carriers should be free to employ satellites in their communications network, in the same manner that they would employ advanced microwave technology, waveguides, etc. A carrier should be able to apply to the FCC for permission to construct a domestic satellite system just as it would apply for construction of a microwave or any other communications system. The Commission, of course, would consider the technical and economic aspects of the proposed system, including cost and revenue relationships. As with terrestrial private microwave systems, noncommon carrier private entities could also apply for establishment and operation of domestic satellite facilities. 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.

The precise configuration of any domestic system or systems which may be authorized involves many considerations of both a technical and economic nature. Much has transpired since proposals were made to the FCC in its domestic satellite inquiry, and those proposals are now clearly outdated. The merits of any proposals which are advanced by organizations or groups interested in establishing domestic systems should be judged on their specifics, taking into account relevant technical and economic factors.

Need for Experimental Trials

As noted above, the technical feasibility of satellites has already been clearly established. We feel that information with respect to "tradeoffs" among spectrum utilization and orbit location can be developed through laboratory research and mathematical studies without requiring implementation of an expensive experimental satellite system solely for this purpose. Nor would establishment of a working satellite system shed any particular light on the economic or market characteristics of satellite systems.

Incentives for Innovation

In this area, we would like to emphasize strongly our conviction that the private sector is able and willing to provide whatever research and development is needed in the field of domestic communications including communications by satellite. We look forward to the possibility in future years of highly sophisticated satellites employing multiple beams, demand access and frequencies above 15 GHz. In keeping with our commitment to utilize the optimum combination of available facilities, AT&T would expect to use satellites as soon as they become advantageous to our customers.

We do not see any need for extensive government research in the area of satellite development. We are sure that the existing common carriers, and the manufacturers of communications equipment, will continue their efforts to preserve and improve this nation's superior communications capacity. Thus, we do not believe that institutional re-arrangements are needed to promote this goal in the case of satellites any more than in the case of other technological advances in the communications field.

Regulation

We believe that satellites should be available to the common carriers at such time as they determine that these facilities will serve the best interests of their users, and that this can easily be done within the present regulatory framework established by Congress. In our opinion, it would not be desirable to have regulatory policies which place satellite facilities in a different category from terrestrial facilities, because the two are simply alternative means to the same end.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N. Y. 10007

AREA CODE 212 393-1000

BEN S. GILMER
PRESIDENT

August 22, 1969

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

Dear Mr. Whitehead:

Thank you for your letter of August 19, 1969, regarding the introduction of satellites to domestic commercial communications.

We would be pleased to provide a statement of our current views on the subject for your review, and to be of any other assistance we can in connection with this undertaking.

I have asked Mr. Edward B. Crosland, Vice President - Federal Relations, to handle this matter personally, and he will be in touch with you as soon as possible.

Sincerely yours,

Ben S. Gilmer

HENRY G. CATUCCI

VICE PRESIDENT
WESTERN UNION INTERNATIONAL, INC.

521 12TH STREET, N. W.
WASHINGTON, D. C.
TEL. 638-6724

FW
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WESTERN UNION INTERNATIONAL, INC.

ALL AROUND THE WORLD

26 BROADWAY • NEW YORK, N. Y. 10004

E. A. GALLAGHER
President

September 30, 1969

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

Dear Dr. Whitehead:

Thank you for your letter of August 19, 1969 inviting Western Union International, Inc. (WUI) to submit further comments concerning the implementation of a domestic satellite system.

In a series of earlier statements to the Federal Communications Commission (July 29, 1966, December 15, 1966, April 3, 1967 and April 14, 1969) WUI has recommended the following:

¶Development of a single multipurpose system.

¶Both the space and earth segments to be owned and operated by Comsat and the existing communications common carriers.

¶Such system to be integrated into the existing communications systems.

WUI continues to believe that this approach will ensure the most effective utilization of the system in the public interest.

Comsat and the international common carriers have now had about four and one-half year's experience in providing commercial service via satellites on a global scale. Operation of the domestic system by all authorized carriers, including the international carriers--rather than by a newly formed entity--would assure the public of the benefits of the expertise acquired during this time.

Ownership participation by WUI and the other international common carriers, who will be important users of the domestic system, will result in optimum economies of scale to the benefit of users of international communications. Interconnection of the domestic satellite system with the global system will not only enable WUI to effect economies for its users, but will also strengthen the bond between the United States and the other Intelsat member nations by increased usage of the global system through the stimulus of our domestic system.

Similarly, implementation of the new system under the existing regulatory scheme will facilitate coordination with existing spatial and terrestrial communications systems and permit a continued impartial balancing of the various available means of communication in the public interest.

Utilization of both the existing industry structure and the existing regulatory scheme will most effectively bring the public technical excellence, diversity and economy in communications.

One of the issues presented in your letter involves technical and market innovations. Western Union International is pleased to have demonstrated the innovations possible through satellite technology during the epic Apollo 11 lunar mission. WUI arranged for the transportable satellite earth station aboard the U.S.S. Hornet which transmitted live to the world's largest television audience the successful recovery of the astronauts and their precious lunar cargo. The world was also able to watch President Nixon aboard the recovery vessel and see him greet the astronauts. WUI installed and operated a complete press center aboard the Hornet enabling the press media to file news releases via satellite covering the President's activities and the Apollo mission.

WUI has participated in all phases of satellite communications through joint ownership and supervision of all existing U. S. permanent earth stations, and has provided all types of communications via global satellite. WUI now looks forward to playing a significant part in the exciting future of domestic satellite service.

Sincerely,

E A Gallagher

E. A. Gallagher

CTW
WK

CBS

Columbia Broadcasting System, Inc.
51 West 52 Street
New York, New York 10019
(212) 765-4321

Frank Stanton, President

Dear Mr. Whitehead:

We appreciate the opportunity you have given us to comment on possible applications of satellites in the field of domestic communications.

CBS has long been interested in the potential of satellite transmission. We regret the delays which have prevented practical application of a development in which the United States has been the outstanding pioneer and on which our country has made vast expenditures. It would be unfortunate if space communications were used domestically for the benefit of other nations before they are used to serve the nation which developed the new system. We welcome the establishment of your study group and hope that, as a result of its activities, further lengthy delays in this important application of satellites will be avoided.

Another consideration which adds to the urgency of reaching a prompt decision is the World Administrative Radio Conference scheduled to meet in Geneva in June 1971. The purpose of the Conference is to obtain international agreement on spectrum allocations and orbital spacing criteria; it probably will set the pattern for satellite utilization for a number of years to come. The American delegation to that Conference should have a clearly defined position, backed by as much technical experience as possible, if the interests of the United States in this important new mode of communications are to be properly represented and supported.

These general observations aside, planning the use of satellites is complicated by the fact that, despite great progress in satellite technology, further information is needed to insure maximum efficiency in the use of spectrum and orbital space. It is likely that satellite systems designed in 1975 or 1980 will use frequencies, equipment and techniques presently unproven. However, this is not sufficient reason to postpone the use of existing technology in domestic communications. In fact, application of today's state-of-the-art seems essential to the development of new information and more advanced equipment.

After a period of practical use and when more sophisticated, higher-capacity satellites become available, it may prove more efficient to employ a multi-purpose satellite system carrying traffic of many types -- telephone, teletype and data as well as audio and video program material. In the immediate future, however, available satellite designs are uniquely adapted to the program transmission requirements of the television networks. To be more specific:

> A satellite is inherently a wide-bandwidth device -- and television, unlike most communications, requires wide bandwidths.
>
> A satellite channel is a one-way device -- and the great majority of television program transmission is uni-directional.
>
> A satellite can deliver the same signal to many different geographical locations as easily as to a single location -- and television networks need to deliver programs to several hundred affiliates scattered throughout the United States.
>
> Satellites can serve areas such as Alaska, Hawaii, Puerto Rico, and the Virgin Islands and other remote portions of U. S. territory -- and no other communications system is available to deliver "live" television to such areas.

As to the economics: the television networks offer a large, ready-made market for a domestic satellite system. It is probable that the television networks will provide the major economic support for such a system for a considerable number of years. In fact, the start-up costs of a domestic satellite system are so great and the growth of non-television utilization so uncertain that, were it not for the prospect of serving the television networks, it might be difficult to attract the needed capital.

There is another economic consideration. The rates charged by AT&T for television program transmission are under review and it now appears that these rates may be increased to a level which will force the CBS Television Network and other television networks to consider a substitute for AT&T service. In addition, we are informed that modifications now being made in AT&T's microwave facilities will double the number of telephone channels displaced by a single broad-band television channel -- making it less desirable for AT&T to divert telephone channels to television use.

From the social and political points of view, it seems desirable that domestic satellites be placed in service at an early date because of their ability to improve the flow of news and informational programs on the commercial networks, because they could provide economical program distribution facilities for educational and instructional television networks and because of their potential value in delivering messages of national importance throughout the United States in times of emergency.

Without implying support for any specific proposal which may be under consideration at present or which may be made in the future, I believe your working group should indicate that it favors early establishment of a domestic satellite system to provide a more efficient and more economic method of distributing television programs and that proposals by interested parties are invited and will receive prompt disposition. A two-step development schedule might be advisable -- the first, what has been termed a pilot operation of limited scope -- the second, a full-fledged nationwide system. The first phase would be designed to answer such questions as:

> The reliability and quality of transmission on a day-in, day-out basis.
>
> The restraints which may apply in the choice of locations for down-link receiving stations.
>
> The degree to which signal absorption or reflection in areas of heavy precipitation may interfere with reception.

Improvements in design and reductions in cost of ground terminals.

Development of operational experience with a satellite system serving a multiplicity of ground terminals.

Forcing the resolution of problems involving frequency allocations and the rights of other nations.

I hope that these comments will be helpful in your efforts to resolve this very complex problem. If we can be of any further assistance in your studies, please feel free to call upon me.

With all good wishes.

Sincerely,

Mr. Clayton T. Whitehead
White House Assistant
The White House
Washington, D. C.

September 26, 1969

THE FORD FOUNDATION
320 EAST 43RD STREET
NEW YORK, NEW YORK 10017

McGEORGE BUNDY
PRESIDENT

October 1, 1969

Dear Mr. Whitehead:

In your letter of August 19, 1969, you asked the Ford Foundation for its current views on domestic communication satellites. We are pleased to respond.

For fifteen years the Foundation has been concerned with what the Carnegie Commission called "public television." We initially participated in the FCC's March 2, 1966, Notice of Inquiry in Docket No. 16495 because satellites held the promise of contributing to a solution of the problems of public television. Although that participation widened our perspective, we continue to believe that the promise can and must be realized. Free interconnection for public television and the "people's dividend" are, in our judgment, still essentials in building a strong public broadcasting system for this nation.

What was said in 1966 and 1967 about the promise and challenge of the satellite has been reinforced by technological developments since then. We believe that a viable domestic communication satellite system has the potential to provide the nation with dramatic new benefits in education and in the quality of life. Moreover, the policies the nation now develops will affect the character and quality of the nation's communications services for the next decade and perhaps longer. The first step -- one that can be taken without delay -- is the authorization of a pilot program.

The dramatic worldwide uses of international satellites during the moon landing, the European coverage of the 1968 election, and the investiture of the Prince of Wales, are only the top layer of what promises to be a period of fundamental changes in our method of exchanging information. Instant electronic delivery of news, information, data, instructional material, books, magazines and television programs, at reasonable cost, seems close to reality. With facsimile reproduction, medical information and even business and personal letters could be relayed by satellite.

In the not too distant future, cable television may make the "wired city" a reality. CATV has the capacity for many more channels than conventional over-the-air broadcasting, and the ability to serve discrete sections or neighborhoods. Full development of CATV can wholly change the present structure of the American broadcasting system, commercial and public, providing far more diversity, competition and choice. Its potential for instructional television, community broadcasting and extensive political broadcasting is just emerging. With regional and transcontinental satellite interconnection, at reasonable cost, a whole new network of communications services will be available to local communities.

Furthermore, by the mid-1970's, it may be possible to engage in community satellite direct broadcasting -- that is, in broadcasting from a satellite to a relatively inexpensive receiving station serving a city or town, from which the broadcasts would be distributed to the home television set either by cable television systems or, over the air, by either low-powered repeating stations or regular broadcasting stations. The recent announcement of the agreement between the United States and India for the experimental use of a NASA ATS satellite for direct broadcasting suggests a similar potential for Alaska and for some of our less populated western areas.

In essence, the satellite has the potential to be the electronic highway of the future.

In analyzing the issues in your letter, we find that we can raise more questions than answers. We agree with the President's Task Force on Communications Policy that it is "premature to fix domestic satellites into a particular institutional and operational pattern." Final arrangements for Intelsat have not been concluded; frequency allocations for satellite communication are to be reconsidered at an ITU World Administrative Radio Conference for Space Telecommunications in 1971; major economic issues are still unresolved; and potential markets for satellite services are still undetermined. But, at the same time, we are of the opinion that it is not in the public interest to delay a pilot program now. It should go forward, providing for all interests, including public broadcasting.

Although we have not resolved the question of the institutional framework for the design of the domestic satellite system, there are general guidelines which we believe essential for these arrangements:

1. Guarantee protection of the public interest by full representation of public broadcasting and of other public interest groups or individuals in policy decision-making.

2. Assure that the full technical potential of communication satellites (distribution and direct broadcast) will be exploited.

3. Arrange that the widest variety of services be provided.

4. Guarantee flexibility of the structure so that modification in light of experience or changing international obligations will be possible.

5. Ensure right of access to any person or group.

6. Provide free interconnection for public broadcasting both nationally and regionally.

7. Wherever feasible, ensure competition in the furtherance of lower rates, better service, and technological innovation.

8. Give a voice to potential users in the design of the pilot system.

It is essential that the entity or entities chosen for the pilot system take the broad public view in making the management decisions on ways in which the space effort should be developed and operated. It should be an organization free of conflict of interest. The task might be given to a communications common carrier that also operates other modes of communication, but such a carrier would have an institutional conflict that could prevent exploitation of the full potential of the satellite. Or the task could be given to the Communications Satellite Corporation (Comsat), which is the chosen instrument of the United States for its participation in a global communication satellite system, but carriers are represented on Comsat's board of directors, and here again, there might be some conflict regarding exploitation of the satellite. Moreover, there would inevitably be conflicts between Comsat's domestic and international obligations. Or, finally, the task could be given to a group of large users, but the primary incentive of such a group would be to develop and deploy the space segment solely in the light of its own needs; it might seek to deny the space segment to users outside the group who wish to compete with members of the group, and it would probably not be imaginative in developing the space segment for wholly new kinds of uses.

The present structure of the communications industry leads us to believe that serious consideration should be given to the creation of a new entity to operate the domestic satellite system. It seems to us that the special safeguards necessary to minimize the dangers outlined above suggest this solution. In any case, a decision on such arrangements should not prevent the launching of the pilot program provided sufficient flexibility and protections are retained to keep the long-range options open.

The level of savings that will accrue from satellite transmission is still undetermined. We have urged that a part of the savings from the operation of domestic satellite systems be used to support public television. This "people's dividend," in our view, is justified by the taxpayer's investment in the space program and by the free use of the frequency spectrum accorded the broadcasters. Public television continues to require these benefits; we continue to believe that the satellite can provide them.

In responding to your letter we have also considered the manner and method by which communications policy, with which the domestic satellite system is so intimately connected, is formulated and regulated. We believe that there is need in the Federal Government for increased capacity to determine overall national communications policy. The FCC has neither the staff nor the Congressional mandate to do this job alone. Responsibility in the Executive Branch is diffuse and unclear. The same reasoning that led to the establishment of the Department of Transportation should be applied to a re-examination of Federal organization in this field. Technological advances, since the end of World War II, have constantly been ahead of the policy planners and social scientists. The combination of CATV and the domestic satellite will radically alter the communications system of this country. While going forward with a pilot satellite system, it is our hope that further consideration will be given to the question of what should be done to boost the power and ability of the Executive Branch to deal with public policy in this field.

We appreciate the opportunity you have given us to state our current views. The Foundation's interest in this subject is a continuing one. As your work progresses and as the Executive Branch formulates specific positions, we would welcome the opportunity to provide you with further comments.

Sincerely,

McGeorge Bundy

McGeorge Bundy

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

C-Tech
w/c

RME

TELEVISION COLOR PRODUCTIONS • COLUMBUS/NEW YORK

COLOR BROADCASTING

Friday, September 26, 1969

Mr. Clay T. Whitehead
Presidential Staff Assistant
The White House
Washington, D.C.

Dear Mr. Whitehead:

I am writing in regard to the studies and investigations now being conducted concerning the establishment of a domestic satellite system. My letter is being forwarded to you to be considered in association with one which you shall be receiving from Mr. M. G. Robertson, President of The Christian Broadcasting Network.

Even though no inquiry has been made of my company with regard to the domestic satellite program, with your permission I should like to add my attitudes insofar as they touch upon one new area of program sources and materials for dissemination by satellite. It would seem clear, both for reasons of tradition as well as for the moral and ethical climate of the future, that one program area of substance and significance to be considered in addition to commercial and educational originations, centers upon the distribution of religious broadcasts on a regular network pattern and basis. In conjunction with the Christian Broadcasting Network, RME would like to place before you for review the category of religious programming as a stimulating, inspirational, and rewarding catalogue of program materials.

MR. CLAY T. WHITEHEAD
Friday, September 26, 1969
Page 2

Mr. Robertson, whose network is currently presenting religious broadcasts to a number of American communities on several radio and television stations owned and operated by CBN, will outline in his letter the underlying philosophies and operating procedures which would bear upon and contribute to this project. RME, which is a major supplier of television mobile remote facilities to the major broadcasting networks for production both here and abroad and which has recently formed RME Programming as our conceptual arm, stands ready to share with Mr. Robertson both the personal and corporate conviction as well as the financial commitment required to develop this phase of broadcasting within the broad spectrum of program profiles to be presented.

Should you wish to contact me, please feel free to do so through our Home Office which is located in Columbus, Ohio. Our New York office has been recently relocated to 100 West 57th Street in New York City where the telephone number is (212) 582-4460.

I appreciate your attention to this letter and wish you success in the final days of your deliberations. Best regards.

Sincerely,

Richard S. Mann

Richard S. Mann
President
The RME Group of Communication Companies

RSM/jv

CHRISTIAN BROADCASTING NETWORK, INC. P. O. Box 111 / 1318 Spratley Street / Portsmouth, Virginia 23705 / Phone (703) 393-2505

CTW
WK

September 26, 1969

Mr. Clay T. Whitehead
Presidential Staff Assistant
THE WHITE HOUSE
Washington, D. C.

Dear Mr. Whitehead:

I understand that you are presently conducting studies into the use and operation of a domestic satellite system. Although I have not been directly requested to submit information to amplify the material available to you, I would like to take this opportunity to present briefly the concept of the transmission of religious programs over the satellite system.

As you know, a recently released report of the NATIONAL COMMISSION ON THE CAUSES AND PREVENTION OF VIOLENCE has issued an urgent call for the production and distribution of high quality television programs which are not oriented toward violence and other bizarre situations.

The aims and goals of the Christian Broadcasting Network are completely in harmony with this approach.

At present we are operating a network of radio stations in New York State and a radio facility in Virginia. Our television station in Virginia has been augmented by the grant of Channel 46 in Atlanta, Georgia; a proposed transfer of Channel 40 in Indianapolis, Indiana; and network affiliates in Miami, Florida; Akron-Cleveland, Ohio; Los Angeles, California; Houston, Texas; and Greenville, South Carolina.

We are presently building four (4) major color production facilities for the preparation of outstanding television programs and series for transmission over our own stations and other affiliated outlets throughout the country. In addition to studio facilities, we have established a close working relationship with RME Productions, Inc. of Columbus, Ohio, which owns and operates four (4) color video tape cruisers which are capable of high quality production at any remote location.

With this framework of stations, remote facilities, and supporting personnel, the Christian Broadcasting Network plans a nationwide thrust of children's programs, drama, inspiring music, and similar religious programs. It is our feeling that there has never been a greater need for a spiritual renewal in the United States, and we are aware that our view on this matter is at one with the unashamed Christian principles of President Nixon.

Although our plans during the 1960's have been formulated toward the existing means of television transmission, we would be most interested in transmitting Christian television and radio programs via domestic satellites to a series of low cost receivers similar to what is being invisioned by NASA and the Government of India for the early 1970's. Whether the technology of the next decade will reveal radically different means of the ground transmission of television and radio programs or not, we do respectfully request that the planning for a satellite transmission system will include plans to carry the programs of The Christian Broadcasting Network as well as those of the Entertainment and News Networks and the Educational and Cultural Networks.

I would be delighted to amplify these suggestions if further information and material is needed. In the meantime please accept my thanks for your consideration of this letter.

With all good wishes, I am

Cordially yours,

M. G. Robertson

M. G. Robertson
President (sm)

MGR/sm

CTW
WK

NATIONAL CABLE TELEVISION ASSOCIATION
INCORPORATED
1634 EYE STREET, N.W. WASHINGTON, D.C. 20006

October 14, 1969

(202) 347-3440

Dr. Clay T. Whitehead
The White House
Washington, D.C.

Dear Dr. Whitehead:

This is in reply to your request of August 19 for ideas and information on the use of satellites for domestic commercial communications.

Our main interest, of course, would be in the use of satellite technology for interconnection of cable television systems (the phrase "cable television" should be considered synonymous with the phrase "broad-band communications network" since off-the-air reception of television signals may be the smallest part of our service to subscribers by the end of the next decade).

The brief points that we would like to make at this time are:

First, the meld of satellite technology with the broad-band communications services represents the ideal marriage of technologies. Both systems' economic advantage stems from their multiple-address technique -- that is, programs and services are originated at one central source and distributed simultaneously to multiple users. This means the systems are best suited for services requiring mass-distribution, e.g., conventional television programming, instructional television, educational and cultural television programming, newspapers, journals, and the congressional record via facsimile, electronic mail delivery and all sorts of special services to minority groups who need access to perishable information (nationwide weather patterns and analysis, full-time congressional coverage and analysis, medical and health data, employment offerings and so forth).

The need for a host of instructional television programs has been well documented and acknowledged but the production of such programming has never been implemented in any substantial amount -- indeed we have not yet begun to tax the ingenuity of the educators in the production of this kind of material which is obviously a highest priority national goal. The two-tiered distribution via satellite to terrestrial facility (civil or private institute, school, college, or CATV headend) and hence via coaxial cable to individual terminals (student and factory class, or CATV subscriber) is the only efficient means to distribute simultaneously the 50-100 program channels necessary to a meaningful ETV/ITV system.

Secondly, at the very least, it is our belief that a shared (satellite) system should be immediately implemented. There seems to be sufficient proof that satellite systems function satisfactorily and further delay in their use is an unnecessary waste of technology. However, if a shared system is to be implemented there should be sufficient guarantees to assure equitable and indefeasible access to the system by potential users. Users should be allowed to own and control the terrestrial facilities.

Undoubtedly a master-plan shared-system design to encompass all domestical satellite activities would accrue economies-of-scale that would redound to the benefit of many users; but it is not immediately obvious why the control and operation of such a facility should reside in one entity. A shared-system would, of necessity, be all things to all users and as such would contain several compromises in techniques and tariffs that would not necessarily be consistent with the needs of specialized users. Therefore, it is our belief that the public interest would be best served by promoting and preserving free, open and effective competition among communications facilities using the satellite technology. Within the contraints of technical compatibility (frequency allocation and satellite station keeping) all segments of private industry should be allowed entry to satellite operation as well as services.

Thirdly, and finally it must be noted there has been no detailed parametric study of the national economic trade-offs involved in a satellite to 1,000-3,000 CATV headends system. Before all satellite options are closed to this industry it would seem to be in the public interest to have such information available prior to making executive decisions.

Respectfully submitted,

Frederick W. Ford

Frederick W. Ford
President

NATIONAL CABLE TELEVISION ASSOCIATION
INCORPORATED
1634 EYE STREET, N. W. WASHINGTON, D. C. 20006

August 26, 1969

FREDERICK W. FORD
PRESIDENT

(202) 347-3440

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

Dear Mr. Whitehead:

Thank you for your letter of August 19. We will be glad to submit comments before October 1 to assist you in your review of the domestic communications satellite issue.

Sincerely,

Frederick W. Ford

Frederick W. Ford
President