"MOBILE SATELLITE COMMUNICATIONS FOR ECONOMIC DEVELOPMENT, HEALTH CARE AND EMERGENCY RESPONSE IN LATIN AMERICA AND THE CARIBBEAN"

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"MOBILE SATELLITE COMMUNICATIONS FOR ECONOMIC DEVELOPMENT, HEALTH CARE AND EMERGENCY RESPONSE IN LATIN AMERICA AND THE CARIBBEAN"

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Jerry Freibaum

ABSTRACT

We are at the threshold of implementing, worldwide, one of the most important developments in communications —— a Mobile Satellite Service (MSS) offering a full range of low cost land, aeronautical and maritime mobile communications (Figure 1). This new service will have a profound universal effect on economic, social and cultural activity---

Because of the large number and variety of Geostationary (GEO) and Low Earth Orbiting (LEO) mobile satellite systems planned for the Western Hemisphere **the dominant problem for the user will be which system to choose.** Several systems are briefly described along with their potential impact on economic development, health care and emergency response

Details are provided about a recently signed agreement between the Pan American Health Organization (PAHO) and the American Mobile Satellite Corp (AMSC) for AMSC to provide communications support to PAHO and its member countries for **disaster management and relief operations.** The application of this new space technology to **AIDS education and disaster medicine** is also described.

INTRODUCTION

Telecommunications is "the engine of growth" for economic, social and cultural activity. This "engine" is non-existent or not affordable in many less developed or underserved areas of the world. These costly inadequacies are about to be corrected.

Affordable, mobile two way voice and data communications and high resolution still frame video images will soon be available by satellite to areas previously considered impractical or impossible to cover because of location, terrain, weather or demography.

Small, simple, mobile terminals will be used. Service and equipment will be comparable in cost and performance to terrestrial mobile services and equipment. (Figure 2)

Mobile satellite systems operate on much the same principle as terrestrial based systems which depend on relay towers (Figure 3). However, terrestrial "line of site" coverage may range from only a few kilometers to no more than 65 kilometers. Land based systems cannot build high enough towers to get around mountains, jungles or buildings to be economically feasible for country wide or rural coverage.

THE NEW MOBILE SATELLITE SERVICE (MSS) WILL HAVE A PROFOUND WORLDWIDE EFFECT ON ECONOMIC DEVELOPMENT, HEALTH CARE AND EMERGENCY RESPONSE.

Economic Development (Land, Aviation and Maritime)

Land

Mobile Satellite Services (MSS) will provide, almost instantly, universal access to low cost telephony within any part of a country. The implications of this capability for economic development are enormous. Isolated communities, ranches, farms and industrial complexes will no longer be cut off from the main stream of their country. Commercial and personal mobile telephone use, as an adjunct to the land transportation and agricultural industries, will be greatly expanded.

MSS will help manage routing, scheduling, manifesting, and highway safety of long-distance trucking, bus, and rail operations. The timely, cost-effective, distribution of food products, manufactured goods and raw material is critical to the welfare of any country's economy.

Theft, hijacking and the safety and security concerns of hazardous material transfer will be effectively addressed.

The tourist and recreation industries will have added growth and safety capabilities.

Speed, reliability and accessibility of data transfer in the national resource exploration and power generating industries will be greatly enhanced. Expedient dispatch and scheduling of maintenance crews will be facilitated.

Aviation

MSS, augmenting existing or planned facilities, can provide air traffic communications or air to ground telephone over regions of the world where these services are either unavailable or marginal today.

Marine

Distress and safety operations for commercial and pleasure boats will be greatly enhanced. Commercial and pleasure boat operations on inland waterways and coastal waters will be facilitated.

Health Care

Aids Education And Rural Health

A healthy population is essential for national growth and economic development. The situation with respect to AIDS is particularly destructive to this process in addition to its tragic effects on people. —— Time is not only running out for people but the survival of some countries is at stake.

- **It has been estimated that, by the year 2000, between 38 million and 110 million adults and over 10 million children will become HIV infected.**

- **"... The spread of HIV has not been stopped in any community or country.... During the next decade, HIV will likely reach most communities around the world,"**

- **The number of children orphaned by AIDS will more than double in the next three years; from approximately 1.8 million today to 3.7 million by 1995.**

- **For HIV prevention activities in 1991, about $2.70 was spent per person in North America, $1.18 in Europe, $0.07 per person in sub-Saharan Africa and $0.03 per person in Latin America.**

The worldwide implications of these statistics are obvious in terms of human tragedy, economic disaster and social and political chaos.

It is obvious that health education must be improved dramatically and without delay.

> **Communications satellite technology augmenting the existing terrestrial communications infrastructure can help by facilitating universal access to health education by all segments of the population,— rich or poor; white or non-white; rural or urban.**

The long term effects of this "outreach" should result in health, education, social, economic and political gains by all segments of the community.

In Latin America the problems of providing adequate health care to all is compounded by shortages and mal-distribution of trained manpower, low population density in rural areas, mountainous terrain and climatic and jungle conditions which make transportation and communications difficult, and national priorities which compete for limited funds.

Health care and education are highly labor-intensive. Maximum efficiency and savings can best be realized by being realistic and reducing dependency on the highest levels of health and education professionals. In the near term they can best be used to manage and train health care and teacher aids and to intervene when their special knowledge and skills are required.

Telecommunications has been demonstrated for more than 20 years to be cost-effective in supporting health teams by providing the physician-manager with the ability to supervise, consult, educate and evaluate the performance of health care workers located in remote communities. Similar results have been experienced by the educational community.

The ability to convey audio or video information interactively (two-way) between any two or more people is basic to the education process. Today's technology enables this process to take place between any two or more points within a country or between countries regardless of their locations or degree of isolation (Figure 4).

Information may originate 1000 miles from its intended user but it arrives in real time and can be responded to in real time. This is the basic concept of "distance learning" which is now being put into practice all over the world. "Master teachers" and medical specialists in any field, located anywhere in the world, can now be made available to the most isolated areas of a country in real time. Rural students, for the first time, can have equal access to the same quality of teaching formerly only available to urban areas. The Mobile Satellite Service, when used in conjunction with existing resources including other communications services can provide this capability.

Community or individual home receivers can be installed for parent training, patient follow-up and to increase public awareness of AIDS in a relatively short time frame.

How Do We Get Started?

The first steps in implementing an Aids Education Program (AEP) or any other health care program would be to develop the message and curriculum to be conveyed; identify the target audience and their locations; and determine who are the senders and where they are located. Locations would include schools, health care clinics, hospitals, public meeting or recreation centers, village square, homes, hotels, native and tourist markets, etc.

> **The goal will be to reach every person regardless of his or her location.**

After sites have been selected the communications equipment needed for that site would be identified. The type of equipment needed would be a function of the service to be provided at the site.

For example, data links only would be required to maintain and transfer patient records or to report health statistics. Two way video might be needed for distance learning where feedback from a teacher being trained is essential. Medical diagnosis, monitoring performance of teachers in training, direct broadcast of information or graphics to the home, telemedicine conferencing, continuing education, town meeting type discussions between a village and a center of expertise or between two or more villages, transmission of graphics to be used in discussions or for distribution to a local community or school all would require different levels of communications capabilities.

The satellite will make it possible to train most health care workers or teachers in the country simultaneously, in real time. Thus, uniformity of quality of teacher training is maintained and the speed in which the whole country is covered is faster by orders of magnitude compared with conventional approaches. All of the teachers would also have the benefit of cross discussion and critiques of others in real time. The same process will take place for the general public no matter how isolated they are. They will be connected to a central facility with expertise and they can be connected to each other in a teleconference mode.

Base stations will be needed to be located in or near the centers of expertise. Once the communication requirements are defined, a network can be designed.

Working with appropriate authorities within your respective countries, existing communications resources that could be used for this network should be identified. These resources would then be augmented with new satellite and terrestrial capabilities as needed. An equipment maintenance plan must be developed, cost estimates for satellite time and ground equipment obtained and total estimated project costs computed.

Given the realities of vested interests, politics, regulatory constraints and the cost benefits of using existing resources as much as possible It is crucial that new service

providers and users augment, extend, or enhance existing services with these new services whenever possible.

Any satellite augmentation must be ultra-sensitive to emerging competing commercial and institutional interests. The ability to deal with these interests will make the difference between ending up with a fragmented, marginally effective, communications infrastructure or an integrated and effective communications network.

In some cases integrating the new services with existing terrestrial or satellite systems would be essential. VSATSs (Very Small Aperture Terminals) and the Fixed Satellite Service may be needed, for example, when video is required.

Another vital implementation policy is to establish an institutional mechanism to enable and encourage a commonality of use of a new system. This is essential to reduce costs, enhance operations and to ensure continuity and longevity. Multiple economic, social or public safety problems can be addressed simultaneously by sharing facilities and their costs. It is this commonality that permits a country to address all of the economic, social, educational and environmental factors that enable comprehensive economic and health promotion programs to succeed.

Strong consideration should also be given to sharing resources and programming with other Administrations or organizations outside of your own country to reduce costs, minimize duplication of efforts and to generally benefit from their experience.

A regional satellite system such as the " On again off again" Condor program might lend itself nicely to this approach. Cost comparisons using global, regional or dedicated systems would have to be made.

NOTE: PAHO recently approved "The Iberian American Channel Educational TV project"(Hispasat Program). Using a Spanish satellite, Spain has offered to provide approximately 15 minutes of free channel time per day to PAHO for one way video transmissions to South America of health related programming. This could include Aids, Cholera, Malaria or any other subject consistent with PAHO'S objectives. The Hispasat Program, scheduled to begin January 1993, presents an excellent opportunity to test some programming material quickly and will provide PAHO with the means to begin the long process of sensitizing the public to critical health problems. Hopefully, it may present the catalyst for the more comprehensive program described in this paper.

Emergency Response

Disaster Mitigation

Almost 3 million lives have been lost, over $ 100 billion in property damage and almost 1 billion people have been affected by natural disasters in the past two decades. With the objective to reduce the devastating effects of catastrophic natural disasters The United Nations has designated the 1990's as the "International Decade for Natural Disaster Reduction"

Satellite delivery systems are already in orbit worldwide that are capable of meeting the most demanding emergency response communications needs. More systems are planned

for the 1990's. PAHO/WHO will be experimenting with one of these new systems in 1994 as a result of a recently signed Memorandum of Understanding between PAHO/WHO and the American Mobile Satellite Corporation.
AMSC's Mobile Satellite Service(MSS) will be used by PAHO in cooperation with its member countries to coordinate international relief assistance and to improve their capacity to respond promptly and efficiently to the health problems caused by emergency situations: The MSS will also be used for disaster management,post-disaster operations and recovery and search and rescue operations.

Disaster Medicine - Space Bridge -Armenian Earthquake

The Armenian earthquake, which occurred in early December 1989, caused more than 150,000 casualties as well as enormous, wide spread, destruction. The economic impact to the Soviet Union had been estimated at that time at 20 to 40 billion dollars.

Under the auspices of a US/USSR Joint Working Group on Space Biology and Medicine, NASA's Communications and Life Sciences Divisions initiated, funded and implemented a "Telemedicine Spacebridge" which provided satellite video, voice, FAX and telex links between Soviet and US medical teams for treatment of Armenian earthquake victims.

Initial satellite communications links consisted of one-way video, two-way audio, data, fax and telex. It was the product of a cooperative effort on the part of the COMSAT Corporation, INTELSAT, AT&T, Satellite Transmission and Reception Specialists and NASA's Goddard Space Flight Center in the US, and the Soviet Ministries of Post and Telecommunications and Health.

The US physicians and specialists from four university hospitals that participated in the spacebridge project provided consultative support to more than 200 Soviet physicians, primarily in the areas of reconstructive surgery, rehabilitation and psychiatric care for post-traumatic stress disorder. The four month project was considered highly successful by the participants and they recommended that the concept be continued and expanded.

In June, 1990, the Soviet Ministry of Health urgently requested technical assistance from NASA for Soviet medical experts treating victims of a gas explosion near the city of Ufa in the Ural region. Twelve hundred casualties resulted when sparks from a passenger train ignited gas escaping from a ruptured line nearby.

NASA responded in real time by extending the Space Bridge to include black-and-white slow scan video and voice communications between Ufa and Yerevan, Armenia for retransmission through the space bridge to the US Hospitals which then provided consultation to burn specialists in Ufa.

It is significant to note that the application of slow scan and audio technology in Ufa was constrained to using only existing voice circuits and infrastructure. This permitted the rapid deployment of low-cost interactive equipment to a region whose existing communications network could not accommodate full-motion video. MSS can provide this kind of low cost, real time deployment and capability.

Links like this make it possible for medical specialists anywhere in the world to participate in disaster relief efforts within hours rather than days or weeks.

Transmission of graphics, symbols, descriptive material, health alerts and patients' records can be accomplished promptly and cheaply.

Emergency Medical

MSS will reduce, significantly, response time to medical emergencies.. There are 25,000 daily medical emergencies in the United States. Nearly 40 percent of them occur in rural, wilderness or isolated areas. The probability of survival is directly affected by the immediate availability of dependable, all-weather, communications.

Other Public Safety Applications

MSS will also greatly benefit search and rescue operations, highway and water safety, forest fire control, fire protection, and national park security.

WHICH SATELLITE SYSTEM SHOULD BE USED? WHAT CRITERIA SHOULD BE USED FOR SELECTION? THERE ARE MANY OPTIONS AND CHOICES WILL BE DIFFICULT.

Five years ago users were faced with severe problems of technology readiness, availability, cost, size, deployment and compatibility. Today, these problems are minimal or non existent and have been replaced by the very difficult problem of choices --- which system to use. **Criteria for making this selection should include:**

- low user costs, both capital and operating;
- small, preferably portable, ground terminals;
- readily available and easy to maintain terminals;
- use of proven, current state of the art, technology;
- compatibility with international standards;
- compatible with and or useful to other users and applications such as health care and public safety;
- compatible with and acceptable by local and international regulatory institutions.

The importance of this last point should not be underestimated. Some satellite service providers, for example, are reluctant to serve or market some countries because of the regulatory, political and economic barriers in place. Existing barriers must be identified and a plan developed on how to deal with them.

Users must rapidly become knowledgeable about all of their options so that they do not lock into a soon to be obsolete system or one that becomes a fatal casualty in the rapidly heating up competition war. Incentives will be offered and a wide variety of service and equipment packages will be available.

Examples Of Some Potential Options

The mobile satellite systems are grouped into two main categories, **Geostationary Orbit (GEO)** and **Low Earth Orbit (LEO).** Only one system is described in each group as being representative of the rest of the systems in that group. It is not intended to imply an endorsement or preference of that system.

Approximate costs and tariffs are indicated. Explicit tariffs are not spelled out because the Corporations are still in the process of formulating them. From a competitive standpoint they are probably not prepared to divulge their pricing strategies at this time.

Geostationary Orbit (GEO) Mobile Satellite Systems

A single geostationary orbit (GEO) mobile satellite can act as a 36,000 kilometer high relay tower extending coverage to an entire hemisphere and provide vital communication services to areas which, up until now, have largely been impossible, impractical or too expensive to serve. (Figure 5).

Three systems comprise this group: **American Mobile Satellite Corporation (AMSC), Telesat Mobile Inc (TMI) Canada) and Inmarsat.** The TMI and AMSC systems are identical. They provide total back-up to each other while serving their respective countries. AMSC is of special interest here because of its recent Memorandum of Understanding (MOU) with The Pan American Health Organization (PAHO) to provide disaster communications and public health support. Inmarsat is an International Consortium which was initially formed to serve the maritime community. They are now planning a global full service mobile satellite capability

American Mobile Satellite Corporation (AMSC)

AMSC is authorized to launch three spacecraft. The first is scheduled for launch in 1994. It will provide full two way 4800 bps voice service, high speed data and fax, and low speed data and position determination, paging, database access and private networks.

AMSC is exclusively licensed by the FCC in the US to serve all 50 states, Puerto Rico, the Virgin Islands and 200 miles of coastal territorial waters. Its coverage extends to the northern portion of South America and the Caribbean (Figure 6). AMSC is currently providing mobile data and position location early service to the transportation, maritime, railroad and remote monitoring markets by leasing space from Comsat on Inmarsat's Marisat F-1.

The system is designed to compliment the current terrestrial cellular system. This will be accomplished through a dual mode cellular/satellite mobile phone. When a customer presses the send button, the call will be processed by the cellular system if one is available. In the event that a caller is not in the range of a cellular system, the call will automatically be processed via AMSC's satellite.

The dual mode phones should cost under $ 2000 according to AMSC. The per minute usage rate will be competitive with current terrestrial cellular roaming rates.

AMSC will be targeting the full range of land, aeronautical (both commercial and general aviation), and maritime (commercial and pleasure) markets.

Low Earth Orbiting (LEO) Mobile Satellite Systems

Low Earth Orbit (LEO) mobile satellite systems have recently emerged as strong competitors and possible alternatives to the more traditional geostationary satellite. These systems employ smaller, less expensive but numerous satellites to provide the same coverage as geostationary satellites. The satellites are in much lower orbits of only hundreds of kilometers and are not in the equatorial plane (Figure 7). The same relay tower analogy applies to LEO systems.

Two groups of LEOs are planned. One has a full personal communications capability of two way voice and data represented by **Iridium, Globalstar, Ellipso, Aries and Odyssey.** The second group has a data only capability represented by **Orbcomm, Starsys, VITA, Leosat and GPS.**

Iridium is the most complex and expensive having 66 Satellites. Odyssey, by comparison has only 9 and Orbcomm 20. Iridium will be offering global coverage while Ellipso will offer North American or Western Hemisphere coverage. GPS will offer only global position location data.

Iridium

Iridium is designed to provide global voice, data, paging and radiodetermination satellite services to hand-held, wireless telephones anywhere in the world (Figure 8). Subscribers will use small, hand, "pocketable" telephones to communicate with any other telephone on earth. The system will track the location of handsets as they move with their users, providing global one-person, one-number service to subscribers.

Iridium has signed a contract with Motorola, Inc for U.S. $ 3.37 billion for the total system. Commercial service is planned to be initiated in 1998. Most of the other systems plan to be operational in the 1993 1996 time frame. These estimates exclude any regulatory and technical delays that may occur.

Iridium is proposing to use 10.5 Mhz of spectrum between 1616 and 1626.5 MHz. The Federal Communications Commission has awarded an experimental license to Motorola Satellite Communications for construction and launch of five satellites.

A constellation of 66 (originally 77) low earth orbit satellites is planned, located approximately 420 nautical miles above the earth (Figure 9). The satellites will be small, light-weight, and interconnected to provide continuous line-of- sight coverage between all points on the globe and within an altitude of 100 miles. Each satellite will transmit 48 beams or cell patterns onto the earth's surface and the entire constellation will provide ubiquitous coverage. The system should be able to concentrate capacity where demand is most required as well as reallocate channels in response to specific consumer demand for voice or paging services.

The Iridium telephone will communicate with satellites overhead and will interface with public switched telephone network through terrestrial gate-ways. These gate ways will store customer billing information, keep track of user locations and interconnect with terrestrial carriers. Service will be available on a country-by-country switched basis as negotiated with individual governments, telecommunications authorities and service providers.

Like terrestrial cellular systems, the orbiting satellite antennas will be interconnected as one switched network. Their proximity to earth will permit real-time global communications to hand held telephones, comparable in size to existing cellular phones.

Motorola estimates that these handsets may cost about $ 3,000 per unit. Phone calls may cost as much as $ 3.00 per minute. All of the other LEO systems are estimating comparable or lower costs depending on their coverage and capabilities.

OBSERVATIONS AND RECOMMENDATIONS

Most Latin American countries are conspicuously absent as active players in the Mobile Satellite Service (MSS) market either as providers or users. This is puzzling since so many Latin American countries can benefit greatly from the service. Extensive mountain ranges, isolated communities, vulnerability to catastrophic natural disasters, poverty, unemployment, large dependence on truck and bus transportation, tourist industry, poor communications, AIDS, malaria --- Latin America has all of these. MSS can help.

Why have most Latin American countries been inactive in the MSS arena? You (Latin America) may wish to take more aggressive steps to better understand the new technologies available to you and act accordingly. If you stand still everyone will lose, including the existing communications infrastructures which can benefit financially by extending their operations using the MSS.

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