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The Entry of New Satellite Carriers in International Telecommunications: Some Interests of Developing Nations

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The possible entry of new communications satellite carriers into international markets has led to questions about the benefits and costs of these new carriers to developing countries. These questions largely arise from INTELSAT's claims that it will suffer significant financial harm from entry, and from the counterclaims by the applicants that their services will both benefit new customers and not harm INTELSAT. Only one of the applicants, Panamsat, has designed its service primarily for service to developing nations. Thus, one must ask whether the other entrants, which will primarily serve the United States and Western Europe will have any affect on, and anything to offer, the developing world.

These issues are important to developing nations. There is no question that developing nations have a strong interest in an international satellite system which provides the types of con-

nectivity INTELSAT now provides. While one might argue with facets of the INTELSAT system, it clearly is popular with most of the developing world.

There is also no question that many of these nations are interested in developing domestic and regional satellite systems for telecommunications, broadcast networking, and, increasingly, direct broadcast services. Domestic satellite systems exist, or will soon exist, in Indonesia, India, Brazil, and Mexico, and studies for systems are going on in Pakistan, Turkey, China, Argentina, and the Andean group, to name a few. Apart from Indonesia and India, all other domestic satellite systems in developing nations are provided using leases on INTELSAT satellites.[1]

The policy interests in this area are in the roles that might be played by INTELSAT, regional satellite carriers, and private satellite carriers in meeting the developing nations' service demands. There is also the question of whether the entry of private satellite carriers, operating either in new markets or in competition with INTELSAT, will adversely affect INTELSAT's ability to provide service to developing nations. The best point of departure is to review the issues tied to international telecommunications linkages, and then move to the problems of regional and domestic satellite service.

INTERNATIONAL TELECOMMUNICATIONS LINKAGES

The INTELSAT system was designed to make maximum use of global connectivity for telephone and other switched services. By using a small number of earth stations within each country (generally one per primary path satellite) operating through a small number of satellites, it is possible to provide maximum connectivity among all member nations by increasing the number of individual links or routes served by each satellite.

The INTELSAT system provides wide connectivity at a price. Achieving wide connectivity among areas that do not have strong mutual communities of interest requires wide beam dispersion. As the beam is dispersed, the EIRP diminishes, requiring larger and more costly ground stations, or less efficient use of the

space segment. In addition, the INTELSAT satellites are based on standard designs oriented to meeting the requirements of the Atlantic Ocean region. These requirements are different from the other two regions and from the non-international services. While INTELSAT has expressed interest in developing satellites designed for specific purposes and areas, it has not yet done so.

This engineering design has not been a serious problem in developing the global INTELSAT system. However, it does pose problems for regional and domestic services, which will be discussed below.

The INTELSAT system's success is demonstrated by the major changes and improvements in international telephone service to developing nations since INTELSAT's creation. In the past long-distance telephony to developing nations was often routed through third countries, generally in Europe. This meant that neighboring countries might have to call each other through London, using HF radio links of poor quality. Capacity into these countries was limited, costs high, and quality unreliable. While some cable systems have been available to developing nations, these have been relatively limited, and have been used to connect high density routes.

Developing nations now largely have reliable, high quality telecommunications links with their neighbors and major trading partners. Their international telecommunications services have tended to be the most profitable part of the overall telecommunications activities. And they have far greater control over their international communications than in the past.[2]

INTELSAT's political structure was a major factor in promoting its penetration into most countries. While the organization is dominated by the United States, there has been an attempt to emphasize the organization's nonpolitical nature and its structure as a cooperatively owned, nonprofit venture.[3] The cooperative structure tied with the separation between the space segment, owned by the cooperative, and the ground segment, owned by each national signatory, helped ease many of the political obstacles which have traditionally occurred in organizing other regional transmission systems. Countries can join the INTELSAT system without many of the political problems associated

with arranging bilateral arrangements with neighboring or other states, or with systems explicitly tied to national or political interests, such as Intersputnik.

However, INTELSAT's success does not mean that it has satisfied all demands for service, among both the industrial and developing nations. Among the industrial states there has been growing interest in developing new international satellite systems for providing specialized communications, not served well by INTELSAT, and developing nations have been searching for more effective means of providing regional and domestic communications. It is the proposed entry of new carriers centered in the United States, but likely to be joined by European firms, which has made the debate of how international satellite communications should be provided, more pressing.

PROPOSED ENTRY INTO INTERNATIONAL SATELLITE MARKETS

Since Orion's application to enter the international satellite market was filed with the F.C.C. in 1983 four additional applicants have indicated interest in the market. Volumes of testimony, pro and con, have been filed in Congressional hearings. This paper will not dwell on the merits or substance of these applications—the papers by Mr. Vizas and Mr. Pelton discuss the issues posed by the new entrants to the satellite market.

The reason for the applications for new satellite service is the perception by some entrepreneurs that INTELSAT is not economically meeting the needs of particular users. The calculation of potential markets is based largely on INTELSAT's engineering economics. As the space segment has largely determined the engineering, the ground segments have been expensive relative to the ground segments usable with domestic satellite systems offering higher EIRPs. Lower ground segment costs can quickly overcome space segment costs for domestic satellite systems, or for systems providing specialized services, like Customer Premises Services (CPS), which require many inexpensive earth stations.

Also, INTELSAT's operation of its satellites for the Atlantic region leads to a spacecraft design that is not as economical for domestic or regional services as a satellite specifically designed for such services. By changing the engineering of the overall system specifically to meet certain types of services, significant economies may be achieved in overall costs.

Whether there is a demand for satellite services which is constrained by INTELSAT's costs and which would be stimulated by a lower cost package cannot be verified before the service is actually offered. However, the history of satellite services in the United States and INTELSAT's own traffic history seem to suggest that lower costs will lead to large increases in customer demand.

INTELSAT has raised a number of objections to the applications for new entry, largely focusing on the potential for economic harm to INTELSAT, with the potential of significantly increasing INTELSAT charges, and the possibility of collapse of the INTELSAT system.[4]

Economic harm can occur in two ways—through direct diversion of traffic which is a significant part of INTELSAT's switched telecommunications and video traffic, and through the diversion of secondary traffic (i.e., specialized traffic, private lines, and some video). While two of the five potential entrants might divert some of the primary traffic, INTELSAT's attention has been largely focused on the secondary traffic.

In a recent study prepared at INTELSAT's request by Hinchman Associates, the problem of economic harm from this "secondary" entry is directly tied to the structure of INTELSAT's major Atlantic Ocean services. That is, new generations of satellites must be placed in the primary path to accommodate the rapidly growing service demands, leaving INTELSAT with older, but still usable, satellites. These satellites are used to provide domestic and specialized services, and their revenue contributions help to diminish the overall INTELSAT revenue requirement. As Hinchman argues: "so long as INTELSAT has available residual or excess capacity sufficient to satisfy additional demand, the satisfaction of that demand by other systems will necessarily result in higher costs per unit of capacity actually provided and utilized by INTELSAT members—including capacity utilized for basic telephone and telegraph services."[5]

Acceptance of this argument requires first, that INTELSAT's assumption that any of the new carriers will divert substantial amounts of traffic from the INTELSAT system be correct. For example, Orion and Panamsat have argued that the traffic which they hope to carry is not presently carried by INTELSAT, and will not be carried by INTELSAT in the future. Orion argues that the economies of the ground segment possible through specialized satellites cannot be realized using INTELSAT's spacecraft and, given the total costs of using INTELSAT for CPS, the service will not develop.[6]

Similarly, Panamsat has argued that regional broadcasting in South America has been constrained by the high costs of the INTELSAT occasional video leases and the cost of the ground segment. Panamsat anticipates that the substantially lower costs associated with its planned satellite, with high power coverage of specific South American markets, will stimulate the creation of a large market for regional and domestic broadcast networking.[7] While INTELSAT has noted on several occasions the importance of reducing ground segment costs associated with its system, it has not addressed this aspect of demand elasticity in its public testimony.

If, in fact, INTELSAT is not carrying the traffic proposed to be carried by the new entrants, but would like to carry the traffic now that it has been identified, it is difficult to argue that serious, or any, economic harm is probable. This would hold even for the extraordinarily narrow definition of harm proposed in the Hinchman study. The difficulty with the argument is exacerbated if static market definitions are rejected and the possibilities of overall market expansion taken into account.[8] The definition of economic harm which the Hinchman study proposes has no relevance in a competitive market and, interestingly, was rejected by the Federal Communications Commission when raised by AT&T during the early 1970s specifically because it posed an overly narrow and static view of the telecommunications marketplace.

Second, one would have to argue that the growth in INTELSAT's primary services will not generate sufficient traffic to meet the system's revenue requirements. However, INTELSAT's own predictions of traffic growth in its primary services—switched telephone, data, and telex, as well as television transmission—are

all projected to show substantial gains over the rest of the decade. It is far more likely that any losses from these figures will be from competition from new cable capacity in the Atlantic and Pacific, which will directly challenge some current INTELSAT markets, than from new carriers attempting to serve markets which either do not currently exist or which are marginal.

Third, one would have to assume that INTELSAT has little control over its current plant or future investment. This is a difficult argument to make with satellites which are medium term investments. Given the ten-year life of satellites, INTELSAT has far more flexibility to modify its investment decisions than a firm like AT&T, which has far more embedded plant with economic lives of greater than twenty years. INTELSAT can move satellites, control launching dates, cancel satellite production, and modify satellites, all admittedly, at some cost. Again, this is far more flexibility than AT&T had at the time competition was allowed by the F.C.C. during the 1970s.

Fourth, one would also have to assume that INTELSAT has virtually no control over its business practices or pricing. While INTELSAT's structure makes changes in business practices difficult, it does not make them impossible. In the face of the types of economic harm INTELSAT has alleged will occur due to new entry, it is likely that its owners will agree to changes in practices, particularly pricing policies, to maintain the firm's economic health.

It is useful, however, to review the possibility of economic harm to developing nations if INTELSAT's assumptions about traffic diversion are accepted. The Hinchman study commissioned by INTELSAT projects that INTELSAT's transponder costs will increase between 8.6 percent and 35.6 percent by 1987, depending on the level of traffic diversion due to new entry.[9] Transmission costs represent less than 10 percent of the end to end costs of an international communication.[10] The vast majority of the costs are embedded in the ground segment. Thus, even with the worst case increase in the space segment costs, the actual increase in overall costs for international telecommunications would be approximately 5 percent. It is also worth mentioning that in

many countries, particularly developing nations, the international telephone service is used to generate large cash surpluses. It is well known that the rates for overseas telephony are far in excess of costs, and that considerable profits are generated by the overseas service.

One major reason for this is that demand for international communications is relatively inelastic in countries with high telephone prices—the primary users are likely to be businesses for which communication is a minor part of the production function. Thus, raising the prices further will not significantly affect demand. Reducing prices dramatically will stimulate demand, but this raises other problems outside of the interests of the immediate debate. It is unlikely that a 5 percent increase in costs would be noticed within the prevailing overseas rate structures and could probably be passed on to its users.

The far more troubling intimations that the overall INTELSAT structure is threatened[11] are improbable viewed in light of INTELSAT's own traffic projections for its primary services. A serious threat to INTELSAT's structure would have to be predicated on massive diversions of traffic, not just from the North Atlantic route, inability to change investment programs or plant utilization, inability to change pricing for services, and a specific decision by major signatories to allow the organization's collapse. This combination of factors does not presently exist, and is unlikely to exist in the foreseeable future.

Given the current data available both from INTELSAT and its competitors, it is unlikely that the entry of new satellite carriers will adversely affect INTELSAT's service to developing nations in any significant way in the forseeable future. Even in the worst case posited by INTELSAT's economists, the cost increase for total end-to-end international communications will be modest. However, other developments which may pose serious problems for the INTELSAT organization, unless it begins to modify its approaches to engineering and organization, may arise within the decade by the growth of new international cable systems, and the probability of new regional satellites offering transborder switched communications.

REGIONAL AND DOMESTIC SYSTEMS: THE SEARCH FOR CONNECTIVITY

Like the industrial nations, developing nations have been seeking means of promoting communications outside of the INTELSAT system. Both regional and domestic satellite systems have been the focus of intense planning. Systems exist in Indonesia and India, and will soon be implemented in the Middle East, Brazil, and Mexico. Other systems are being examined for China, Africa, Pakistan, Thailand, the Andean Region of South America, and Argentina, to name a few.

The development of national and regional networks can be problematic in the early stages because of the need to develop both the ground and the space segments within a short time period. Satellite economics are "lumpy"—the initial investment is relatively high, inflexible, and in space. Its efficiencies, in effect, are achieved in "lumps" of utilization—the greater the utilization, the greater the efficiency. The failure to rapidly develop the ground segment, by far the most expensive part of a satellite communications system, or to develop a sufficient customer base, means that the space segment will be poorly utilized and costly.

This was a familiar problem in the development of the U.S., Canadian, and Indonesian domestic systems. In the initial years, and during subsequent periods of excess capacity, space segment was utilized inefficiently, with attendant financial penalties to the carriers. This was particularly a problem for the U.S. domestic satellite carriers prior to the emergence of the television distribution market.

One solution to this problem has been to utilize spare satellite capacity, when available, to develop domestic services. This has allowed nations to lease the amount of capacity required in the short term, allowing the gradual construction of ground segment and development of customer bases. INTELSAT has been able to provide domestic service due both to its requirement to maintain backup satellites in the event of the failure of one of its primary satellites, and its possession of functional satellites which have been replaced by new, larger capacity satellites.[12] These older satellites often have a number of years of economic life remaining

and can be profitably leased by INTELSAT at a price higher than their short-run marginal cost. More recently, the Indonesians have made domestic leases available for its ASEAN partners on its spare capacity on the Palapa A-1, and will presumably make capacity available on the B-1 once the B-2 is placed in service.

THE INTEREST IN DOMESTIC AND REGIONAL SERVICES

Domestic and regional satellite systems are developing outside of INTELSAT for a number of technical, political, and economic reasons. Nontechnical reasons for domestic and regional systems are national or regional pride, attempts to promote national or regional cohesion, development of regional or domestic high technology industries, and an interest in having greater control over national or regional communications than is possible through an international organization. The validity or importance of these reasons is not of concern here—what matters is that a growing number of nations are using these arguments to justify system construction.

On the technical level, INTELSAT's limitations make domestic satellites attractive investments, assuming the need for a nation to increase the capacity and scope of its telecommunications system. INTELSAT's domestic leases are clearly a secondary use of its satellites. These satellites were largely designed to meet the requirements of the Atlantic Ocean region. As a result, multiple access to the satellites using inexpensive ground segments is not possible except, at least at the moment, with the tolerance of substantial inefficiency in the use of the space segment. Other types of satellite communications, for example, use of small, inexpensive television receive-only earth stations, are problematic due to the low EIRP. There are also relatively high ground segment costs caused by the requirement for circular polarization with the new INTELSAT satellites. Thus, large satellite-based domestic systems are to a large extent precluded by the cost of the ground segment. Also, INTELSAT's use of retired satellites for domestic service has been problematic at times because of operational problems attached to the aging satellite.

For traffic among neighboring nations where multiple gateways may be desired, for extensive telecommunications development, as well as for extensive broadcasting use, the higher power available from a regional or domestic satellite with focused or high powered beams offers large savings in the ground segment. Ground station intensive systems like those in Alaska and Indonesia are economically dependent on the high EIRP possible from focused beams. Extensive rural systems, which must have very low costs to be economically viable, would be very difficult to build using INTELSAT's capacity.

INTELSAT has attempted to improve its service offerings for domestic service, and particularly for rural services, over the past year. For example, one major new tariff offering, the Vista service, was designed to meet the perceived requirement of developing nations for rural services requiring less than one quarter transponder leases (the minimum capacity one can lease). The Vista service offers relatively low space segment charges on a channel basis, and allows the use of five meter earth stations, inexpensive by INTELSAT standards. This service however, remains expensive in comparison to what is achievable with domestic or regional satellites largely due to the cost of the ground segment. Recent estimates for earth stations for use in Australia were in excess of $200,000 for two SCPC channels. A comparable station produced in small quantities for a domestic satellite would be less than $100,000. Unless significant cost breakthroughs are achieved in earth station technology, the least expensive ground segment and hence most efficient domestic satellite systems will be those using satellites with greater beam power than INTELSAT now offers.

INTELSAT could improve its domestic and regional services through changes in its engineering. It has considered providing higher powered beams or even satellites tailored for domestic purposes without having reached any decision. Such a decision could represent a divergence from its primary responsibility to provide universal telecommunications service and would increase the organization's levels of risk. At the same time, it might be able to provide domestic and regional services more quickly

than a new regional or even domestic satellite organization. Whether such new approaches to its business would be acceptable to INTELSAT's members needs to be explored.

MECHANISMS FOR CREATING DOMESTIC AND REGIONAL SYSTEMS

While there may be compelling reasons for developing national or regional systems, often economics and politics interfere. It is in these areas where the possibility of new entrants may be useful for developing nations.

For domestic systems, the most serious economic impediment is lack of sufficient traffic to justify a dedicated satellite system. While one may project growing into a satellite, the expansion of the ground segment may be sufficiently expensive to make a satellite cost ineffective for some time. This, as discussed previously, is one reason for the success of INTELSAT's domestic leasing program. Within the past two years Colombia, which had proceeded quite far in developing a domestic satellite system, decided to withdraw largely due to the cost of developing a national system. The two existing systems in developing nations—India and Indonesia, exist as much for national political purposes as for any economic motivations. Thus, a regional or global system (i.e., INTELSAT) can provide a country with interim service until it has sufficient traffic for its own system.

A dedicated regional system can provide higher powered beams than INTELSAT, making it more attractive for intensive development of the telecommunications system. Regional systems offer the greater likelihood of being able to develop sufficient traffic to economically justify the satellite. However, creating regional systems introduces political and administrative issues which can greatly extend the amount of time necessary to organize and implement the system. Such issues include resolving who will invest how much, who will receive which components of the system's operations, and so forth. As the Arabsat case showed, and as now can be viewed in the intense politics surrounding the proposed African regional satellite, this is not a trivial set of problems.

Four vehicles for regional service may usefully be explored. First is the approach now being explored by the Andean nations through the ACETA mechanism to organize regional service by collectively leasing a group of transponders from INTELSAT. This mechanism will minimize the initial investment for the participants to the ground segments and only the necessary space segment. It will also allow the development of a technical organization which will eventually be able to take over the major technical operations of a satellite system.

The Andean countries are hoping to be able to completely take over the leased transponder's use so that they have fairly complete control over the service. As long as they do not interfere with other INTELSAT services, this will allow the countries to utilize nonstandard technologies, with presumed savings in ground segments. The long-term goal of this approach, however, is to develop a regional satellite apart from INTELSAT.[13]

The second mechanism is the creation of a regional satellite organization, like Arabsat or Eutelsat, which owns and operates its own system of satellites on behalf of regional members. These satellites are designed to make optimum use of beam power within the region. While this mechanism is appealing on paper, the long lead time required for Arabsat, the current political disagreements within Africa, and the mixed experience in South America with regional collaboration may make this approach a long-term, rather than medium-term, means of developing satellite services.

The third mechanism is the expansion of a domestic system into regional service. This has occurred in a limited way in the Western Hemisphere, with the U.S. domestic satellites being used for limited transmission of video services to the Caribbean, and occasional use of the Canadian satellites by the United States. On a larger scale, Indonesia has applied to INTELSAT for permission to use the Palapa for regional service within the ASEAN group, now uses it for transborder service, and has successfully leased service to its ASEAN partners. The Palapa B series is capable of providing domestic services to all of ASEAN, as well as to New Guinea.

The limitations on this type of service relate to problems of regional politics. As Palapa is owned and operated by Indonesia, this raises some questions in the other ASEAN countries about the long-term risk of trusting their domestic communications to a country with which they may eventually have political differences. While ASEAN is a relatively cohesive group now, this is clearly a concern in at least one of the states.

A fourth mechanism is through the development of a private regional system, such as Panamsat is proposing. In this scheme, individual countries, or groups of countries, can arrange to buy or lease capacity from Panamsat. As with the Andean model, they can acquire the capacity needed in the short term, while developing regional or domestic mechanisms for an eventual satellite. A major difference between the two is that the Panamsat satellites will be designed to provide significantly higher powered coverage of South America than the capacity the Andean countries may lease from INTELSAT. Panamsat has argued that the overall design of its system will allow lower space segment costs and, more importantly, much lower ground segment costs than would be possible through use of INTELSAT. Also, the countries participating in the Panamsat program will be able to own their transponders (which can have important tax and regulatory benefits), presumably providing greater control over transponder use, and will be better able to utilize customized services, given the greater EIRP.

While Panamsat raises the political problem of being owned by entrepreneurs who are seeking profits, of being separated from the traditional means of providing international telecommunications service, and having a far higher level of risk for the participants than INTELSAT offers, it does offer the advantage of coming into existence relatively quickly with satellites tailored for very specific types of service to South America. Its service offerings are sufficiently open that each participant would have control over its space segment. It also presents no long-term impediments to regional or domestic system developments.

It is possible that offerings like Panamsat will be evolutionary businesses, changing as regional and domestic traffic,

politics, and economics allow the development of new satellite systems. While this may pose some long-term problems for Panamsat's investors, this is not a problem for the initial policy analysis. Unlike INTELSAT, Panamsat would be constructed strictly with private funds, so that any loss of capital due to new systems would encumber only the investors, not other users of the INTELSAT system.

As matters of policy, private systems such as Panamsat should not raise different problems relating to economic harm than such regional systems as Arabsat or Eutelsat. The success of such systems will necessarily rest with the judgment of the countries in the region that such service is preferable to the other alternatives.

CONCLUSIONS

New entry into international satellite markets is unlikely to jeopardize the interests of developing nations in achieving global connectivity via INTELSAT, or to cause significant increases in end-to-end costs. While the proposed entrants pose significant deviations from the means satellite service has been provided historically, these deviations will have to be accepted by individual nations if these ventures are to succeed. The success or failure of the ventures will rest with private investors.

More importantly, at least one of the new entrants is proposing service solutions for developing nations which should prove more cost effective for domestic or regional services than INTELSAT's offerings. The diversity of services and different cost structures which may come through new entry may help expand the international, regional, and domestic satellite markets in developing nations in ways similar to what has occurred in the United States and Canada, and more importantly, Indonesia. Given the enormous requirements to develop an information infrastructure in the developing world, the possibility of new service offerings may have enormous development potential.

There is no reason to suggest that INTELSAT be excluded from these markets, or that it not attempt to tailor its

offerings specifically for these markets, assuming that any new service offerings would not affect its primary international services. However, INTELSAT neither offers appropriate capacity to provide many of these services nor has it indicated when it will. Given the enormous technological changes in telecommunications which have made many services affordable given appropriate engineering and service configurations, individual nations, or groups of nations, should be offered the option of having diverse vendors of satellite services for their regional or domestic needs. Private vendors offer one approach to the attempt to meet these needs.

NOTES

1. Developing countries using INTELSAT domestic leases include Algeria, Argentina, Brazil, Chile, Colombia, India, Mexico, Niger, Nigeria, Peru, Sudan, and Zaire.

2. At least to the gateway station. Many developing nations continue to have problems with their terrestrial telephone systems, so that calls may have difficulty getting from the international gateway station to their final destination in the country.

3. While INTELSAT is technically a nonprofit cooperative, it still earns its cost of capital, similar to regulated utilities. Given that the members of the cooperative are all state owned or private, publically regulated utilities, it is likely that INTELSAT's economic motivations are closer to regulated telecommunications utilities than to nonprofit charitable organizations.

4. See Director General, "Report to the Assembly of Parties on New Developments Concerning International Satellite Communications," INTELSAT Document AT-8-9E W/10/83, July 29, 1983.

5. Walter Hinchman Associates, Inc., "The Economics of International Satellite Communications," prepared for INTELSAT, May 1984, I:13.

6. Christopher Vizas, "Letter to All Parties to the INTELSAT Agreement or Their Representatives at the Assembly of Parties Meeting," September 30, 1983.

7. Interview with Frederick Landman, president of Panamsat, November 18, 1984.

8. The issue of economic harm is highly problematic with INTELSAT as it wishes, as the monopoly supplier, to assume for itself the right to determine what is and is not harmful. This is awkward from any regulatory standpoint. It also appears to lead to inconsistent policy criteria, assuming INTELSAT's definition of harm, where traffic may be "lost" from domestic leases as domestic satellites are launched, and from regional carriage as regional satellites are launched, yet not be defined as economic harm, but be defined as harm if private carriers attempt to enter similar markets.

9. See Hinchman, "The Economics of International Satellite Communications," p.14.

10. Statement of Richard R. Colino, Director General-Designate, INTELSAT, before the Subcommittee on Arms Control, Oceans, International Operations and Environment, Senate Foreign Relations Committee, October 19, 1983.

11. See Richard Colino, "Report to the Assembly of Parties on New Developments Concerning International Satellite Communications," INTELSAT Document AT-8-9E W/10/83, July 29, 1983.

12. A discussion of the advantages of INTELSAT leases for development of domestic space segments may be found in Future Systems, Inc., "The Use of INTELSAT Transponders for Domestic Satellite Communications, FSI Report 102, April 1978; and Satellite Systems Engineering, "Review of the ITU Study 'Appropriate Modern Telecommunications Technology for Integrated Rural Development in Africa,'" Final Report, prepared for INTELSAT, SSE-R-82-10S, March 15, 1982. Unfortunately, both studies fail to adequately examine the financial consequences of developing domestic ground segment with leased INTELSAT transponders.

13. Interview with Dr. Angel Velasquez Arbaca, director of the Oficina de Asuntos Internacionales, ENTEL-Peru, July 1984.