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Access to Information Resources: The Developmental Context of the Space WARC

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At the 1979 World Administrative Radio Conference (WARC), delegates unanimously passed Resolution 3, which states that a World Administrative Radio Conference is to be convened "to guarantee in practice for all countries equitable access to the geostationary satellite orbit and the frequency bands allocated to space services."[1]

The principles of access and sharing of the geostationary orbit which were first put forward at the Extraordinary Administrative Radio Conference (EARC) in 1963 were further refined at the 1982 ITU Plenipotentiary, in paragraph 154 of the Nairobi Convention:

> In using frequency bands for space radio services, Members shall bear in mind that radio frequencies and the geostationary satellite orbit are limited natural resources and that they must be used efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may

have equitable access to both, taking into account the special needs of the developing countries and the geographical situation of particular countries.[2]

The first session of the Space WARC will be convened in August 1985. In the United States, representatives of government and industry are currently studying options and developing positions concerning the "principles, technical parameters, and criteria for planning" which are to be the subject of this first session.[3] (ITU Administrative Council, 1983).

Yet it is the premise of this paper that the actual agenda of the Space WARC and other international telecommunications negotiations is in fact much greater: it concerns equitable access to the tools of the information revolution—the means of accessing, transmitting, and sharing information that are the keys to social and economic development.

GREATER INFORMATION GAPS?

What progress has there been since 1979? Despite the rapid advances in technology in the past five years, there is evidence that most developing countries are not catching up to the industrialized world in access to these information tools. As of mid-1984, there were 149 commercial satellites in orbit, of which 121 or 81 percent had been launched since 1979. Only fourteen satellites serving developing countries had been launched during this period. Even taking into consideration the fact that INTELSAT satellites are used by both industrialized and developing nations, satellites for the exclusive use of industrialized countries make up 72 percent of the total.

Middle-income countries have benefited most from increased access to satellites for domestic and regional communications. By the end of 1985, twenty-six middle-income countries will participate in domestic or regional satellite systems, or will lease domestic capacity from INTELSAT. Only seven of the thirty-four countries classified as low income by the World Bank will be participants in such systems (see table 14.1).[4]

TABLE 14.1. Status of Domestic/Regional Satellite Services for Developing Countries in 1985

	Participating Countries	
	Low Income	*Middle Income*
Domestic satellites	1	2
Regional satellites	5	18
INTELSAT domestic leases	3[a]	15[b]
Percentage of countries	21%	41%
Percentage of population	52%	72%
(excluding India and China)	15%	

SOURCES: COMSAT Satellite Chart, 1984; INTELSAT Fact Sheet, 1984.
[a]2 of these countries are also participants in domestic or regional systems.
[b]9 of these countries are also participants in domestic or regional systems.

Eighteen developing countries currently lease capacity from INTELSAT for domestic use. Of these, seven are oil exporters, and only three are among the least developed countries. It must also be recognized that domestic use of INTELSAT is generally limited to improving communications to provincial capitals or regional centers because the satellite is not designed for low-cost, thin-route telecommunications or community broadcast reception.

There has been very little progress in extending access to telecommunications services within developing countries. Although there are now more than 600 million telephones in the world, it is estimated that two-thirds of the world's population has no access to telephone services. Tokyo alone has more telephones than the whole African continent. Nearly three quarters of the world's population live in countries with ten telephones or fewer for every 100 people; over half the world's population lives in countries with less than one telephone per hundred people, and most of these telephones are located in urban areas. As a result, the telephone density is likely to be much lower in rural areas where telecommunication is more critical because of the difficulty of communicating over longer distances.

Again, lower income countries show dramatically limited access to telecommunications (see table 14.2). The highest telephone density among these countries is seven telephones per thousand people, while in many cases there is no more than one

TABLE 14.2. Telephone Densities: Low- and Middle-Income Countries for Which Data Are Available

Low-Income Countries	*Telephones per 100 Population*	*GNP/Capita*
Bangladesh	0.1	140
Ethiopia	0.3	140
Mali	0.1	190
Burundi	0.1	230
India	0.5	260
Tanzania	0.6	200
Sri Lanka	0.7	300
Pakistan	0.5	350
Mozambique	0.4	350
Ghana	0.6	400
Middle-Income Countries		
Kenya	1.3	420
Indonesia	0.4	530
Bolivia	2.5	600
Honduras	0.9	600
Zambia	0.5	600
Egypt	1.2	650
El Salvador	1.8	650
Thailand	1.1	770
Philippines	1.2	790
Papua New Guinea	1.6	840
Morocco	1.1	860
Nicaragua	1.8	860
Nigeria	0.7	870
Congo, Peoples Republic	0.6	1110
Guatemala	1.4	1140
Peru	0.7	1170
Ecuador	3.2	1180
Jamaica	6.2	1180
Dominica	3.0	1260
Columbia	6.3	1380
Costa Rica	10.9	1430
Turkey	4.7	1540
Syria	4.9	1570
Korea, Republic of	13.8	1700
Iran	2.9	1700
Malaysia	6.3	1840
Panama	10.7	1910
Algeria	3.3	2140
Brazil	7.2	2220
Mexico	7.4	2250
Argentina	10.7	2560
Chile	5.2	2560
South Africa	13.1	2770
Uruguay	10.1	2820
Venezuela	9.4	4220
Hong Kong	35.0	5100
Israel	32.1	5160
Singapore	31.6	5240

SOURCES: World Bank, *World Development Report* (Washington, D.C.: World Bank, 1983); AT&T, *The World's Telephones* (Morris Plains, N.J., 1983).

telephone per thousand inhabitants. Yet in most middle-income countries, including those with access to satellites for domestic communications, the infrastructure is still extremely limited. Brazil and Mexico have an average of seven telephones per 100 population; again rural densities are much lower. Many middle-income countries have even lower telephone densities, including members of Arabsat and users of the Palapa system.

The Maitland Commission estimates that $8 billion from all sources was invested in telecommunications in developing countries in 1983 and that at least an additional $4 billion per year will be necessary if minimal worldwide access to telecommunications is to be achieved.[5] Efforts to improve utilization of telecommunications through support for developmental applications and for training have also been disappointingly limited. The International Programme for Development Communication (IPDC) was established in 1980. So far, it has generated a long list of proposed projects, but very limited funding. While training has been identified as a priority, again, advances in training opportunities have been very modest. Recent bilateral initiatives include the U.S. Telecommunications Training Institute, established in 1982 in time to be announced at the Nairobi Plenipotentiary. It provides short-term technical training through U.S. industries. However, there has been little progress to expand longer term technical training in countries and to provide training opportunities in communications applications and coordination with user organizations and their representatives, such as educators, health care providers, and agricultural extension officers.

A recent venture by INTELSAT illustrates the possibilities but also the difficulties of planning developmental services. Project SHARE offers developing countries free time on INTELSAT satellites for tests and demonstrations of satellite technology for education and other developmental activities during a sixteen-month period beginning in January 1985. While free time appears to be a significant contribution, it is a very minor component of a development communications project. Planning at the national level must involve the telecommunications officials in collaboration with users from other agencies or ministries such as health and education. Funding must be found to support the project, including personnel, operations, and equipment. Funding is likely to be sought from bilateral or multilateral aid agencies which have their own priorities and funding cycles. Once funding is obtained, equipment must be procured and installed, and project planning activities must begin. Accomplishing all of this within sixteen months or even two years is highly unlikely. However, demonstrations and pilot projects can be combined with longer term strategies to develop a technology appropriate for Third World use. For example, INTELSAT's new VISTA terminals for low density telephone service for rural and remote areas and its INTELNET service for low cost point-to-multipoint service for very small earth stations are examples of steps in the right direction. But financing is still a problem, particularly for low-income countries. And developing countries will be reluctant to invest the time and effort to plan and implement pilot projects without a very strong possibility of their continuation and expansion.

BASIC REQUIREMENTS

As noted above, developing countries require major investments in their infrastructure to meet minimum telecommunications access goals. These goals may be stated in terms of both distance and density, for example, a minimum of one telephone per hundred people in urban areas; or one telephone within an hour's walk in decentralized rural areas; or one telephone per permanent settlement in remote areas.

Solutions to developing countries' basic telecommunications problems are now within reach. However, a variety of initiatives will be needed. Satellites offer a very promising solution to the rural and remote area problem. With systems designed for thin-route service, earth stations of 4.5 meters or less can be used for rural telephony and broadcast reception. The stations can be installed where needed throughout developing regions, without waiting for the extension of terrestrial networks from cities.

Most developing countries do not need and cannot afford their own domestic satellite systems. Regional systems owned by a consortium of countries are promising if the countries can agree upon an organizational structure and obtain the necessary financing. Yet for many developing regions, notably sub-Saharan Africa, Latin America, the Caribbean, and the South Pacific, appropriately designed satellite capacity is not available. For these countries, the most promising solution may be shared capacity on regional or international systems.

The second step is the acquisition of earth stations and other equipment required to link users to the satellite. Developments in technology in the past five years have resulted in smaller and cheaper equipment now in use in the industrialized world that is ready for use in the developing world, e.g., small earth stations with antennas that can be assembled and pointed with only minimal technical skills and can be broken down for shipping in small aircraft or by truck; spread spectrum techniques that allow transmission to very small terminals (e.g., .7 meters to 1.5 meters); solid state exchanges of 100 lines or less; low-cost VHF and UHF links from earth stations to surrounding communities; alternative power sources for areas without electrification.

Many of these technologies have been developed for specific uses within industrialized countries—for example, data transmission from remote oil rigs to central computers, for voice and data communications with oil exploration crews, for telephone and broadcast services to isolated settlements, for dedicated networks for transmission of market information, news and financial services, weather data, etc. Yet these technologies could also serve developing countries' needs as well. For this to occur, developing country planners need to be aware of these new technologies, and mutually attractive arrangements for suppliers and purchasers need to be negotiated. The latter would include low-cost financing coupled with guarantees of prompt repayment in hard currency; training in installation, operation, and maintenance of equipment; and transfer of technology to the extent feasible, ranging from in-country assembly of components to manufacture under license and joint ventures.

The third step involves utilization. The full verdict on satellite applications is not yet in, but it is safe to say that the technology has not been utilized to its full potential for socio-economic development. The reasons are many, and have been addressed elsewhere.[6] They include lack of coordination between the telecommunications administration and potential users including social service and commerical entities, lack of resources to develop and test applications, and disincentives to innovation within the potential user organizations.

PROPOSED SOLUTIONS: AN AGENDA FOR ACTION

Appropriate Satellite Capacity

A promising near-term solution would be modification of the INTELSAT VI series now under construction, with launches planned to begin in 1986. It appears that a package of transponders with higher powered regional beams could be added to the payload at minimum incremental cost, and within the launch weight limitations. These satellites will be located over the Atlantic and Indian Oceans where they could direct beams for coverage of Latin America and Africa.

The advantage to developing countries would be substantial in that the incremental cost would be far lower than a dedicated national or regional satellite, and each country could negotiate autonomously with INTELSAT for capacity as required, rather than having to reach agreements with individual countries for access to their satellites, or having to create new regional institutions.

The question of financing remains. The cost of leasing or even buying capacity outright for domestic use should be modest enough to be within reach of middle-income countries using available sources of financing. For the least developed countries, financing at concessional rates through the International Development Association and the various regional development banks should be available.

On the Indian Ocean INTELSAT VI, capacity for an African regional network could be added, as well as transponders for unserved Asian countries such as Pakistan or Burma, if required. It is assumed that China will have its own domestic satellite system by the end of the decade. However, interim service for China could also be provided by adding capacity to the Indian Ocean INTELSAT VI satellites.

Similarly, a regional package could be added to an Atlantic Ocean INTELSAT VI for service to Latin America including subregional beams for the Andean nations, Central America, and the Caribbean. Thus domestic and regional service could be provided to all countries not served by the Mexican and Brazilian satellites.

For the South Pacific, the requirement is not for additional capacity, but for a beam with higher power and appropriate gain setting to cover the Pacific Island nations of the South and Southwest Pacific. The requirements for modification are analogous to Alaska's requirements in the early 1970s. As a result of negotiations with the state of Alaska, which required capacity for telephone service for Alaskan villages, RCA modified the transfer gain settings on its Alaskan transponders, thereby making possible the use of small (4.5 meter) antenna earth stations now in use in more than 100 villages. The INTELSAT satellites in the Pacific carry sufficiently low traffic volumes that dedication of a few transponders (say up to four) for intraregional Pacific use could be accommodated. INTELSAT Vs have the capacity for 12,000 simultaneous telephone circuits and two television channels. In 1973, only 3,629 full-time circuits were in use in the Pacific region.[7]

Ground Segment

As noted above, innovative approaches must also be found to ensure that developing countries gain access to affordable and appropriately designed terrestrial facilities. These requirements, which are designed to reduce the risk to suppliers of operating in the developing world and to reduce the risk to developing countries of dependency on external expertise and equipment, include: dissemination of information about available technology appropriate for developing country conditions; financing arrangements that reduce risk to suppliers; training that enables developing countries to take full responsibility for installation, operation, and maintenance; and strategies for technology transfer, varying with the needs and aspirations of countries at various stages of development.

One strategy the United States and other industrialized countries could pursue to meet these requirements, which would in turn open up major export markets for their technology, would be an exhibit in conjunction with the 1985 Space WARC of technology appropriate for developing country use. This would not be on the same scale as TELECOM 83, which emphasized technologies aimed at large-scale users in industrialized countries, but would include small earth stations, transportable uplinks, small exchanges, low power radio and TV transmitters, and solar and wind power supplies. It could be sponsored by the ITU and underwritten by industrialized countries and companies. Another would be a meeting of major lenders for telecommunications including the World Bank, the regional development banks, the Arab fund, the EEC, and private and bilateral lenders to put together a funding package for countries interested in leasing or buying INTELSAT space segment, and obtaining ground segment facilities. The agenda would include both financing and risk reduction strategies such as loan insurance or payment guarantees.

Developmental Applications

In order to encourage applications of satellite technology for social and economic development, including education for children and adults, health care delivery and other social services, support for economic development activities including agricultural extension, cooperatives, and private sector production and marketing, a variety of approaches could be pursued, including:

- creation of a Center for Telecommunications Development within the ITU, as advocated by the Maitland Commission, with staff that could assist not only with technical planning, but also with economic feasibility and evaluation studies;
- support for pilot projects in satellite applications that could be undertaken with existing INTELSAT and regional facilities and with augmented INTELSAT capacity as proposed above. This approach could include an expansion of project SHARE, with support from industrialized countries in terms of donations or loans of equipment and resource people, and from

multilateral and bilateral aid agencies in the form of funds for project development, staffing, and evaluation;

- internships for developing country technical and applications planners and practitioners in agencies and organizations with experience or responsibility for developmental applications of satellite services. These would include: Departments of Communications—e.g., in Canada and Australia; and applications projects such as the Learn/Alaska Network in Alaska, the Learning Channel, the University of Wisconsin Extension Network, the National Technological University in the United States; the Inuit Broadcasting Corporation, the Canadian Broadcasting Corporation Northern Service, Knowledge Network, and Wawatay Radio Network in Canada; the Open University in the United Kingdom; the School of the Air and aboriginal media projects in Australia; and regional Saami (Lapp) broadcasting in Scandinavia.

Other exchanges could take place with developing countries, such as projects sponsored by the U.S. Rural Satellite Program in Peru, Indonesia, and the West Indies; INSAT rural services in India, and the University of the South Pacific in Fiji.

Funding for these internships could be provided by host countries, or could take the form of exchanges between countries, so that both would benefit from the experience. Multilateral funding, for example, from UNESCO and regional broadcasting and telecommunications organizations could also be provided for exchanges between developing countries.

RELATIONSHIP TO THE SPACE WARC

The steps outlined above could make major strides toward achieving the goals of equitable access to information resources for developing countries. If commitments could be made before the first session of the Space WARC in August 1985, they could demonstrate a pledge by the industrialized world to ensure that developing countries are able to gain access to satellite technology. At the same time, they would demonstrate an efficient use of orbit and spectrum resources.

These approaches need to be considered within a framework of policy guidelines based on the principles of equity and flexibility such as:

- accommodation of international and regional systems: although the ITU functions as a body of national administrations, planning for satellite systems needs to include international and regional systems, so that entities are protected that can efficiently serve both industrialized and developing countries;
- flexibility in proposing technical solutions: It must be recognized that many trade-offs are involved in evaluating solutions to orbit utilization. Developing country planners are likely to be wary of technical solutions including computerized models and frequency reuse techniques with which they have little experience or which may result in more costly solutions in terms of hardware cost or complexity;
- assessment of cost: While cost to industrialized countries may be seen primarily in modifications to technical designs or delays necessitated by uncertainty, cost to developing countries may include the number of staff needed to monitor short time-frame plans and procedures, the cost in time and travel for countries to meet frequently to resolve problems or modify the planning process; the perceived danger of depending on imported, overly complex and/or costly technology;
- allocation of costs: To ensure equity or fairness to all entrants requiring satellite orbit locations and spectrum, guidelines must ensure that all participants share the cost of accommodating new systems; and
- verification of requirements: To avoid "requirements inflation" and wasteful squatting on unused orbital

locations, criteria must be adopted to assure that requested capacity is in fact utilized within a reasonable time period; otherwise, they would revert to the pool of available locations and frequencies.

These guidelines should be acceptable to both industrialized and developing countries in that they are designed to promote both equity in access to the geostationary orbit and flexibility to accommodate changing technology, and regional and international requirements. Yet they do not solve the problem of increasing access to the telecommunications tools which developing countries need to acquire, transmit, and share information needed for social and economic development.

However, these guidelines combined with the steps outlined above can address the issues underlying the Space WARC. Failure to view the Space WARC in a developmental context could result not only in an impasse at the conference, but in the perpetuation of inequitable access to information resources that will impede development and prolong dependency.

NOTES

1. ITU (International Telecommunications Union), *Final Acts of the 1979 World Administrative Radio Conference* (Geneva: ITU, 1979).

2. ITU, *Final Acts of the Plenipotentiary Conference* (Nairobi: ITU, 1982).

3. The 1985 Space WARC agenda is contained in Resolution No. 895 which was adopted by the ITU Administrative Council in 1983. Dr. Hudson's paper was written before the conference, as were the other papers in this part of the book.

4. INTELSAT, "INTELSAT Fact Sheet" (Washington, D.C.: GPO, June 30, 1984).

5. Maitland Commission, "Draft Report," London, 1984.

6. Heather E. Hudson, "Satellite Communication and Development: A Reassessment." Paper presented at the Annual Conference of the International Communications Association, Dallas, May 1983.

7. INTELSAT, *Annual Report* (Washington, D.C.: GPO, 1983).