Republic of Cuba
Telecommunications Infrastructure Assessment

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Executive Summary

The purpose of this study is to evaluate the existing telephone network in Cuba, to recommend an interim plan for the essential communications with the rest of the world (after a transition from the current government), and to provide an order of magnitude analysis for the cost to modernize the current network to meet the short and the long-term demand.

In June, 1993, Cuba decided to privatize telecommunication, and invited proposals for joint venture partners. In June, 1994 the Monterey, Mexico holding company Grupo Domos Internacional (Domos), through their subsidiary CITEL (Corporacion Interamericana de Telecomunicaciones), agreed to purchase a 49% interest in the Cuban phone system for a reported $1.5 billion.

The Empresa de Telecomunicaciones de Cuba, S. A. (ETECSA) was separated from the Ministry of Telecommunications, and established as a private joint venture. However, the Ministry regulates the phone system and set rates, so one can assume there are close ties between them and ETECSA.

ETECSA is in charge of:

- National and international basic telephone services
- Radio and TV signals conduction
- Data transmission
- Telex service
- Public phone booth services
- Added value telecommunication services
- Interactive and multimedia services development
- Cellular Telephony
- Internet services

The table labeled "Study Details" shows the detailed results of the market analysis. The assumptions used for the analysis are included in the methodology section. A summary of the results by province is included in this section

The economic analysis provides an estimation of the economic value of the existing equipment. This value recognizes the economic value of the existing franchise. It should be noted that that investing company will be required to have a capital outlay in the range of $1,500 million to fully adequately provide service for the anticipated long term demand of 15%.

If the transition in Cuba is made during the next few years the selected company could possibly reduce the capital outlay for the Island by purchasing used equipment currently available in large supply in the United States due the recent bankruptcy of many small to mid size common carriers.

The chart labeled Summary of Characteristics by Provinces depicts selected data summarized by provinces. This information can be used to provide detailed information summarized by governmental units.

The graph labeled "Sensitivity Analysis" depicts the return expected if the price is set based on earning 20 percent for various demand levels (assuming that the demand could vary over the range of 5.3 to 20. Table 1 depicts each of the points on the graph.

As an example if the average revenue per access line is $427 (based on 20% return at 15 Access Lines per Population), and the actual demand is 10 Access Lines per 100 Population the actual return would be 16.90% assuming that Maintenance Costs and Capital Deployment Costs are as expected and that sufficient equipment is purchased to meet the demand of 10 access lines per 100 population.

It was not until late 1990s that ETECSA started introducing digital telephony, and fiber optics in Cuba's telephone system. ETECSA has invested US$15 millions to improve the company's fixed-line infrastructure (fiber optic) in the last 5 years.

SUMMARY OF WIREDTELEPHONE SYSTEM

VALUE OF EXISTING EQUIPMENT	$289,100,000
10 YEAR AFTER TRANSITION CAPITAL REQUIREMENTS	$446,312,000
AVERAGE ANNUAL REVENUE REQUIREMENTS PER LINE (Annual Cost per line to Customer)	$427
RATE OF RETURN	20.00%
CURRENT ACCESS LINE DEMAND	609,400
ACCESS LINES PER 100 POPULATION CURRENTLY	7.3
ESTIMATED ACCESS LINE DEMAND 10 YEARS AFTER TRANSITION	2,098,800
ACCESS LINES PER 100 POPULATION AFTER TRANSITION FOR 10 YEARS	15

It was assumed that the new private company would not be saddled with the economic burden of offering universal service. Initially, telephone service would only be provided to towns with a population of 2,000 and higher. it was assumed that telephone service would be priced at a level, which will cover the higher risk of capital investment. (20% rate of return, compared to a risk of

around 14% in the United States). In many countries in the underdeveloped world, telephone service is artificially priced low at a level, which does allow for recovering the investment in new equipment.

Because Cuba is a relatively small market, an exclusive long-term (20 years) telephone franchise should be awarded to the highest bidder. This should include all local exchange communication services and domestic long distance as well. The revenues from the highly profitable long distance and cellular services could be used to subsidize to some extent local telephone service.

Most telecom markets in Latin America have been both privatized and liberalized. Those that are still monopolies are striving towards an open market, but the privatization trend has been reversed. When it comes to fixed lines, it is not easy for new entrants to roll out a network that can compete with the incumbents. Even with the deployment of alternative technologies, in most countries the historical telecom operators continue to dominate the basic telephony sector.

Fiber optic cables in Cuba were installed first around government offices, military installations, key resort areas, but since 2004, in places such as: Villaclara, Cienfuegos, Ciego de Avila, Holguin, Santiago de Cuba, Bejucal, Wajay, Camaguey. **In total, there are 9, 850 Kms of fiber optic cable installed within Cuba.**

ETECSA has invested US$ 10,000,000 in fiber optic cable and related equipmet to improve the company's fixed-line infrastructure. The investment and work has been done in conjunction with the PRC, which has worked very close with Cuba since 2004 to improve telecommunications.

The primary objective of installing the Florida to Cuba Cable System is to provide a direct fiber optic connection between the U.S. and Cuba to alleviate bandwidth gluts, shortages, and increase telecommunications services between Cuba, the United States, and the global community.

Other objectives could be to provide Miami- Dade and Monroe County bandwidth to support their applications and exceed current and future Dade and Monroe County bandwidth requirements. Also, to generate revenues through domestic and international interconnect agreements with T1 and T3 carriers.

Carriers will reduce their costs by a minimum of 20% and receive over 99.9% completion ratio at the Network Access Point (NAP) in La Habana. Currently, satellite provides only a 38% completion ratio at escalated costs to terminate in Cuba. A return on investment should occur in one year after the system is in operation. The cable system is intended to improve the international broadband (voice and data services) connections from Cuba to various international networks in Miami, and the USA. The system can provide ETECSA and US companies the ability to manage revenue streams.

Cubacel is the business unit of ETECSA, and offers mobile telephony services with GSM (900MHz) and TDMA (800MHz) for national coverage and GSM (850 MHz) in the cities of La Habana, Varadero, Santiago de Cuba, Cayo Coco and Cayo Guillermo. The standard for the

system is AMPS. The frequency spectrum is from 824MHz to 856 MHz. The system operates in the B band. The switching is done using Ericsson-AXE Miniswitch. The initial capacity of each switch is up to 8,000 subscribers, with an average traffic of 0.07 erlangs. The switch capacity can be increased to 10,000 subscribers.

Cuba has also the GSM technology, which is widely used worldwide. One of the most important elements to consider in Cuba is that cellular phones in Cuba must be able to transmit and receive in the 900 Mhz band.

Mobile penetration in Latin America and the Caribbean was approximately 80% in early 2009, well above the world average, which was about 58%. With 458 million people owning a mobile phone in early 2009, Latin America and the Caribbean holds approximately 12% of the world's 3.97 billion mobile subscribers. Cuba, the country with the region's lowest mobile penetration, stagnated at 2.9%. The Cuban government has approved Resolution 84 where it is incorporated a plan to reach 1.6 million of subscriber in 5 years, from a total in mid 2009 of 300,000.

Cellular telephony has a brilliant future in a democratic and free market economy Cuba. Projections for the market, after a transition in Cuba, estimates, after the first three years of the transition a total of 3.5 million subscribers for both temporary and fixed customers. A national cellular system could be part of the entire franchise, wired, wireless

The present value of Cubacel, at the end of 2008, is $ 45,220,247 US dollars.

Cuba has the lowest Internet penetration in Latin America. Cubans cannot legally buy a computer or subscribe to an ISP without having a government permit. Until a fiber optic cable is in place, Cuba has to rely on satellites for international connectivity. Almost all Caribbean countries offer a full range of telecom services, despite being characterized by small markets in terms of population. **Liberalization agreements have been reached in most countries.**

The new ETECSA division, Internet services provider has a connection network spread all over the country with the technology to offer:

- Internet commuted access
- National and international e-messaging
- Connections devoted to corporation networks

To achieve a sustainable market-based telecommunications system, Cuba will need extensive policy and regulatory training and technical assistance to develop a telecommunications policy and a legal and regulatory structure that would attract private investment and promote competition to expand and modernize the telecommunications infrastructure at affordable prices.

The U.S. Government, through the Department of State, Federal Communications Commission, and the National Telecommunications and Information Administration could assist Cuba. The World Bank, USAID, and other international donor agencies, and the private sector, in cooperation with countries in the region, and the EU, can begin assisting the Cuban

Telecommunications sector as soon as conditions allow in the placing of advisors in the Ministry and inviting Cubans for training outside the country.

The new government in a democratic Cuba will have to initially assume the control and operation of the system to avoid a shut down. During the transition process the country will have to make a decision on how best to run the system. A national legal system which includes a Privatization Law and its regulations should offer all parties involved in the privatization process an opportunity to participate. The legal structure designed to implement the program should be approved by a Parliament or Congress and should become public law. For such Law to be effective and credible in the eyes of the domestic populace and workforce, in addition to domestic and foreign investors, it should clearly set forth the process that is to be followed.

The Law must also fit within the framework of the general plan for the economic reconstruction of the country, including the range of the other economic and business legislation such as the commercial, tax, regulatory, and bankruptcy codes. The Law should create a "privatization Agency" authorized to coordinate the many stages and activities involved in implementing the program. The degree and type of powers to entrust to such an agency as well as the nature of the resources available to it are primary issues to be considered by the Parliament or Congress.

Over the last 20 years, the world economy has been characterized by constant progress in the development of information and communication technologies. This has triggered a complex pattern of social and economic change. This technological revolution is shaping the process of globalization by providing new tools and infrastructures with which to capture global opportunities. In particular, the technological progress and deregulation of the telecommunications industry has considerably lowered the marginal cost of communications. Furthermore, the growth of the telecommunications industry has allowed a huge increase in the amount of cross-border information flows, reducing transaction costs and stimulating consumer demand for world-class products, services, and brands.

Investment in communications does not always increase the size of overall communication infrastructure. In some countries, investments in mobile communication networks, boosted by the rapid market growth, are partially substituting for investments in the fixed network. Therefore, measuring the telecommunications industry performance and its impact on the economies of different countries through the evolution of the telecommunications infrastructure by means of variables such as the main lines in operation could be misleading for countries characterized by a rapid take-up of the mobile market.

In order to assure a success in the privatization of the Telecommunications system, Cuba must:

- Develop a favorite climate for domestic and foreign investors
- Secure property and contract rights
- Provide basic infrastructure (Transport, Electrical Energy, Water and Sewer)
- Simplify licensing and regulatory procedures
- Develop a competitive and efficient banking system

The new government in a democratic Cuba will have to initially assume the control and operation of the system to avoid a shut down. During the transition process the country will have to make a decision on how best to run the system. There exist several possibilities:

- Government owned infrastructure. This possibility will require a large amount of capital investment for the improvement of the infrastructure, that otherwise could be directed to the restoration of other segments of the economy and other basic infrastructure, such as transportation and power sector. Also, publicly owned telecommunications systems try to develop areas that are politically important to the government, ignoring the real areas in need. The Telecommunication system will eventually become a large bureaucracy, that will make it operate inefficiently.
- System owned by one private Telecommunications Company. This possibility will require a large private investment to improve and enlarge the system.

- Fragmentation of the system in smaller companies. This can be done in two forms:

(1) By territorial areas
(2) By segments of the system. Here private investors can compete and the growth of the sector can be dictated by a well planned regulatory commission.

The most important step, however, is the establishment of long, medium, and short range objectives to achieve the final goal in Telecommunications.

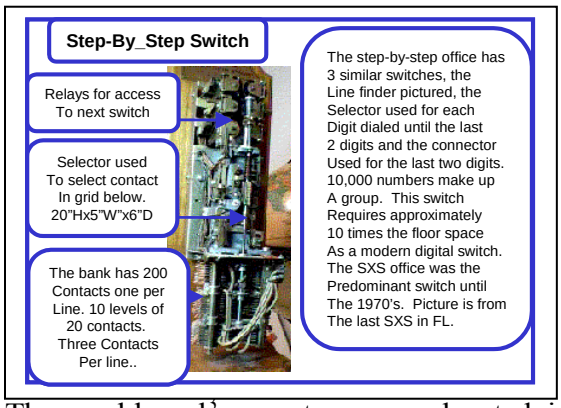
1. Wired Telephony

Pre ETECSA Status (up to 1994)

Local Telephone Service

La Habana

The city of La Habana had 17 Central Offices with a capacity of approximately 210,000 access lines. About half of these Central Offices were equipped with Step-by-Step[1] (SXS) and half with Crossbar[2] (XB) switching equipment. Some Central Office locations are:



Principe	Step by Step, about 40,000 lines (Groups 7, 70,71, 72)
Vedado	Step by Step and Crossbar, about 30,000 lines. (Groups 30, 31 32)
Guanabacoa	Step by Step
Monte	Step by Step
Buenavista	Step by Step and Crossbar (Hungarian)
Alamar	Crossbar (ATZ65, German)

The cord-board[3] operators were located in the International Communications Complex in the intersection of Aguila and Dragones Streets.

There is a Tanden Office equipped with a Hungarian made Crossbar switch in the Ministry of Communications.

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[1] Step-by-Step Switching Systems are direct dial control switching systems based on the Stroger Switch developed in the very early 1900's. This system was the first automatic dialing system widely deployed worldwide. The last new Step-by-Step office in the United States was placed in service in the mid 1950's. This electromechanical analog system is not capable of handling multi-frequency touch tone signals and cannot provide Enhanced Automatic Number Identification necessary for E911 service.
The Step-by-Step Offices were removed from the U. S. network during the 1970's and early 1980's due to the limitations for providing Touchtone Service, and the lack of capability for providing custom calling features which were marketed to consumers.

[2] Crossbar systems are non-electronic program control systems that use relays for logic storage. Western Electric introduced this system in the United States as the No.5 Crossbar System in the mid 1950's. Other Manufacturers worldwide made crossbar equipment until the early 1980's. The Crossbar Office can provide Touch-tone service, but cannot handle custom calling features requiring electronic stored program control. These systems are not compatible with E911 service and were removed from the United States Network in the late 1980's. Crossbar systems can be used for local exchange offices and toll tandem offices.

[3] All Cord-boards (manual attended switching positions) were replaced in the United States during the early 1970's and replaced with Toll Tandem Switching Systems. The Cord-Boards were the foundation of toll telephony until the early 1950's.

Interoffice facilities are copper for the most part. Japanese or German (GDR) Digital Carrier[4] conforming to CCITT standards PCM with 32 channels/system is used to connect far away locations. A Japanese NEC system is used to provide Interoffice (Trunk) Facilities between Marianao and the International Communications Complex.

Equipment

The crossbar switching equipment is mostly of German (GDR) manufacture, ATZ63, ATZ64 or ATZ65. The Step-By-Step switches are still the pre-Castro American made types manufactured by Western Electric. The Airport complex has the only digital switch[5] serving 1200 lines.

A typical Central Office switch has a capacity of 10,000 access lines in the larger metropolitan areas. Community Dial (Step by Step) offices with low subscriber penetration serve the smaller towns. As an example, an 80-line ATZ63 switch providing 15 public telephone lines and 65 private lines serves the town of Fomento.

Billing

The billing of service to private homes is computerized.

Public Communications

Public communications was provided by pay phones of German and Japanese manufacture. A local call cost 5 cents and long distance calls are sent-paid only. Although directories are available they are not located in each pay phone location. Dialing 113 provides directory assistance. The operators use microfiche with auto- search to locate the requested numbers.

National Long Distance Service

Toll offices, called Centros de Mantenimiento de Telecomunicaciones (CMT), are located in each Municipal entity, "Municipios", according to the political structure of the pre-1959 Cuba. These offices are mostly Number 5 Crossbar of German (GDR) manufacture.

The toll interoffice facilities are either Microwave[6] or Coaxial cable. The military uses mostly the coaxial facility due to its "privacy".

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[4] The world has two Pulse Code Modulation (PCM) Standards. The American Standard uses T-Carrier at 1.544 Megabits per Second providing 24 channels per System. The European Standard (CCITT) uses 2 Megabits with 32 Channels per System. Digital Carrier Systems were introduced in the early 1960's on copper based trunk facilities in the early 1960's. Digital Carrier systems were originally used for Interoffice facilities. Currently the systems are deployed using fiber based facilities and are used for both Inter-office facilities, and local subscriber facilities.

[5] Digital Switching Systems were introduced in the early 1980's to switch PCM signals in the Toll and Local Networks. These Switches are electronic program control systems with decentralized processors and as considered state of the art switching systems. These Switching Systems have been used to replace electromechanical switching systems, and are currently being used to replace analog electronic systems. By the year 2005 over 95% of the total demand in the United States will be served by Digital Switching Systems according to current plans.

[6] Microwave Systems require line of site between offices. The system is impacted by atmospheric conditions. Repeater locations can be used to extend the range of systems where line of site cannot be obtained.

Numbering Plan

There was a Numbering Plan in place that allows Direct Distance Dialing (DDD) to any point in the Nation. Long distance lines are accessed by dialing "5" followed by the city code, the 1 or 2 digit exchange code and the 4 digit station number. A call from La Habana to Matanzas would be dialed: 5 + 52 + NN-XXXX.

Microwave Network

The microwave facility network is shown in the figure. The Thompson (French made) equipment has a capacity of 960 channels (16 Supergroups of 60 channels) and it links La Habana with the other old province capitals, Pinar del Rio, Villa Clara, Camaguey and Santiago (except Matanzas). The terminal equipment located in Villa Clara, Camaguey and Santiago is the French made LTT. At Pinar del Rio and other secondary points is the German (GDR) made VKM.

Coaxial Cable

This system[7] has a capacity of 1920 channels out of La Habana. The facilities terminal equipment is German made VLV or Telemecanica VKD. The repeaters are soviet made and all conform to CCITT standards. The cable runs by the new "Autopista" all the way to Cabaiguan and then follows the old “Carretera Central” to Santiago de Cuba. There are repeaters every 6.3 Kilometers located in huts above ground.

The facility has the following drops: S1 Sancti Spiritus, S2 Cienfuegos, S3 Villa Clara, S4 Villa Clara, S5 Camaguey, S6 Ciego de Avila, S7 Victoria de Las Tunas, S8 Villa Clara, S9 Camaguey, S10 Camaguey, S11 Bayamo, S12 Santiago de Cuba, S13 Guantanamo, S14 Holguin, S15 Santiago de Cuba, S16 Cerro Pelado (24 Channels to Jamaica).

The drop in Cerro Pelado links to a microwave system and it is used for the Aerial Corridor communications (AICC). The equipment located at the old province capitals is terminal equipment. At other points, it links with the CW20 microwave facilities.

International Long Distance Service

Satellite

Two systems were in service:

1. IntelSat, an automatic Japanese system with 24 channels.
2. Intel-Sputnik, a Russian manual system with 60 channels.

[7] Coaxial cables are used to host Pulse Code Modulation systems. The system is subject to signal loss due to impedance and inductance. Repeaters are required to regenerate the signal. Coaxial Technology was widely used in the United States until the advent of Fiber based systems. The United States plans to replace all Microwave Systems and Coaxial based systems by the end of the 20th century. Since 1980, the facility Inter office facility of choice has been fiber. Fiber is also being introduced in the feeder network .

Coaxial Cable

A submarine cable was installed in 1950 between Key West and La Habana using an analog Carrier System[8]. It is composed of two coaxial cables, one for each direction of transmission. It was originally designed to carry 24 voice channels. The terminal equipment for this system is located on the third floor of the former Cuban Telephone Company in Aguila and Dragones Streets. This equipment was damaged by fire several years ago. A new cable was placed by ITT from Key West to Cojimar. From here it terminates in the International Communications Complex in La Habana with a capacity for 138 channels (PCM). The terminal equipment has not been installed due to the trade embargo with the island.

Microwave

An over the horizon tropo-scattering system was placed in service in September of 1957 for the transmission of one B&W video channel and 36 audio channels of 4 MHz. This system is composed of three radio spans. The first one operates at 3 GHz from La Habana to Guanabo. The second operates in the UHF range between Guanabo and Florida City. The third operates at 3 Giga Hertz between Florida City and Miami, with a repeater located in Goulds.

In La Habana, the system terminated in the first floor of the Edificio Masonico, located in Carlos III No. 508. The TD-2 transmitters/receivers reside there along with the L-1 carrier equipment, both of Western Electric manufacture. In Guanabo, in addition to the microwave transmitters, there are two government systems operating at 10 Kilowatts at frequencies of 692 Mhz and 740 MHz, along with two receivers tunned at 840 MHz and 880 Mhz. Both are connected by waveguide to 60 ft. parabolic antennae.

[8] The system uses a 24 channel N-3 type Analog Carrier System. The Terminal equipment in Key West is terminated in the Second Floor of the Southern Bell Local Office and is transmitted over Bellsouth Facilities to The AT&T toll Office in Miami. This is the only N Carrier system in service in the United States. All other systems were replaced by 1977.

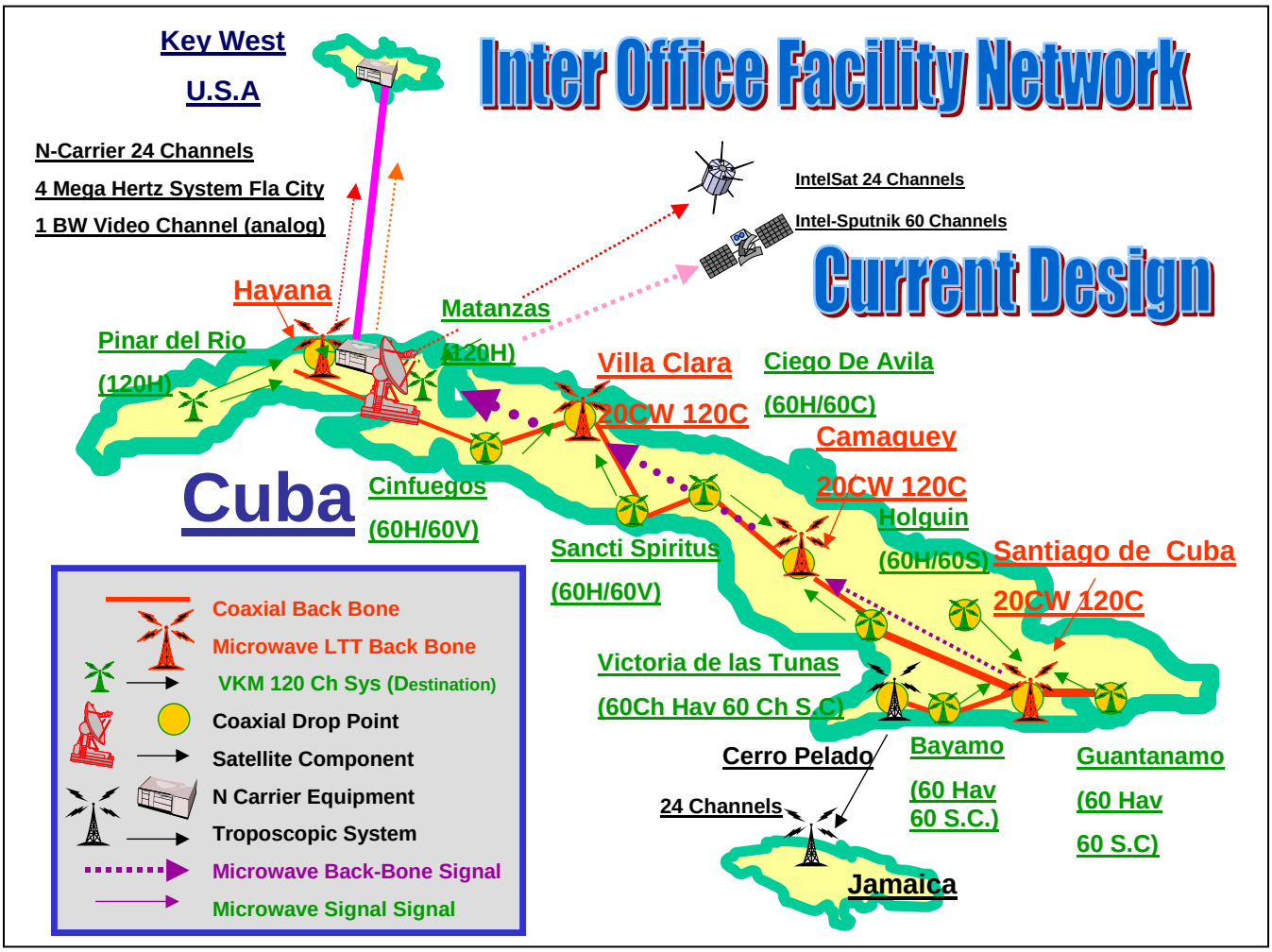


Figure 1

Data Communications

Data communications facilities are utilized for government related business only. In addition to government and military information, the government owned sugar industry is also a user.
The data network is composed of three hubs: La Habana, Matanzas and Villa Clara. Packet switched data is used to interconnect mainframe computers in these locations. The transmission speed is 9600 bits per second[9].

There are 3 Local Area Networks (LAN) in La Habana, and one in Matanzas and Villa Clara. A token ring architecture is used in these LANs. Modems are used for data transmission through voice grade circuits at 300, 1200 and 9600 bits per second. These circuits are used mostly by the military and Prensa Latina.

[9] A voice channel is equivalent to 64,000 bits per second. The theoretical maximum transmission rate for data over voice is 56,000 bits per second because 8,000 bits per second are used to provide routing information. The objective in the United States is to transmit data at 56,000 bits per second over the telephone network using a data modem without need of a separate data network.

Data Communications concerns the transmission of digital messages to devices external to the message source. "External" devices are generally thought of as being independently powered circuitry that exists beyond the chassis of a computer or other digital message source. As a rule, the maximum permissible transmission rate of a message is directly proportional to signal power, and inversely proportional to channel noise. It is the aim of any communications system to provide the highest possible transmission rate at the lowest possible power and with the least possible noise.

Serialized data is not generally sent at a uniform rate through a channel. Instead, there is usually a burst of regularly spaced binary data bits followed by a pause, after which the data flow resumes. Packets of binary data are sent in this manner, possibly with variable-length pauses between packets, until the message has been fully transmitted. In order for the receiving end to know the proper moment to read individual binary bits from the channel, it must know exactly when a packet begins and how much time elapses between bits. When this timing information is known, the receiver is said to be synchronized with the transmitter, and accurate data transfer becomes possible. Failure to remain synchronized throughout a transmission will cause data to be corrupted or lost.

Two basic techniques are employed to ensure correct synchronization. In synchronous systems, separate channels are used to transmit data and timing information. The timing channel transmits clock pulses to the receiver. Upon receipt of a clock pulse, the receiver reads the data channel and latches the bit value found on the channel at that moment. The data channel is not read again until the next clock pulse arrives. Because the transmitter originates both the data and the timing pulses, the receiver will read the data channel only when told to do so by the transmitter (via the clock pulse), and synchronization is guaranteed.

Techniques exist to merge the timing signal with the data so that only a single channel is required. This is especially useful when synchronous transmissions are to be sent through a modem. Two methods in which a data signal is self-timed are nonreturn-to-zero and biphase Manchester coding. These both refer to methods for encoding a data stream into an electrical waveform for transmission.

Cuba will have to depend a lot on United States’s technology and companies to develop a good computer networking system of data transmission. Privacy is a great concern in data communications. Faxed business letters can be intercepted at will through tapped phone lines or intercepted microwave transmissions without the knowledge of the sender or receiver. To increase the security of this and other data communications, including digitized telephone conversations, the binary codes representing data may be scrambled in such a way that unauthorized interception will produce an indecipherable sequence of characters. Authorized receive stations will be equipped with a decoder that enables the message to be restored. The process of scrambling, transmitting, and descrambling is known as encryption.

Custom integrated circuits have been designed to perform this task and are available at low cost. In some cases, they will be incorporated into the main circuitry of a data communications device and function without operator knowledge. In other cases, an external circuit is used so that the device, and its encrypting/decrypting technique, may be transported easily.

Data communications through the telephone network can reach any point in the world. The volume of overseas fax transmissions is increasing constantly, and computer networks that link thousands of businesses, governments, and universities are pervasive. Transmissions over such distances are not generally accomplished with a direct-wire digital link, but rather with digitally-modulated analog carrier signals. This technique makes it possible to use existing analog telephone voice channels for digital data, although at considerably reduced data rates compared to a direct digital link.

Transmission of data from your personal computer to a timesharing service over phone lines requires that data signals be converted to audible tones by a modem. An audio sine wave carrier is used, and, depending on the baud rate and protocol, will encode data by varying the frequency, phase, or amplitude of the carrier. The receiver's modem accepts the modulated sine wave and extracts the digital data from it.
Cuba will need computer scientists and computer engineers to analyze, design, test, and evaluate network systems, such as local area networks (LAN), wide area networks (WAN), Internet, intranet, and other data communications systems. Perform network modeling, analysis, and planning. Research and recommend network and data communications hardware and software. Include telecommunications specialists who deal with the interfacing of computer and communications equipment.

Huge investments will be needed in Cuba to assure a secure, stable, fast data transmission system.

We will expand further below on the new data/internet services.

Maintenance

Most of the problems are in the central offices providing local service. These problems are usually due to a lack of spare parts.

The long distance service is in better shape as parts are more readily available.

Personnel

By 1994, about 525 engineers were working in telecommunications in the Ministry of Communications.

ETECSA

Operator Name: Empresa de Telecomunicaciones de Cuba, S.A.
Network Name: ETECSA

Introduction

In June, 1993, Cuba decided to privatize telecommunication, and invited proposals for joint venture partners. In June, 1994 the Monterey, Mexico holding company Grupo Domos

Internacional (Domos), through their subsidiary CITEL (Corporacion Interamericana de Telecomunicaciones), agreed to purchase a 49% interest in the Cuban phone system for a reported $1.5 billion.

The Empresa de Telecomunicaciones de Cuba, S. A. (ETECSA) was separated from the Ministry of Telecommunications, and established as a private joint venture. However, the Ministry regulates the phone system and set rates, so one can assume there are close ties between them and ETECSA.

Progression

Billed as the first large scale privatization in Cuba since 1959, the agreement was announced during a one-day trip to Cuba by then Mexican President Salinas. In April, 1995, Domos announced completion of the purchase, and the sale of 25% of their interest to Telecom Italia for $ 291.2 million. ETECSA was jointly managed with four Cuban Vice Presidents, three Mexican, and one Italian.

Due to the economic crisis in Mexico in 1995, Domos lost its equity. As a result, now TI controls 30% of ETECSA, the Cuban government 49%, and a coalition of banks the remainder. According to reports in Italian paper Il Sole 24 Ore, citing Spanish financial sources, Telefonica, from Spain, prepares ETECSA bid for TI part of the joint venture. TI reports that ETECSA has not been as profitable as expected. As of now, Telefonica is bidding up to $500 million for the shares, although TI was reportedly looking for nearer to $ 780 million.

Corporate Structure

The commercial offices of ETCSA were at first located at:

Calle 22 entre 3ra. and 5ta.
Miramar, Playa
La Habana

Presently, ETECSA is structured as follows:

Presidencia.
Centro de Negocios Miramar, Edificio Beijing, 5to piso, Ave 3ra, e/ 76 y 78, Playa,
Ciudad de La Habana. CP. 11300
Teléfonos: Recepción 266-8500 / Secretaria Ejecutiva 266-8502

Primera Vicepresidencia.
Centro de Negocios Miramar, Edificio Beijing, 5to. Piso - oficina 508 Ave 3ra, e/ 76 y 78, Playa,
Ciudad de La Habana. CP. 11300
Teléfonos: Recepción 266-8500 / Secretaria 266-8533 / Sec Ej. 266-8532

Dirección Jurídica y Regulatoria.
Centro de Negocios Miramar, Edificio Beijing 3er. Piso – oficina 319, Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfono: 266-8352 (Secretaria)

Dirección Central de Vigilancia Estratégica, Procesos y Calidad.
Centro de Negocios Miramar, Edificio Beijing 4to. Piso Oficina 413, Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfono: 266-8617

Vicepresidencia de Desarrollo y Tecnología.
Centro de Negocios Miramar, Edificio Santa Clara, Oficina 215. Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana CP. 11300
Teléfono: 266-6717 / 266-6719

Vicepresidencia de Economía.
Centro de Negocios Miramar, Edificio Santa Clara Oficina 316, Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfonos: 206-9274 / 206-9277

Vicepresidencia Comercial y de Mercadotecnia.
Centro de Negocios Miramar, Edificio Beijing Oficina 314, Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfonos: Secretaria 266-8364 / Sec.Ejec. 2668363

Vicepresidencia de Capital Humano.
Centro de Negocios Miramar, Edificio Beijing, Oficina 419. Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfono: 266-8401

Vicepresidencia de Negociación y Logística.
Centro de Negocios Miramar, Edificio Santa Clara Oficina 508, Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfono: 266-8544, 266-8545

Vicepresidencia de Operaciones de la Red.
Centro de Negocios Miramar, Edificio Santa Clara Oficina 311, Ave 3ra, e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfono: 266-6985 y 266-6508

Vicepresidencia de Tecnologías de la Información.
Calle 60 esq. 17, Buena Vista
Teléfonos: 206-7565 y 206-7566

Vicepresidencia de Servicios Internacionales.
Centro de Negocios Miramar, Edificio Habana, Oficina 505. Ave 3ra e/ 80 y 78, Playa,

Ciudad de la Habana CP. 11300
Teléfono: Pizarra 266-7100 / Secretaria 204-6979

Vicepresidencia de Servicios Móviles.
Centro de Negocios Miramar, Edificio Barcelona 3er. Piso oficina 304, 5ta. Ave e/ 76 y 78, Playa, Ciudad de La Habana. CP. 11300
Teléfono: Pizarra 58802222

Dirección Territorial Isla de la Juventud.
Calle 28 Esquina 41 Nueva Gerona, Isla de la Juventud.
Teléfonos: Recepción 046. 32-4002 / Secretaria 32-3506

Dirección Territorial Pinar del Río.
Alameda # 11A esq. Maceo, Pinar del Río.
Teléfonos: Recepción 0.48 75-4585 / 75-4587 / Secretaria 75-4355 / 75-2337

Dirección Territorial La Habana.
Ave. 47 #8213 e/82 y 86, San José de las Lajas.
Teléfonos: Recepción 86-0500 / Secretaria 860502

Vicepresidencia de Ciudad de La Habana.
Águila #565 esq. a Dragones, Centro Habana, Ciudad de La Habana.
Teléfonos: Recepción 860-7820 / 860-7821 / Secretaria 860-6806 / 860-7879

Dirección Territorial Matanzas.
Milanés e/. Jovellanos y Ayuntamiento, Ciudad de Matanzas.
Teléfonos: Recepción 045. 24-7017 / 25-5206 / Secretaria 24-2659 / 25-5203

Dirección Territorial Villa Clara.
Carretera Central No. 116 Banda Placetas. Reparto Escambray.
Teléfonos: 042. 21-7538 / Secretaria 20-6611

Dirección Territorial Cienfuegos.
Calle 43 No. 5802, entre 58 y 60, Cienfuegos.
Teléfonos: Recepción 043.51-3046 / Secretaria 51-9336

Dirección Territorial Sancti Spíritus.
Bartolomé Massó No. 167 Norte. Sancti Spíritus.
Teléfonos: Recepción 0.41 32-4018

Dirección Territorial Ciego de Ávila.
Prolongación de Bembeta y Circunvalación # 250, Ciego de Ávila.
Teléfonos: Pizarra 0.33 22-8012 / Secretaria 22-8600 / 22-4188

Dirección Territorial Camagüey.
Calle Ignacio Agramonte # 442 Entre López Recio e Independencia, Camagüey.

Dirección Territorial Las Tunas.
Angel Guardia No.117 e/ Francisco Varona y Adolfo Villamar, Las Tunas.
Teléfonos: Recepción 0.31 34-6016 / 34-6533 / Secretaria 34-6581 / 37-5470

Dirección Territorial Holguín.
Martí No. 122 e/ Mártires y Máximo Gómez. Holguín.
Teléfonos: Pizarra 0.24 461102 / Secretaria 42-4800

Dirección Territorial Granma.
Ave. Antonio Maceo s/n e/ Ave. Granma y Segunda. Reparto Antonio Guiteras. CP. 85300 Granma.
Teléfono: (023) 42 50 13 / 42-0671 / Secretaria 42-0678

Dirección Territorial Santiago de Cuba.
Aguilera #401 Esq. Pío Rosado, Santiago de Cuba.
Teléfonos: Recepción 0.22 62-8011 / Secretaria 65-4018

Dirección Territorial Guantánamo.
Ahogados entre 11 y 12 norte, Guantánamo.
Teléfonos: Recepción 0.21 38-1018 / Secretaria 32-6616 / 38-2092

TARIFF

Installation of a main line	60.00 PESOS
Basic monthly bill, residential	6.25 pesos/main line; 300 minutes/month
Commercial	9.95 pesos; 200 minutes/month
Government sectors	9.95 pesos; 450 minutes/month

Depending on the time of the day, an additional bill of 0.03 pesos/minute will apply.

Supplementary services

Wake up call	1.00 PESOS/MONTH AND 0.10 PESOS EACH ACTIVATION PER DAY
Call waiting	0.50 PESOS/MONTH
Call forwarding	1.00 PESOS/MONTH
Three call conference	1.50 PESOS/MONTH)

Functions

ETECSA is in charge of:

- National and international basic telephone services
- Radio and TV signals conduction
- Data transmission
- Telex service
- Public phone booth services
- Added value telecommunication services
- Interactive and multimedia services development
- Cellular Telephony
- Internet services

Workers and New lines

ETECSA has increased its employees to 18,412, out of which 35% is composed of engineers and technicians in the telecommunication specialties. Mean age of workers is 44 years old, with 75% male, 25% female

ETECSA has installed 600,000 new phone lines in 500 central stations along Cuba, of which 75% are digitized. It also has a national network transmission through a digital microwave with secondary distribution as it develops a national backbone optic fiber system as a parallel support.

ETECSA commercializes the following supplementary services:

- Automatic Alarm clock
- E-padlock
- Triparty Conference
- Automatic Call Transfer
- Call in Waiting
- Transfer in Busy
- Transfer in No Answer
- Cordless phone
- Answering Machines
- Fax Machines
- Intelligent phones

It has 50,000 public phones installed. It has developed a public telephony coin and card network into account community call centers, national and international call centers, phone booths. ETECSA publishes the telephone directory in 5 volumes: one national and four regional volumes. The Telephone Directory has a printing of 450,000 copies.

ETECSA recently installed modern digital telephone lines covering all of the national territory. For local calls, special booths have been made available in cities and towns which accept coins or prepaid cards in national currency. Visitors can change money for local coins and call from

any of these cabins or purchase a prepaid card when calling from a communication center or private telephone in the case of local calls.

For international phone calls, customers are required to use a public telephone booth which accepts prepaid cards priced in convertible Cuban pesos. These booths are located in hotels, airports, telephone centrals, etc. Visitors can also call directly from the hotel (either from the room or front desk).

When placing a call to Cuba from overseas:

1. Dial the international code of the country from where the call is placed.
2. The code for Cuba is: 53
3. Area code of the city you are calling. Check the codes of the leading cities in Cuba.
4. Dial the number you want to call.

Example: a person calling from Italy to Varadero in Matanzas must dial:
00: code for placing an international call used in Italy
53: code for Cuba
5 : the Varadero area code plus the desired number:
00 53 5 + the desired number

When placing a call to another country from Cuba:
1. International code in Cuba is: 119
2. Code of the country
3. Area code
4. Desired number

Example: a person calling Rome, Italy from Cuba must dial:
119: International code
39: Code for Italy
06: Area code of Rome
and the desired number

Long Term Plan

The projected telephone demand in Cuba is based on an analysis of the telephone demand in countries in similar stage of development. Based on this information, the demand for Cuba was estimated to be 15% within 10 years. This demand was used to estimate the Average Revenue Requirements per line for telephone service based on a 50% replacement of all plant. Plant replacement is necessary in order to gain operational efficiencies to provide for a three-fold increase in market penetration.

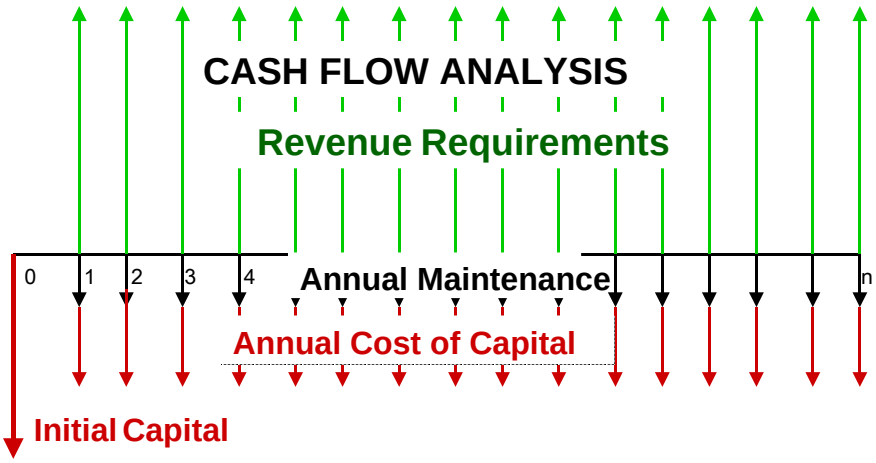
Methodology

The method used to infer the market price for an average access line based on market conditions expected by a telephone company wishing to invest in Cuba was based on similar costs being

experienced in the United States. The specific algorithms used to derive the "Annual Revenue Requirements" (average cost per line) are shown on Figure1. The specific costs used in the study are consistent with assumptions 1 to 7 listed in this section.

In order to determine the capital requirements, population data for each population center were obtained from the census files. The demand profile was generated based on the ratio of telephones to population for various countries with similar demographics. The data was further refined based on population size for each sub-market. Capital replacement costs were based fixed cost- plus variable costs (listed on assumption 3). The Equivalent Uniform Annual Cost derived based on economic parameters described in detail on assumption 4. The Annual Cost of Initial Capital Investment (A) was calculated based on a 20% rate of return as detailed on figure 2. Maintenance costs were calculated as described in assumption 2 . The sum of these two figures is labeled "Annual Revenue Requirements New Equipment" and is detailed on the Study Details for population center. The sum of the individual revenue requirements is labeled "Totals", and is included on Table 2. The "Annual Revenue Requirements per Line New Equipment" is the previously mentioned figure divided by the telephone demand.

The Annual Revenue Requirements per line for existing equipment were set equal to the cost of new equipment ($427) to derive the Current Value of Equipment listed on Table1. The same derivation described in the previous paragraph was used to infer the value of existing equipment.



The Initial investments is amortized over the equipment life:

$$A = P\left((1+i)^n/((1+i)^n - 1)\right)$$

Where P is the Initial Investment (Present Amount)

i is the Interest Rate (ROR-Inflation Rate)

n is the number of years (Equipment Life)

A is the Annual Cost of Initial Capital Investment

Maintenance costs are estimated based on the regression formulas described in the assumptions sections.

The Annual Revenue Requirements is equal to the sum of the Annua l Maintenance costs and the Equivalent Uniform Annual Costs.

Figure 2

Rate of Return on new equipment was based on the perpetual annuity assumption described in detail in the texts listed on assumption 4 and captioned in Figure 2 (above).

It should be noted that the average user cost per line is approximately 60% the average cost currently being experienced in the United States. This cost to the user per line is expected to be comparable to costs being charged in comparable countries. Although the costs were derived based on 50% equipment replacement, the existing plant can continue to be used to provide service to smaller areas where sufficient return is not obtained on the marginal investment. Although the combined rate of return on investment is 20%, many of the smaller markets provide a rate of return below 20% and the 7 smallest markets are unprofitable.

Assumptions and Data Sources

1. The telephone demand was estimated based on the ratio of telephones to population in various countries with similar demographics. The source for this data was primarily the Statistical Office of the United Nations Statistical Yearbook. The data was obtained for various years. The demand for Cuba assumes that within the first 10 years after a transition to democracy, the Cuban economy will have developed to a level comparable to the level that would have been attained if the present system has not existed for the last 51 years. As a result of the above it is expected that the telephone demand will be 15 percent on the population on the aggregate. The demand was further refined using the following criteria:

La Habana Metropolitan Area	25%
Regions with population over 250,000	18%
Regions with population between 100,000 and 250,000	14%
Regions with population under 100,000	11%

2. The maintenance costs are based on current costs used in the United States. Although labor costs, which account for the majority of the maintenance costs will be lower in Cuba, it is expected that more employees will be required than in the United States. This assumption is based on the fact that productivity is much higher in the U. S due to the high level of mechanization.

3. As comparison the labor force per 10,000 main stations for the United States is 43, but 100 in Germany and 127 in Australia. In Cuba 1,200 (20 Engineers per 10,000 Main Stations) are performing tasks that would be accomplished by 300 Engineers (5 per 10,000 Main Stations) in the United States. It is evident that although the wages will be much lower, the productivity will also be lower Therefore; it is assumed that both of these impacts will offset. Maintenance cost model, captioned below and in figure 1 was assumed to be:

Description	Fixed Cost	Variable Cost
Switches with less than 10,000 lines	$ 500,000	$200 per line
Switches with over 10,000 Access Lines	$1,000,000	$155 per line

4. Capital Costs for telephone equipment are also assumed to be similar to the cost in the United States. The reason for this assumption is that most telephone equipment is

purchased from very few international vendors. Some of those vendors are AT&T (US), Siemens (Germany), CIT Alcatel (France & Spain), Fujitsu (Japan), and NEC (Japan).

5. These vendors set worldwide prices based on volume. The vendors do installation of telephone equipment. The American Market has a slightly higher cost due to the cost for Operational Support Systems required to gain labor efficiencies, but the installation costs will be higher in Cuba due to the need to have the workforce force imported. The Capital Costs model, captioned in figure 1 is depicted below:

Description	Fixed costs	Variable Costs
Switches Less than 10,000 Access Lines	$ 400,000	$1,400 per line
Switches with over 10,000 Access Lines	$1,000,000	$1,000 per line

The capital costs are total costs for the equipment. The typical breakdown of costs follows:

Description	Percent
Central Office Equipment[10]	30%
Outside Plant Feeder	30%
Outside Plant Distribution	10%
Local Inter-Office Facilities	*15%*
Toll Network (Switch/Facilities)	15%

The typical network is priced based on the components listed above. The Central Office Network assumes Digital Switches similar to DMS-100 (or No. 5 ESS for the large switching systems, and a DMS-10 for the small switching systems.

[10] The typical network is composed of the Switch, Outside Plant, Interoffice Facilities, and Toll Network. The Switch can range from Electromechanical analog such as the Step-by-Step or crossbar switch to Digital Electronic its function is to concentrate customer demand to reduce the number to channels and to connect customers. The Outside Plant Network consists of two components the feeder network providing an efficient interface to the switch based on distributed demand parameters. This network can be Copper designed based on transmission standards with thicker copper conductors for longer distances, or fiber using a digital multiplexed signal for transmission. The "distribution" network is a less efficient network connecting the customer to the feeder network. This network is usually provisioned in anticipation of demand with each house connected to the feeder network (the U. S. Standard is 2 pairs per living unit). Interoffice facilities interconnect switches (wire centers) and are sized based on point-to-point demand. The toll network includes both switch equipment and Facilities and are also sized on demand. In some cased local and toll networks can share the same switch or facilities.

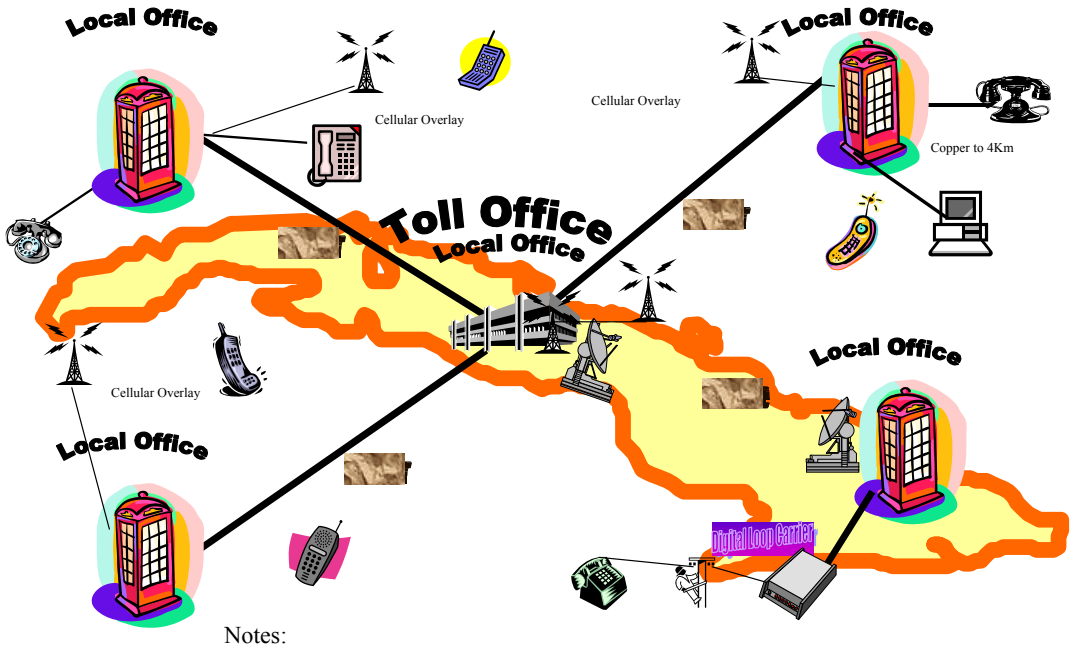
The Outside Plant Feeder Network assumes 26 gauge copper cables up to a distance of 12 kilo-feet (3.8 Kilometers), and Multiplexed single mode fiber cables equipped with digital pair gain systems similar to AT&T Subscriber Loop Carrier SLC 96 for distances greater than 12 kilo-feet.

Rural Areas were priced using a Cellular network. The Cellular Network can also be used to provide Alternate Service in Major Metropolitan Areas such as the city of La Habana. It is expected that 70 percent of the demand will occur at distances less than 12 kilo-feet, and that the cable placed in proximity to the Central Office will be placed on conduit. Outside Plant Distribution Network will use 26 gauge copper cables (aerial or buried).

Central Office facilities will use a single mode fiber backbone route utilizing multiplexing equipment similar to the DDM100. The Toll Network assumes a combination of DMS-200 Toll Switches for the major toll points and DMS-100/200 switches for the smaller locations.

A sketch depicting the existing interoffice network is included in the existing situation section, and the typical network assumptions are shown below:

TELEPHONE NETWORK



Notes:

1. Cellular used for rural, and urban alternate Service
2. Copper 26 Gauge for up to 4 Kilometers
3. Same Network for data and Voice

Figure 3

6. Item 5 discussed the cost of a wire-line network. A cellular network uses same switching components as the wire-line network but replaces the outside plant "feeder" and "distribution" network with radio transmission systems as discussed in detail in the "Cubacel" section of this report. The cost of providing individual wires to a fixed customer is much higher than cellular costs

   Cumulative costs to serve an average cellular line have been maintained by the Federal Communications commission since the introduction of cellular systems and have been approximately constant with an average cost of $842 per line. This cost has not changed significantly because technological innovations have offset the inflationary effects. The complete analysis is contained in the appendix.

   Cellular costs unlike the wire-line counter parts do not vary significantly as a function of demand density because the cellular tower transmission range can vary from 2 to 20 kilometers based on demand density.

7. The Minimum Attractive Rate of Return was assumed to be 18%this is consistent with foreign investment threshold currently assumed by American Companies. It is further assumed that revenues will increase by 1 percent per year after the switch is replaced. The discount rate used in the discounted cash flow analysis is therefore 17%. This takes into consideration the revenue trend and the cost of capital.

8. The average equipment life used in the economic analysis was assumed to be 25 years for the new equipment and 5 years for the current equipment with a total replacement of equipment in 10 years. This average life results in a capital recovery factor (Annual Cost factor) of 0.173423 for new equipment, and 0.31256 for existing equipment.

9. It is assumed that one company will provide telephone service for the entire country and that the price will be based on market pricing for the aggregate market. Population distribution for 169 population centers was based on information gathered by the census files and forms the basis of the analysis. The annual population growth was assumed to be 1%, based on historical trends

Study Details

The table labeled "Study Details" summarizes the detailed results of the market analysis. The assumptions used for the analysis are included in the methodology section. A summary of the results by province is included in this section

.

To conduct the study each population center was evaluated and the demographics characteristics were evaluated. It should be noted what the La Habana Metropolitan Area has 15 population centers (see Ciudad Habana in Summary of Cities and Provinces) and 17 Wire Centers (Telephone Central Offices). Santiago de Cuba also has 2 wire centers within the boundaries. The profitability of telephone equipment is directly related to size and density of the serving

market. Locations with a low density of telephones and smaller size are not as profitable as areas with a high density of service. The detailed list contains a ranking of profitability from 1 most profitable to 169, which is not economically viable.

It is essential to award a bid for the entire island so that companies can cover the risk of serving the lower density markets. This concept generally called "universal service" is essential to any utility where the company must serve unprofitable markets in order to serve highly profitable markets.

The Current Line Demand was estimated based on data obtained from interviews of people who worked in telephone industries on the island and from gathering information from other appropriate sources. The Line Demand in 10 years reflects a 15% aggregate demand in the island distributed based on the parameters described in assumption 1. The 15% of market assumes is for a wired line demand profile, wireless will increment the demand from the 15%.

The current Cubacel service is also described. This service however, is still not targeted to the general population. The current Cuban Cellular network is designed for foreigners who are supplementing the Cuba's government infrastructure by providing investment capital in the island, or for the high government officials and diplomats. Recently, as will be described in the Cubacel section, wireless services has increased to include certain segments of the population.

The economic analysis provides an estimation of the economic value of the existing equipment. This value $410 million (U. S.) recognizes the economic value of the existing franchise. It should be noted that that investing company will be required to have a capital outlay in the range of $1,500 million to fully adequately provide service for the anticipated long term demand of 15%.

If the transition in Cuba is made during the next few years the selected company could possibly reduce the capital outlay for the Island by purchasing used equipment currently available in large supply in the United States due the recent bankruptcy of many small to mid size common carriers.

Equipment from those carriers is currently available at a price much lower than the price of new equipment in some cases as much as 70% lower. The equipment available is state of the art because it was placed during the recent period of phenomenal telecommunications growth, which ended in early 2004.

Details of the other figures included in this study follow.

The Annual Revenues for Existing Equipment Refer to the Sum of Capital and Maintenance Related costs based on the method described in Figure.1. All other categories are consistent with the information described in the methodology section. This table was used to determine the Annual Revenue Requirements (Cost to serve) as well as the Value of Existing Equipment (minimum bid price for the franchise).

Figure 3 depicts the Annual Revenue Requirements (Cost to Serve) from a portion of the Total Market. For example, the top 10% of the market can be served at a cost of approximately $350 per line, while the cost to serve the bottom 10 percent of the market is between $550 and $700 per line. The results captioned in this graph point to the need to award a single franchise for the entire country.

If competition were allowed in the telephone industry, the smaller markets would not be served at all, due to the high cost to serve those markets. In the telephone industry, traditionally the more profitable markets help subsidize the less profitable areas. Figure 4 provides information on rate of return for each of the markets depicted on Figure 5 if we use a common price for all equipment and services in the country (an average price of $427 per access line, which is 60% of the average price, used in the United States.

The chart labeled Summary of Characteristics by Provinces depicts selected data summarized by provinces. This information can be used to provide detailed information summarized by governmental units.

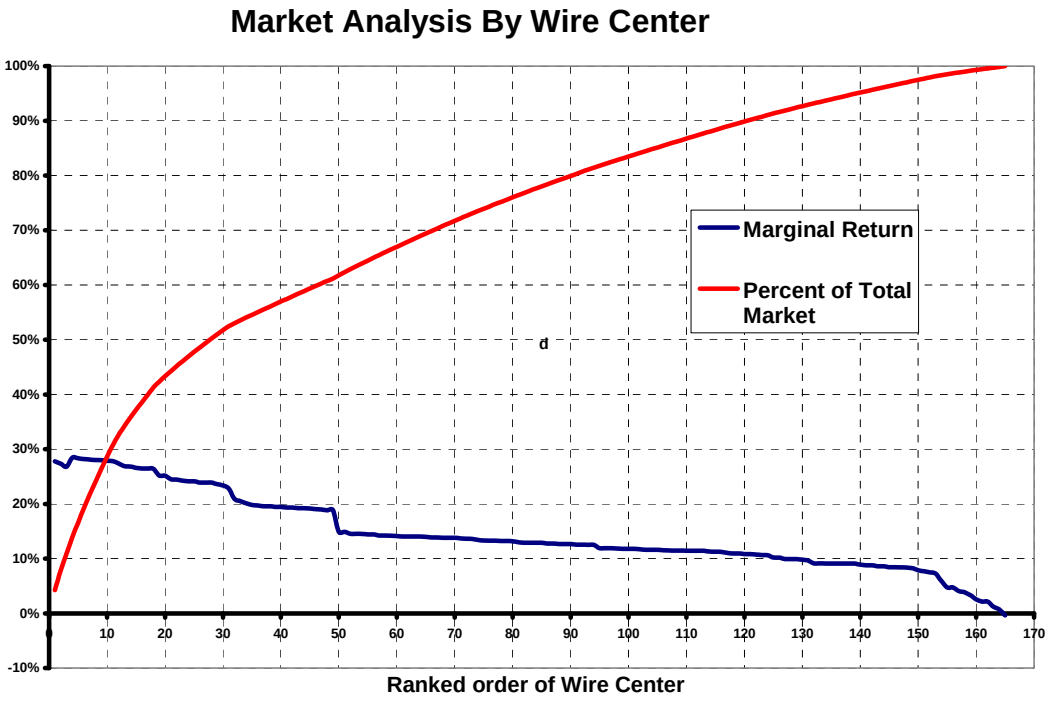


Figure 4

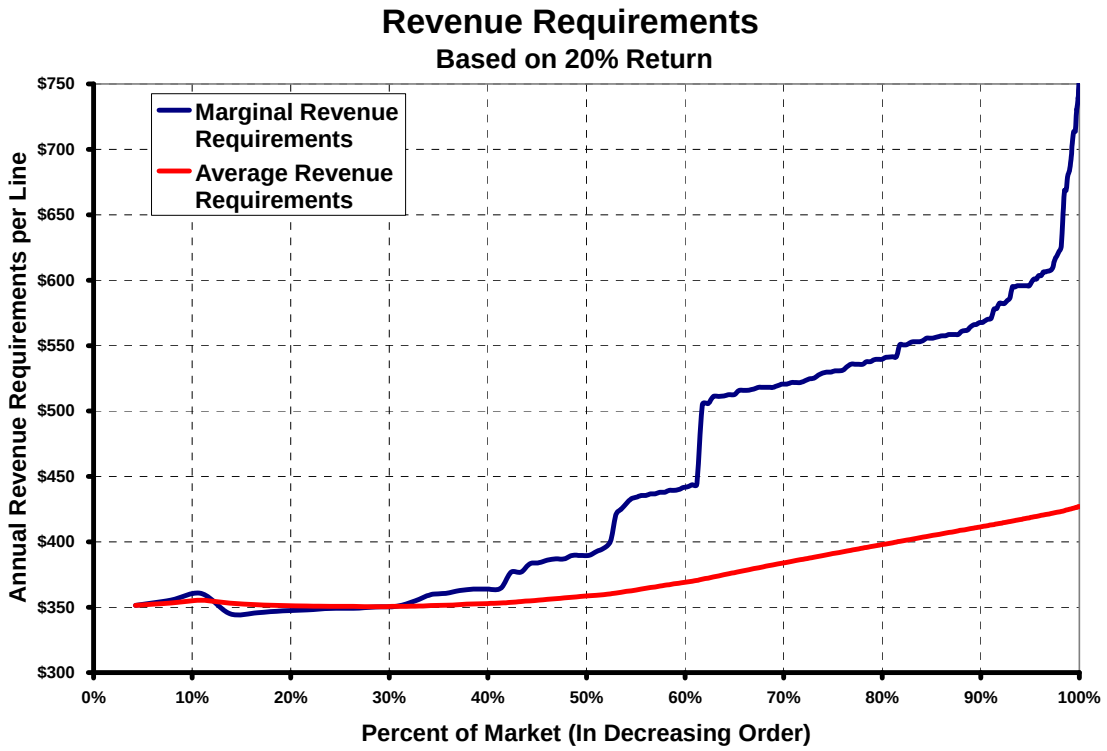


Figure 5

The figure above depicts the cost required to serve a portion of the market. The market is arranged in order of profit. The annual costs assume that the company will earn 20 percent return investment.

STUDY DETAILS BY PROVINCES

Province Name	Population (000)	CURRENT LINE DEMAND (000)	ANNUAL MAINT. EXTG EQ ($000)	ANNUAL COST OF CAPITAL EXTG EQ ($000)	ANNUAL REV REQ EXTG EQ ($000)
Camaguey	788.7	33.7	$12,859	$1,529	$14,388
Ciego De Avila	353.2	14.4	$5,485	$652	$6,137
Cienfuegos	373.6	16.8	$6,397	$760	$7,158
Ciudad Habana	2,548.3	207.6	$79,284	$9,425	$88,709
Granma	780.5	34.7	$13,234	$1,573	$14,807
Guantanamo	526.5	24.3	$9,269	$1,102	$10,371
Holguin	1,040.0	48.2	$18,408	$2,188	$20,596
La Habana	794.6	32.3	$12,340	$1,467	$13,807
Las Tunas	439.0	17.9	$6,818	$810	$7,628
Matanzas	674.3	30.8	$11,748	$1,397	$13,144
Pinar Del Rio	689.7	29.5	$11,281	$1,341	$12,622
Sancti Spiritus	489.9	19.9	$7,608	$904	$8,513
Santiago De Cuba	1,050.0	60.1	$22,943	$2,727	$25,670
Villa Clara	890.5	36.9	$14,083	$1,674	$15,757
Nueva Gerona	60.0	2.4	$932	$111	$1,043
Total	**11,498.8**	**609.4**	**$232,689**	**$27,661**	**$260,350**

Province Name	LINE DEMAND IN 10 YEARS (000)	ANNUAL MAINT. NEW EQ ($000)	ANNUAL COST OF CAPITAL NEW EQ ($000)	ANNUAL REV REQ NEW EQ ($000)	VALUE OF CURRENT EQUIPMENT
Camaguey	127.0	$30,242	$27,002	$57,243	$13,300
Ciego De Avila	46.1	$14,138	$11,176	$25,315	$6,500
Cienfuegos	53.8	$14,709	$12,332	$27,041	$8,100
Ciudad Habana	783.7	$138,471	$138,858	$277,329	$110,200
Granma	111.3	$28,625	$25,535	$54,160	$16,100
Guantanamo	78.0	$19,381	$16,584	$35,965	$9,100
Holguin	154.8	$36,558	$32,367	$68,925	$21,200
La Habana	103.8	$30,563	$25,124	$55,687	$18,500
Las Tunas	57.3	$15,809	$13,207	$29,016	$8,200
Matanzas	98.8	$26,880	$22,296	$49,177	$14,100
Pinar Del Rio	94.9	$26,236	$22,151	$48,387	$1,200
Sancti Spiritus	64.0	$17,139	$14,232	$31,371	$13,500
Santiago De Cuba	192.9	$39,095	$36,302	$75,397	$10,200
Villa Clara	124.6	$30,298	$26,844	$57,142	$23,300
Nueva Gerona	7.8	$2,117	$1,972	$4,089	$15,400
Total	**2,098.8**	**$470,263**	**$425,982**	**$896,245**	**$289,100**

SUMMARY OF CITIES AND PROVINCES

CAMAGUEY
Camaguey
Carlos Manuel De Cespedes
Cubitas
Esmeralda
Florida
Guaimaro
Jimaguayu
Najasa
Niñas
Nuevitas
Santa Cruz del Sur
Sibanicu
Vertientes

CIEGO DE AVILA
Baragua
Bolivia
Chambas
Ciego De Avila
Florencia
Majagua
Moron
Primero de Enero
Venezuela

Cienfuegos
Abreu
Auade de Pasajeros
Cienfuegos
Cruces
Cumanayagua
Lajas
Palmira
Rodas

Ciudad Habana
Arroyo Naranjo
Boyeros
Centro Habana
Cerro
Cotorro
Diez De Octubre
Guanabacoa
Habana Del Este
Habana Vieja
La Lisa
Marianao
Playa
Plaza de la Revolucion
Regla

GRANMA
Bartolome Maso
Bayamo
Buey Arriba
Campechuela
Cauto Cristo
Guisa
Jiguani
Manzanillo
Media Luna
Niquero
Pilon
Rio Cauto
Yara

GUANTANAMO
Baracoa
Caimanera
El Salvador
Guantanamo
Imias
Maisi
Nicento Perez
San Antonio Del Sur
Yeteras

HOLGUIN
Antilla
Baguanos
Banes
Cacocum
Calixto Garcia
Cieto
Frank Pais
Gibara
Holguin
Mayari
Moa
Raael Freyre
Sagua de Tanamo
Urbano Noris

LA HABANA
Alquizar
Artemisa
Batabano
Bejucal
Caimito
Guanajay
Guines
Guira de Melena
Jaruco
Madruga
Mariel
Melena Del Sur
Nueva Paz
Quivacan
San Antonio de los Banos
San Jose de Las Lajas
San Nicolas
Santa Cruz Del Norte

LAS TUNAS
Amancio
Colombia
Jababo
Jesus Menendez
Las Tunas
Majibacoa
Manati
Puerto Padre

MATANZAS
Caliente
Cardenas
Colon
Jaguey Grande
Jovellanos
Limonar
Los Arabos
Marti
Matanzas
Pedro Betancourt
Perico
Playa Larga
Union de Reyes
Varadero

NUEVA GERONA
Nueva Gerona

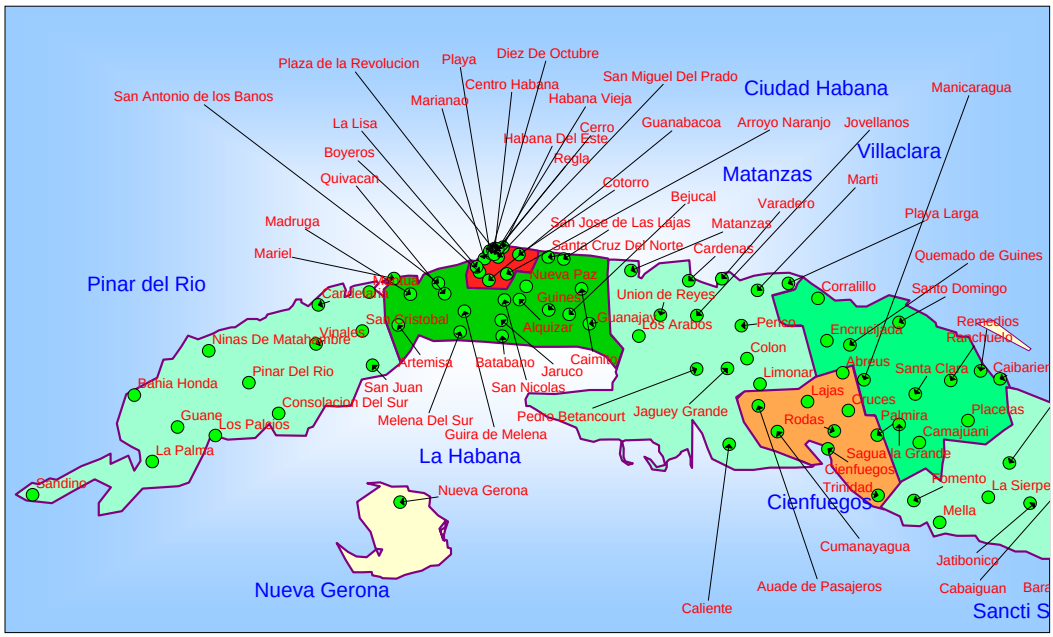
PINAR DEL RIO
Bahia Honda
Candelaria
Consolacion Del Sur
Guane
La Palma
Los Palcios
Mantua
Niñas De Matahambre
Pinar Del Rio
San Cristobal
San Juan
San Luis
Sandino
Viñales

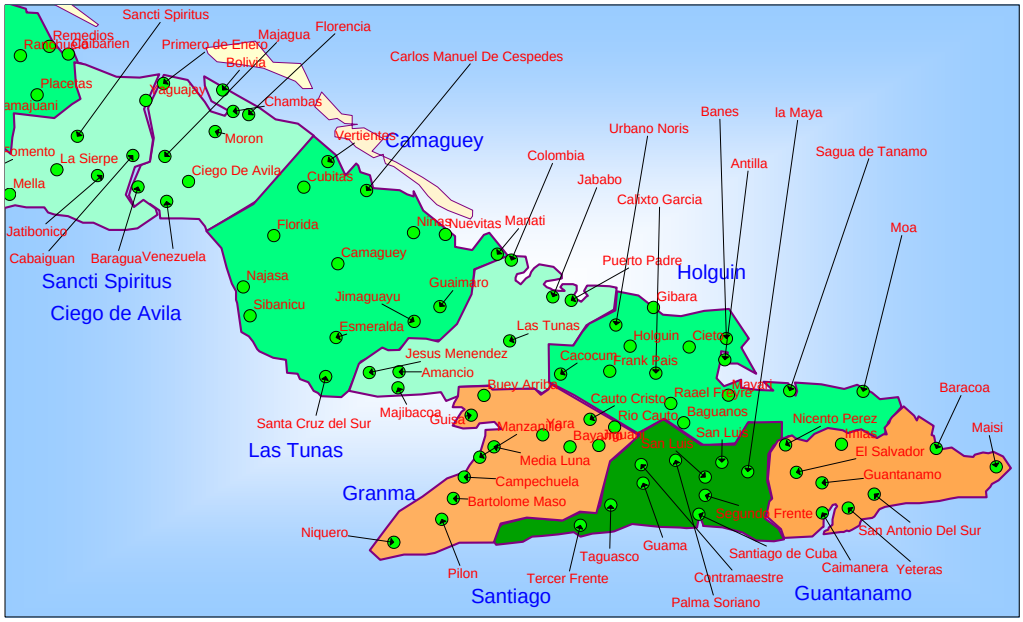
SANCTI SPIRITUS
Cabaiguan
Fomento
La Sierpe
Mella
Sancti Spiritus
Trinidad
Yaguajay
Jatibonico

SANTIAGO de CUBA
Contramaestre
Guama
La Maya
Palma Soriano
San Luis
Santiago de Cuba
Segundo Frente
Taguasco
Tercer Frente

VILLA CLARA
Caibarien
Camajuani
Corralillo
Encrucijada
Manicaragua
Placetas
Quemado de Guines
Ranchuelo
Remedios
Sagua la Grande
Santa Clara
Santo Domingo

POPULATION CENTERS





Sensitivity Analysis

The purpose of this section is to evaluate the impact of changes in conditions from the situation described in the study result section. Although the capital and maintenance costs could vary from the predicted range, the most volatile parameter is the demand for telephone service. The study assumed 15 access lines per 100 population within a ten-year deployment horizon. This section will evaluate the possible impact of different demand parameters. This demand can be further enhanced by a significant wireless market demand that provides higher margins than the traditional wire line business.

The Republic of Cuba currently has 7.3 Access Lines per 100 population, it is highly unlikely that the demand for telephone service within the planning horizon will exceed 20 access lines per 100 population. Therefore, profitability and cost parameters were derived based on the variation of demand between 5.3 and 20 access lines per 100 populations.

The graph labeled "Sensitivity Analysis" depicts the return expected if the price is set based on earning 20 percent for various demand levels (assuming that the demand could vary over the range of 5.3 to 20. Table 1 depicts each of the points on the graph.

As an example if the average revenue per access line is $427 (based on 20% return at 15 Access Lines per 100 Population), and the actual demand is 10 Access Lines per 100 Population the actual return would be 16.90% assuming that Maintenance Costs and Capital Deployment Costs are as expected and that sufficient equipment is purchased to meet the demand of 10 access lines per 100 population.

The graph was generated based on computing the internal rate of return (Using Lotus algorithms) for a variable demand profile using the same distribution of demand described in the assumptions. The total demand for the Island as well as the Total Capital Costs, Maintenance Costs, and Unit Capital and Maintenance Costs are depicted on Table 2.

Table 2 also depicts various other parameters for variable demand. It should be noted that the unit provisioning costs increase as demand decreases. Therefore, profitability is significantly influenced by demand.

The Revenue Requirements (Cost to Consumer) is significantly impacted by demand. For example if the demand does not increase from 5.3 Access Lines per 100 Population (other than growth due to population growth of 2 percent per year), the market price to the consumer would be approximately 30% higher ($555 vs. $427). The graph below depicts price variability.

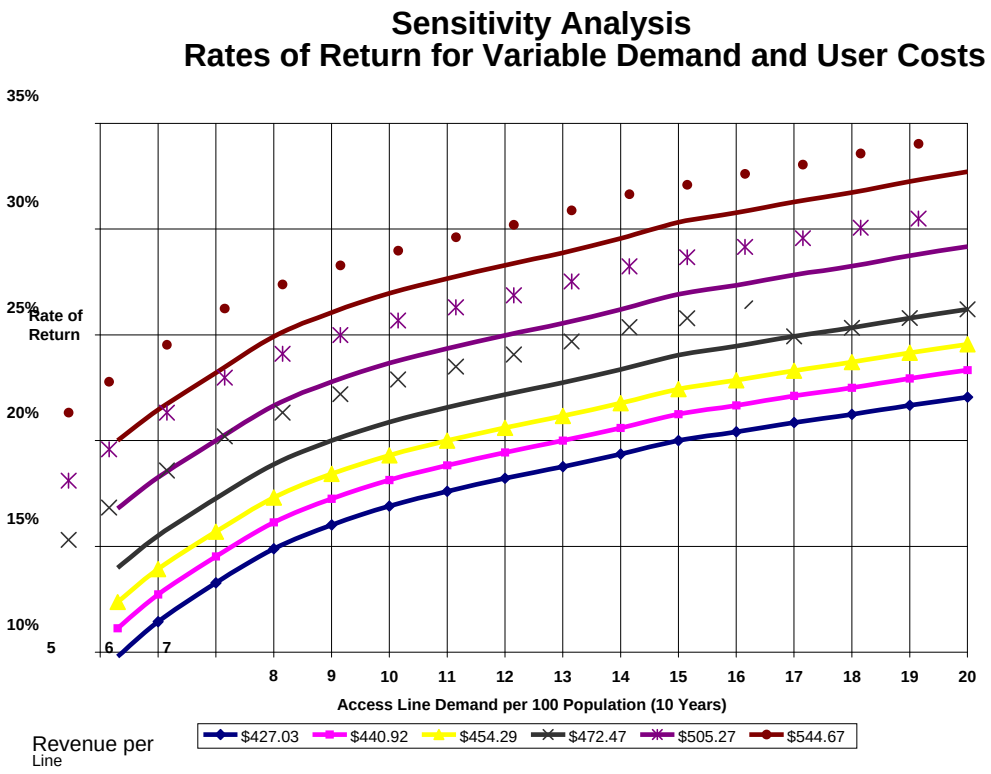


Figure 4

Table 1
Sensitivity Analysis
Summary

Access Lines per 100 Pop. in 10 Y.	Market Price Based on 20% Return	Annual Maintenance. Per Line	Average Cost Per new Line	Total Demand in 10 Years (000)
20	$404.96	$210	$1,125	2,798
19	$408.99	$212	$1,135	2,658
18	$413.54	$215	$1,146	2,519
17	$417.69	$218	$1,154	2,379
16	$422.50	$221	$1,164	2,239
15	$427.03	$224	$1,170	2,099
14	$434.14	$228	$1,189	1,959
13	$440.93	$232	$1,203	1,819
12	$447.27	$237	$1,211	1,679
11	$454.29	$243	$1,218	1,539
10	$462.27	$250	$1,224	1,399
9	$472.47	$259	$1,233	1,25

Table 2

Sensitivity Analysis
Summary

Access Lines per 100 Pop. In 10 Y.	Total Equipment Cost (000)	Total Annual Maintenance (000)	Total Costs	Demand in (000)	Total Growth in Demand 10 Years (000)
20	$3,149,080	$587,112		2,798	2,189
19	$3,017,131	$564,026		2,658	2,049
18	$2,887,215	$540,786		2,519	1,909
17	$2,745,571	$517,375		2,379	1,769
16	$2,606,272	$493,845		2,239	1,629
15	$2,456,314	$470,263		2,099	1,489
14	$2,328,876	$446,537		1,959	1,349
13	$2,188,431	$422,496		1,819	1,210
12	$2,033,373	$398,340		1,679	1,070
11	$1,874,392	$374,126		1,539	930
10	$1,711,956	$349,905		1,399	790
9	$1,552,819	$325,673		1,259	650
8	$1,396,403	$301,365		1,119	510
7	$1,257,711	$276,756		979	370
6	$1,096,183	$251,872		840	230
5.3	$977,605	$234,370		742	132

Demand, Cost, Revenue and Rate of Return

Study Details for 169 Population Centers

(Cities or Subdivisions)

Rk [11]	City	Popu-lation (000)	Current Demand (000)	Ultimate Demand (000)	Rev. Req. Extg Eq. ($000) Annual	Rev. Req. New Eq. ($000) Annual	Existing Equip. ($000) Capital	New Equipment ($000) Capital	Per line Existing Equip Ann. Rev	Revenue per line New Equip.	Rate of Return New Equip.
	TOTALS	**11,498**	**609**	**2,099**	**280,350**	**896,245**	**289,100**	**2,458,312**	**$ 427**	**$ 427**	**20.0%**
135	Abreu	31.0	1.26	4.0	954	2,412	541	6,068	$ 756	$ 596	9.1%
147	Alquizar	28.9	1.18	3.8	931	2,291	511	5,684	$ 792	$ 607	8.4%
89	Amancio	49.0	1.99	6.4	1,148	3,453	798	9,360	$ 576	$ 540	12.6%
165	Antilla	15	0.61	2.0	780	1,487	314	3,143	$ 1,279	$ 759	-0.3%
5	Arroyo Naranjo	221.0	17.33	67.3	4,658	23,293	5,583	68,349	$ 269	$ 346	28.3%
38	Artemisa	83.9	3.41	11.0	1,526	4,772	2,294	11,958	$ 447	$ 436	19.6%
125	Auade de Pasajeros	35.1	1.43	4.6	998	2,649	600	6,818	$ 699	$ 578	10.2%
54	Baguanos	69.0	2.81	9.0	1,365	4,610	1,082	13,017	$ 486	$ 512	14.5%
88	Bahia Honda	49.2	2.00	6.4	1,150	3,465	800	9,396	$ 575	$ 539	12.7%
30	Banes	101.0	5.48	17.6	2,075	6,950	2,017	18,588	$ 379	$ 395	23.4%
32	Baracoa	97.0	3.95	12.7	1,668	5,334	1,481	13,669	$ 423	$ 421	20.9%
132	Baragua	31.2	1.27	4.1	956	2,424	544	6,105	$ 753	$ 595	9.1%
60	Bartolome Maso	64.0	2.60	8.4	1,311	4,321	1,011	12,102	$ 503	$ 517	14.1%
128	Batabano	34.0	1.38	4.4	986	2,586	584	6,617	$ 713	$ 582	9.9%
27	Bayamo	110.0	5.97	19.2	2,205	7,465	2,188	20,156	$ 370	$ 390	23.9%
144	Bejucal	29.5	1.20	3.9	937	2,325	2,520	5,794	$ 781	$ 604	8.6%
159	Bolivia	19	0.77	2.5	824	1,718	370	3,874	$ 1,066	$ 692	3.3%
7	Boyeros	163.0	18.64	59.9	4,924	20,833	6,910	60,861	$ 264	$ 348	28.1%
120	Buey Arriba	38.0	1.55	5.0	1,029	2,817	641	7,348	$ 666	$ 568	10.8%
139	C. Mauel de Cespedes	31.0	1.26	4.0	954	2,412	541	6,068	$ 756	$ 596	9.1%
48	Cabaiguan	78.0	3.17	10.2	1,462	4,519	1,210	11,187	$ 461	$ 444	18.8%
78	Cacocum	54.0	2.20	7.1	1,202	3,742	869	10,274	$ 547	$ 531	13.2%
55	Caibarien	68.0	2.77	8.9	1,354	4,552	1,068	12,834	$ 490	$ 513	14.4%
162	Caimanera	10.5	0.71	2.3	807	1,631	349	3,600	$ 1,135	$ 714	2.1%
98	Caimito	43.4	1.77	5.7	1,088	3,129	718	8,336	$ 616	$ 552	11.8%
117	Caliente	39.0	1.59	5.1	1,040	2,875	655	7,531	$ 656	$ 564	11.1%
57	Calixto Garcia	65.0	2.64	8.5	1,321	4,378	1,025	12,285	$ 500	$ 516	14.2%
8	Camaguey	275.0	12.78	56.8	3,733	19,818	5,446	57,770	$ 292	$ 349	28.0%
39	Camajuani	83.0	3.38	10.8	1,516	4,734	1,281	11,840	$ 449	$ 437	19.5%
66	Campechuela	61.0	2.48	8.0	1,278	4,147	968	11,554	$ 515	$ 521	13.9%
158	Candelaria	19.7	0.80	2.6	831	1,759	380	4,002	$ 1,038	$ 684	3.9%
34	Cardenas	89.0	3.62	11.6	1,581	4,991	2,367	12,624	$ 437	$ 429	20.1%
156	Cauto Cristo	21	0.85	2.7	845	1,834	399	4,240	$ 990	$ 669	4.7%
4	Centro Habana	232.0	18.20	70.7	4,833	24,393	6,799	71,702	$ 266	$ 345	28.4%
11	Cerro	171.6	13.46	52.3	3,870	18,348	4,615	53,295	$ 288	$ 351	27.8%
94	Chambas	48.0	1.95	6.3	1,137	3,395	783	9,177	$ 583	$ 542	12.5%
40	Ciego De Avila	83.0	3.38	10.8	1,516	4,734	2,281	11,840	$ 449	$ 437	19.5%
25	Cienfuegos	115.0	6.24	20.0	2,277	7,751	4,283	21,026	$ 365	$ 387	24.2%
83	Cieto	51.0	2.07	6.7	1,170	3,569	826	9,725	$ 564	$ 536	12.9%
121	Colombia	38.0	1.55	5.0	1,029	2,817	641	7,348	$ 666	$ 568	10.8%
49	Colon	78.0	3.17	10.2	1,462	4,519	1,210	11,187	$ 461	$ 444	18.8%
44	Consolacion Del Sur	81.0	3.29	10.6	1,494	4,648	1,253	11,579	$ 454	$ 439	19.2%
23	Contramaestre	117.0	6.34	20.4	2,306	7,865	2,321	21,375	$ 363	$ 386	24.3%
138	Corralillo	31.0	1.26	4.0	954	2,412	541	6,068	$ 756	$ 596	9.1%
21	Cotorro	70.2	5.51	21.4	2,083	8,199	2,027	22,393	$ 378	$ 383	24.5%
115	Cruces	40.0	1.63	5.2	1,051	2,933	669	7,714	$ 646	$ 561	11.2%
161	Cubitas	17.5	0.71	2.3	807	1,631	349	3,600	$ 1,135	$ 714	2.1%
82	Cumanayagua	51.0	2.07	6.7	1,170	3,569	826	9,725	$ 564	$ 536	12.9%
1	Diez De Octubre	335.0	26.27	102.1	7,609	35,876	10,069	104,091	$ 290	$ 351	27.8%

[11] Rank refers to profitability to serve the market. Numbers are 1 to 169 with 1 as the highest Rate of Return. All Population Centers in "La Habana are listed by Geographic Subdivision Ex: Diez De Octubre, Centro Habana, etc.

Rk [11]	City	Popu-lation (000)	Current Demand (000)	Ultimate Demand (000)	Rev. Req. Extg Eq. ($000) Annual	Rev. Req. New Eq. ($000) Annual	Existing Equip. ($000) Capital	New Equipment ($000) Capital	Per line Existing Equip Ann. Rev	Revenue per line New Equip.	Rate of Return New Equip.
61	El Salvador	63.0	2.56	8.2	1,300	4,263	997	11,919	$ 507	$ 518	14.1%
101	Encrucijada	43.0	1.75	5.6	1,083	3,106	712	8,263	$ 619	$ 553	11.8%
124	Esmeralda	37.0	1.50	4.8	1,018	2,759	627	7,165	$ 677	$ 571	10.6%
150	Florencia	27.5	1.12	3.6	916	2,210	491	5,428	$ 819	$ 615	7.9%
35	Florida	86.0	3.50	11.2	1,549	4,862	1,324	12,232	$ 443	$ 433	19.8%
85	Fomento	51.0	2.07	6.7	1,170	3,569	826	9,725	$ 564	$ 536	12.9%
126	Frank Pais	35.0	1.42	4.6	997	2,643	598	6,800	$ 700	$ 578	10.2%
45	Gibara	80.5	3.27	10.5	1,489	4,626	1,246	11,514	$ 455	$ 440	19.2%
62	Guaimaro	63.0	2.56	8.2	1,300	4,263	997	11,919	$ 507	$ 518	14.1%
96	Guama	44.0	1.79	5.7	1,094	3,164	726	8,445	$ 611	$ 551	11.9%
14	Guanabacoa	120.0	9.41	36.6	3,122	13,184	5,394	37,570	$ 332	$ 361	26.8%
107	Guanajay	41.5	1.69	5.4	1,067	3,019	691	7,988	$ 632	$ 557	11.5%
102	Guane	42.7	1.74	5.6	1,080	3,089	708	8,208	$ 622	$ 554	11.7%
17	Guantanamo	190.0	10.30	33.1	3,228	12,040	5,826	34,087	$ 313	$ 364	26.5%
36	Guines	85.0	3.46	11.1	1,538	4,819	2,310	12,102	$ 445	$ 434	19.7%
106	Guira de Melena	41.7	1.70	5.4	1,069	3,031	694	8,025	$ 630	$ 557	11.6%
72	Guisa	58.0	2.36	7.6	1,246	3,974	926	11,005	$ 528	$ 525	13.6%
16	Habana Del Este	107.0	10.30	33.1	3,228	12,040	4,826	34,087	$ 313	$ 364	26.5%
12	Habana Vieja	145.5	11.41	44.3	3,454	15,736	6,103	45,341	$ 303	$ 355	27.4%
15	Holguin	196.0	10.63	34.1	3,294	12,383	4,907	35,132	$ 310	$ 363	26.6%
134	Imias	31.0	1.26	4.0	954	2,412	541	6,068	$ 756	$ 596	9.1%
71	Jababo	59.0	2.40	7.7	1,256	4,031	940	11,188	$ 524	$ 523	13.7%
86	Jaguey Grande	50.0	2.03	6.5	1,159	3,511	812	9,542	$ 570	$ 538	12.8%
109	Jaruco	41.3	1.68	5.4	1,065	3,008	688	7,952	$ 634	$ 558	11.5%
81	Jatibonico	52.0	2.11	6.8	1,181	3,627	840	9,908	$ 558	$ 534	13.0%
93	Jesus Menendez		1.95	6.3	1,137	3,395	783	9,177	$ 583	$ 542	12.5%
63	Jiguani	63.0	2.56	8.2	1,300	4,263	997	11,919	$ 507	$ 518	14.1%
164	Jimaguayu	16	0.65	2.1	791	1,545	328	3,326	$ 1,216	$ 739	0.7%
64	Jovellanos	63.0	2.56	8.2	1,300	4,263	997	11,919	$ 507	$ 518	14.1%
13	La Lisa	123.5	9.69	37.6	3,195	13,534	5,490	38,636	$ 330	$ 360	26.9%
24	la Maya	115.0	6.24	20.0	2,277	7,751	2,283	21,026	$ 365	$ 387	24.2%
119	La Palma	38.4	1.56	5.0	1,034	2,840	647	7,421	$ 662	$ 566	10.9%
160	La Sierpe	18	0.73	2.4	813	1,660	356	3,691	$ 1,110	$ 706	2.6%
145	Lajas	29.0	1.18	3.8	932	2,296	513	5,703	$ 790	$ 606	8.4%
42	Las Tunas	82.0	3.34	10.7	1,505	4,691	3,267	11,710	$ 451	$ 438	19.3%
154	Limonar	23.1	0.94	3.0	868	1,955	429	4,624	$ 924	$ 648	5.9%
148	Los Arabos	28.8	1.17	3.8	930	2,285	510	5,666	$ 794	$ 607	8.4%
104	Los Palcios	42.0	1.71	5.5	1,073	3,048	1,698	8,080	$ 628	$ 556	11.6%
108	Madruga	41.3	1.68	5.4	1,065	3,008	688	7,952	$ 634	$ 558	11.5%
105	Maisi	42.0	1.71	5.5	1,073	3,048	698	8,080	$ 628	$ 556	11.6%
143	Majagua	29.5	1.20	3.9	937	2,325	520	5,794	$ 781	$ 604	8.6%
110	Majibacoa	41.0	1.67	5.4	1,062	2,990	684	7,897	$ 637	$ 558	11.4%
113	Manati	41.0	1.67	5.4	1,062	2,990	684	7,897	$ 637	$ 558	11.4%
37	Manicaragua	84.0	3.42	11.0	1,527	4,777	1,296	11,971	$ 447	$ 435	19.6%
133	Mantua	31.2	1.27	4.1	956	2,424	544	6,105	$ 753	$ 595	9.1%
29	Manzanillo	105.0	5.69	18.3	2,133	7,179	2,093	19,285	$ 375	$ 393	23.6%
10	Marianao	177.0	13.88	53.9	3,956	18,889	6,721	54,940	$ 285	$ 350	27.9%
92	Mariel	48.2	1.96	6.3	1,140	3,407	2,786	9,213	$ 581	$ 541	12.5%
140	Marti	30.4	1.24	4.0	947	2,377	533	5,959	$ 766	$ 599	8.9%
22	Matanzas	121.0	6.56	21.1	2,364	8,094	4,397	22,071	$ 360	$ 384	24.4%
20	Mayari	139.0	7.54	24.2	2,623	9,123	2,738	25,206	$ 348	$ 377	25.2%
90	Media Luna	49.0	1.99	6.4	1,148	3,453	798	9,360	$ 576	$ 540	12.6%
152	Melena Del Sur	26.5	1.08	3.5	905	2,152	477	5,245	$ 840	$ 622	7.5%
137	Mella	31.0	1.26	4.0	954	2,412	541	6,068	$ 756	$ 596	9.1%
112	Moa	41.0	1.67	5.4	1,062	2,990	1,684	7,897	$ 637	$ 558	11.4%
74	Moron	56.0	2.28	7.3	1,224	3,858	897	10,640	$ 537	$ 527	13.4%
163	Najasa	16.5	0.67	2.2	797	1,574	335	3,417	$ 1,187	$ 730	1.2%
155	Nicento Perez	21.0	0.85	2.7	845	1,834	399	4,240	$ 990	$ 669	4.7%
114	Ninas	40.2	1.63	5.3	1,053	2,944	672	7,751	$ 644	$ 561	11.3%

Rk [11]	City	Popu-lation (000)	Current Demand (000)	Ultimate Demand (000)	Rev. Req. Extg Eq. ($000) Annual	Rev. Req. New Eq. ($000) Annual	Existing Equip. ($000) Capital	New Equipment ($000) Capital	Per line Existing Equip Ann. Rev	Revenue per line New Equip.	Rate of Return New Equip.
97	Ninas De Matahambre	43.9	1.79	5.7	1,093	3,159	725	8,431	$ 612	$ 551	11.9%
84	Niquero	51.0	2.07	6.7	1,170	3,569	1,826	9,725	$ 564	$ 536	12.9%
68	Nueva Gerona	60.0	2.44	7.8	1,267	4,089	1,954	11,371	$ 519	$ 522	13.8%
151	Nueva Paz	27.0	1.10	3.5	910	2,181	484	5,337	$ 829	$ 618	7.7%
99	Nuevitas	43.0	1.75	5.6	1,083	3,106	2,712	8,263	$ 619	$ 553	11.8%
19	Palma Soriano	140.0	7.59	24.4	2,638	9,180	4,757	25,380	$ 347	$ 377	25.2%
127	Palmira	34.0	1.38	4.4	986	2,586	584	6,617	$ 713	$ 582	9.9%
122	Pedro Betancourt	37.5	1.53	4.9	1,024	2,788	634	7,257	$ 671	$ 569	10.7%
131	Perico	33.0	1.34	4.3	975	2,528	570	6,434	$ 727	$ 586	9.7%
95	Pilon	44.0	1.79	5.7	1,094	3,164	726	8,445	$ 611	$ 551	11.9%
26	Pinar Del Rio	110.0	5.97	19.2	2,205	7,465	4,188	20,156	$ 370	$ 390	23.9%
33	Placetas	93.0	3.78	12.1	1,624	5,163	2,424	13,146	$ 429	$ 425	20.5%
3	Playa	239.2	18.76	72.9	6,227	26,288	10,766	74,896	$ 332	$ 361	26.8%
157	Playa Larga	12	0.81	2.6	835	1,776	385	4,057	$ 1,026	$ 680	4.1%
6	Plaza de la Revolucion	205.0	16.08	62.5	4,403	21,691	10,270	63,473	$ 274	$ 347	28.2%
142	Primero de Enero	30.0	1.22	3.9	943	2,354	1,527	5,885	$ 773	$ 601	8.8%
43	Puerto Padre	81.0	3.29	10.6	1,494	4,648	2,253	11,579	$ 454	$ 439	19.2%
149	Quemado de Guines	28.5	1.16	3.7	926	2,268	1,506	5,611	$ 799	$ 609	8.3%
130	Quivacan	33.5	1.36	4.4	981	2,557	577	6,525	$ 720	$ 584	9.8%
70	Raael Freyre	60.0	2.44	7.8	1,267	4,089	954	11,371	$ 519	$ 522	13.8%
50	Ranchuelo	76.0	3.09	9.9	1,440	5,015	2,182	14,297	$ 466	$ 505	14.9%
31	Regla	53.3	4.18	16.2	1,730	6,508	2,563	17,243	$ 414	$ 401	22.8%
67	Remedios	61.0	2.48	8.0	1,278	4,147	968	11,554	$ 515	$ 521	13.9%
77	Rio Cauto	54.5	2.22	7.1	1,208	3,771	876	10,365	$ 545	$ 530	13.3%
118	Rodas	38.5	1.57	5.0	1,035	2,846	648	7,440	$ 661	$ 566	11.0%
80	S. Antonio de los Banos	53.6	2.18	7.0	1,198	3,719	863	10,201	$ 550	$ 531	13.2%
47	Sagua de Tanamo	79.0	3.21	10.3	1,473	4,562	2,225	11,318	$ 458	$ 442	19.0%
56	Sagua la Grande	68.0	2.77	8.9	1,354	4,552	1,068	12,834	$ 490	$ 513	14.4%
111	San Antonio Del Sur	41.0	1.67	5.4	1,062	2,990	684	7,897	$ 637	$ 558	11.4%
59	San Cristobal	64.8	2.64	8.5	1,319	4,367	2,022	12,249	$ 501	$ 516	14.2%
52	San Jose de Las Lajas	69.5	2.83	9.1	1,370	4,639	1,089	13,108	$ 485	$ 511	14.5%
73	San Juan	57.6	2.34	7.5	1,241	3,950	920	10,932	$ 530	$ 525	13.6%
28	San Luis	110.0	5.97	19.2	2,205	7,465	3,188	20,156	$ 370	$ 390	23.9%
123	San Luis	37.2	1.51	4.9	1,021	2,771	630	7,202	$ 675	$ 570	10.7%
9	San Miguel Del Prado	185.0	14.51	56.4	4,084	19,689	4,877	57,378	$ 281	$ 349	28.0%
153	San Nicolas	26.0	1.06	3.4	899	2,123	470	5,154	$ 851	$ 625	7.3%
41	Sancti Spiritus	82.0	3.34	10.7	1,505	4,691	2,267	11,710	$ 451	$ 438	19.3%
103	Sandino	42.0	1.71	5.5	1,073	3,048	1,698	8,080	$ 628	$ 556	11.6%
18	Santa Clara	190.0	8.39	32.6	2,851	11,883	5,037	33,608	$ 340	$ 364	26.4%
116	Santa Cruz Del Norte	39.8	1.62	5.2	1,049	2,921	667	7,677	$ 648	$ 562	11.2%
53	Santa Cruz del Sur	69.5	2.83	9.1	1,370	4,639	1,089	13,108	$ 485	$ 511	14.5%
2	Santiago de Cuba	400.0	27.11	87.1	7,780	30,943	8,278	89,071	$ 287	$ 355	27.3%
58	Santo Domingo	65.0	2.64	8.5	1,321	4,378	1,025	12,285	$ 500	$ 516	14.2%
87	Segundo Frente	50.0	2.03	6.5	1,159	3,511	812	9,542	$ 570	$ 538	12.8%
129	Sibanicu	34.0	1.38	4.4	986	2,586	584	6,617	$ 713	$ 582	9.9%
79	Taguasco	54.0	2.20	7.1	1,202	3,742	869	10,274	$ 547	$ 531	13.2%
100	Tercer Frente	43.0	1.75	5.6	1,083	3,106	712	8,263	$ 619	$ 553	11.8%
46	Trinidad	79.5	3.23	10.4	1,478	4,584	1,232	11,383	$ 457	$ 441	19.0%
75	Union de Reyes	55.0	2.24	7.2	1,213	3,800	883	10,457	$ 542	$ 529	13.3%
76	Urbano Noris	54.5	2.22	7.1	1,208	3,771	876	10,365	$ 545	$ 530	13.3%
91	Varadero	14.5	1.97	6.3	1,141	3,415	1,893	9,238	$ 580	$ 541	12.6%
146	Venezuela	29.0	1.18	3.8	932	2,296	513	5,703	$ 790	$ 606	8.4%
69	Vertientes	60.0	2.44	7.8	1,267	4,089	954	11,371	$ 519	$ 522	13.8%
141	Vinales	30.0	1.22	3.9	943	2,354	527	5,885	$ 773	$ 601	8.8%
51	Yaguajay	75.4	3.07	9.8	1,434	4,980	1,173	14,187	$ 468	$ 506	14.9%
65	Yara	62.0	2.52	8.1	1,289	4,205	983	11,737	$ 511	$ 519	14.0%
135	Yeteras	31.0	1.26	4.0	954	2,412	541	6,068	$ 756	$ 596	9.1%

Telephone System Configuration

TABLE 3

ETECSA OVERALL INFRASTRUCTURE

SYSTEM COMPOSITION	2003	2004	2005	2006	2007	2008
Total Central Offices	523	502	505	505	506	506
Digital CO	186	214	275	313	354	354
Public Phones	25,242	28,605	34,571	40,358	44,126	50,530
Total Telegraphic Central Offices	14	8	4	4	4	4
Telex Telegraphic lines	1,372	1,673	486	486	486	486
Total telephone lines (1)	865,136	897,122	934,999	982,801	999,490	1,033,565
Digital lines	698,167	765,387	839,590	905,516	947,639	987,978
% Digital lines	80.9	85.3	89.8	92.2	94.9	95.6
Total telephone lines including wireless, and TFA(2)	819,823	841,135	988,015	1,113,318	1,253,370	1,419,825
Residential lines	495,476	534,862	572,885	701,356	758,051	778,709
Lines per 100 persons(Including wireless)	6.4	6.8	7.6	7.7	8.2	8.5

(1) Only wired telephones
(2) TFA=Telefonia Fija Alternativa(Alternative telephony service, Hybrid)

Digital telephony is the use of digital electronics in the provision of digital telephone services and systems. Since the 1960s a digital core network has almost entirely replaced the old analog system, and much of the access network has also been digitized. Digital telephony was introduced to provide voice services at lower cost, but was then found to be of great value to new network services such as ISDN that could use digital facilities to transfer data speedily over telephone lines. It was not until late 1990s that ETECSA started introducing digital telephony, and fiber optics in Cuba's telephone system. ETECSA has invested US$15 millions to improve the company's fixed-line infrastructure (fiber optic) in the last 5 years.

TFA is similar to a wired phone, but it is like a hybrid, because it allows communication as a cel phone. Its use is supposedly for remote places or rural areas. It works with batteries or an AC-CD power supply. They are used with cellular cards, and even though they use the cell grid, the payment is not on CUC, but pesos.

TABLE 4
ETECSA INTERNATIONAL TELEPHONE SERVICE INDICATORS

Indicator	2003	2004	2005	2006	2007	2008
Total International Traffic, Mmin	308,789.5	323,114.8	344,597.2	375,016.9	406,950.0	418,904.0
Incoming	282,304.8	295,999.9	314,635.2	344,140.5	377,980.0	388,723.0
Outgoing	19,814.3	21,260.0	24,531.8	26,017.7	24,560.0	25,937.0
Collect	6,670.4	5,584.9	5,430.2	4,858.7	4,410.0	4,244.0
Telephone Circuits, Units	2,500	2,795	2,912	3,594	3,840	3,832

TABLE 5
ETECSA INVESTMENT IN THE TELECOMMUNICATIONS INFRASTRUTURE
Million pesos

AREA	2003	2004	2005	2006	2007	2008
Total	156.3	121.5	103.0	177.0	211.5	158.5
Construction and Assembly	33.1	36.9	29.7	76.0	91.1	29.3
Equipment	117.0	74.4	69.3	90.0	112.7	123.2
Other	6.2	10.2	4.0	11.0	7.7	6.0

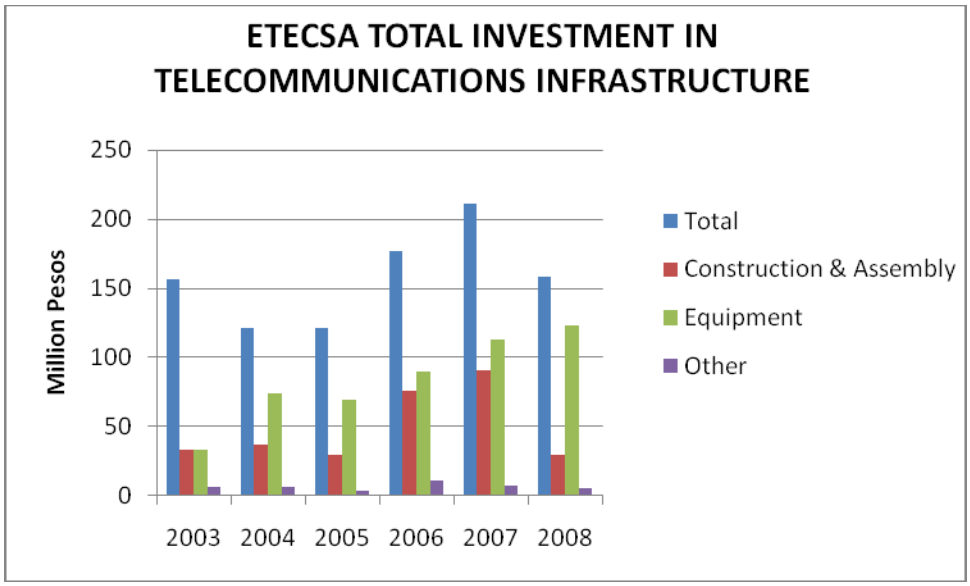


Figure 7

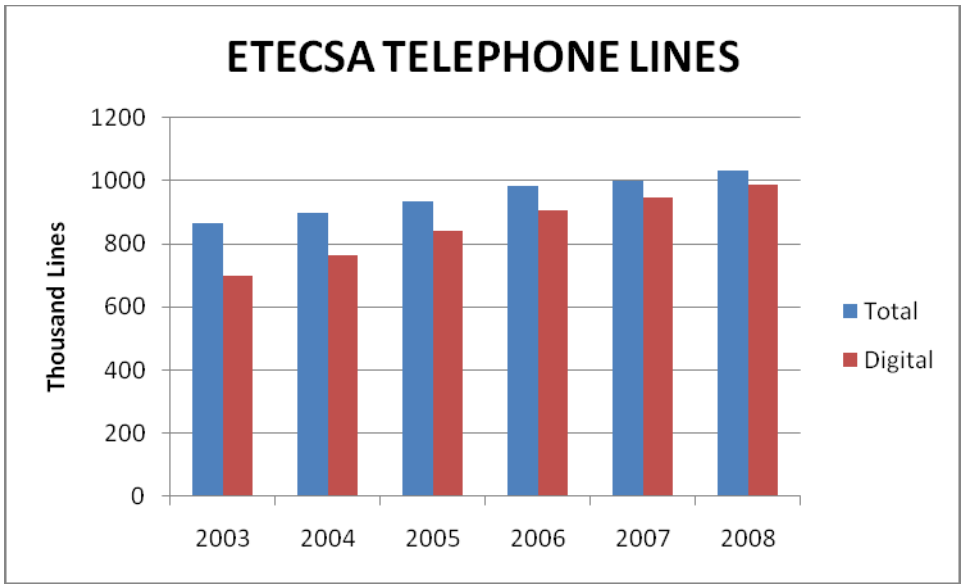


Figure 8

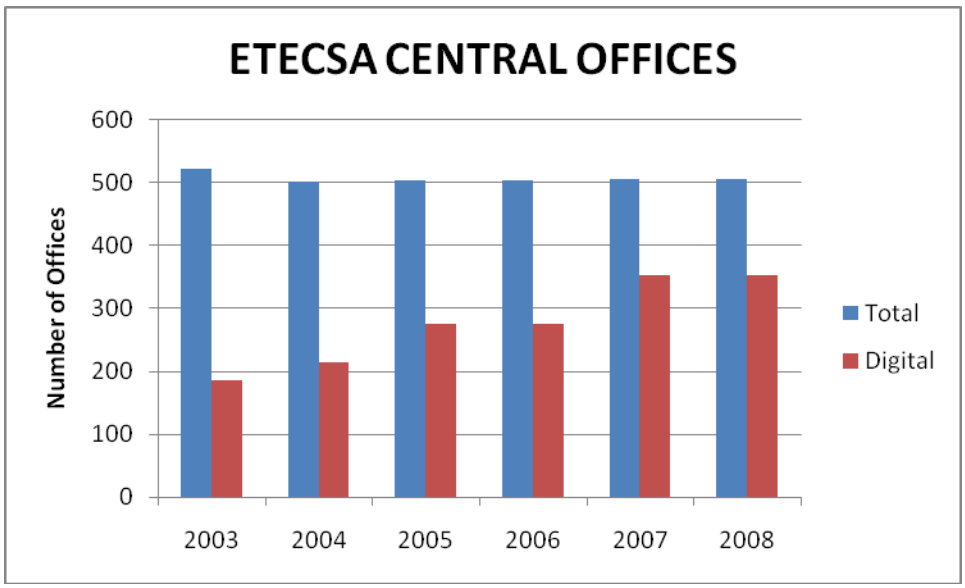
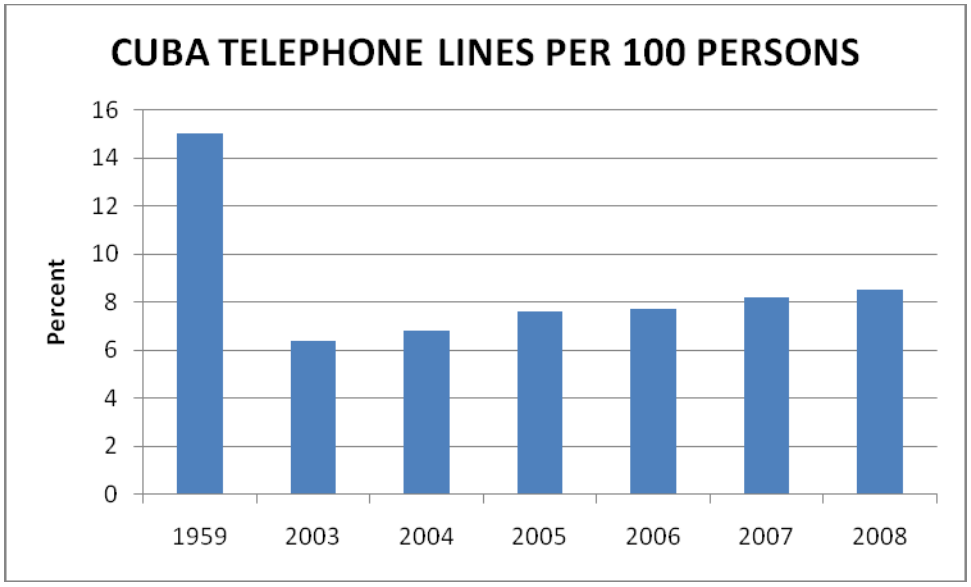


Figure 9



Note: 2003-2008 include Wireless

Figure 10

SUMMARY OF WIREDTELEPHONE SYSTEM

VALUE OF EXISTING EQUIPMENT	$289,100,000
10 YEAR AFTER TRANSITION CAPITAL REQUIREMENTS	$446,312,000
AVERAGE ANNUAL REVENUE REQUIREMENTS PER LINE (Annual Cost per line to Customer)	$427
RATE OF RETURN	20.00%
CURRENT ACCESS LINE DEMAND	609,400
ACCESS LINES PER 100 POPULATION CURRENTLY	7.3
ESTIMATED ACCESS LINE DEMAND 10 YEARS AFTER TRANSITION	2,098,800
ACCESS LINES PER 100 POPULATION AFTER TRANSITION FOR 10 YEARS	15

Privatization Potential

Several assumptions of a socio-political nature were made throughout the study to increase the attractiveness of a privatized communications enterprise in a democratic Cuba.

First, it was assumed that the new private company would not be saddled with the economic burden of offering universal service. Initially, telephone service would only be provided to towns with a population of 2,000 and higher. Individual farms will not be provided with telephone service. With wireless communications technology, it should become profitable to offer telephone service to the smallest towns and farms.

Second, it was assumed that telephone service would be priced at a level, which will cover the higher risk of capital investment. a (20% rate of return, compared to a risk of around 14% in the United States). In many countries in the underdeveloped world, telephone service is artificially priced low at a level, which does allow for recovering the investment in new equipment.

The result of this short-sighted policy is that, although telephone service can be afforded by more people, it is not available due to the artificially low price and potential subscribers have to wait for years to obtain a telephone line. A better solution would be to allow poor people access to telephone service by low priced public phones. These telephones would provide a minimum

level of service to the lower economic strata. Satellite or cellular public phones could be used in rural areas where the cost of providing a cable infrastructure is higher than the cellular cost.

Third, because Cuba is a relatively small market, an exclusive long-term (20 years) telephone franchise should be awarded to the highest bidder. This should include all local exchange communication services and domestic long distance as well. The revenues from the highly profitable long distance and cellular services could be used to subsidize to some extent local telephone service. It is assumed that competition in the highly profitable international long distance service will best serve the subscribers. However, including this service in the exclusive franchise could be negotiated. Monopoly rates should be regulated and some form of incentive regulation should be used to ensure efficiency.

Latin America and Cuba Comparison

In the LAC region, telecom infrastructure varies from nonexistent to rudimentary, and from adequate to well advanced. Despite a low 18% teledensity, fixed-line growth in most LAC countries has stagnated since 2001. Operators have reached their service goals for line installation, and consumers increasingly favor mobile over fixed-line. There is, however, a growing demand for high-speed data services, and fixed-line operators are looking to ADSL services to increase their revenue potential. A number of fixed-line companies have introduced prepaid voice services in order to reduce payment defaults. Nevertheless, the fixed line market is likely to remain in its present stagnant condition, not helped by the global recession.

The roll out of fiber optic networks continues to grow in Latin America, driven by the explosion of the mobile markets, the increase in broadband access, and the growth of IP-based services. There has, however, been hardly any activity in terms of FTTH deployments.

Most telecom markets in Latin America have been both privatized and liberalized. Those that are still monopolies are striving towards an open market, but the privatization trend has been reversed. Two countries, Venezuela and Bolivia, have renationalized their telecom incumbents, while other countries where the main telco is still state-owned have shown no interest in selling it to the private market.

When it comes to fixed lines, it is not easy for new entrants to roll out a network that can compete with the incumbents. Even with the deployment of alternative technologies, in most countries the historical telecom operators continue to dominate the basic telephony sector. Nevertheless, their market share is being eroded in a few countries, especially thanks to WLL, WiMAX, and triple play (voice, data, video) solutions offered by cable TV companies.

Latin America's largest fixed-line operator in terms of lines in service is Telmex, founded and controlled by Mexican billionaire Carlos Slim. In terms of revenue, Brazil's Telesp, owned by Telefónica, is in the lead. The second place, both in terms of fixed lines and revenue, is occupied by Brazilian Oi (Telemar).

The main international companies operating in Latin America are Telefónica and Telmex. Telefónica dominates the fixed-line market in several countries, while Telmex is the market leader only in Mexico but has operations throughout the region. Telmex's sister company América Móvil also competes with Telefónica in most of Latin America's mobile markets, and sometimes also in the fixed-line sector.

Top 10 fixed-line operators by lines in service - 2007 - 2008

Operator	Country	2007	2008	Annual change
		Fixed lines in service (million)		
Telmex (Mexico only)	Mexico	17.80	17.59	-1.2%
Oi	Brazil	14.22	13.94	-2.0%
Telesp (Telefónica)	Brazil	11.97	11.66	-2.5%
Brasil Telecom	Brazil	8.03	8.13	+1.2%
CANTV	Venezuela	4.25	5.06	+19.1%
TASA (Telefónica)	Argentina	4.68	4.60	-1.7%
Telecom Argentina	Argentina	4.21	4.30	+2.2%
TdP (Telefónica)	Peru	2.84	2.99	+5.0%
Colombia Telecom	Colombia	2.33	2.30	-1.3%
CTC (Telefónica)	Chile	2.17	2.12	-2.4%

Key highlights:

Argentina

Argentina has adopted a single license for all telecom services (Licencia Única), including fixed and mobile telephony, Internet access, data communications, and value added services. Argentina's long-distance market is highly competitive, but in the basic telephony sector, meaningful competition has yet to develop. Two regional incumbents, Telefónica de Argentina and Telecom Argentina, dominate the local fixed-line infrastructure. Telecom Argentina is under cross-holding scrutiny since rival operator Telefónica acquired a stake in its parent company, Telecom Italia.

Brazil

The bulk of Brazil's fixed-line network is divided between Telefónica's Telesp and locally owned Oi, which is in the process of taking over the third incumbent, Brasil Telecom. América Móvil's Embratel is the long-distance domestic and international telecom incumbent. The government authorised the merger of Oi and Brasil Telecom as a way of creating a strong national player able to compete with foreign-owned giants América Móvil and Telefónica, which would otherwise dominate the Brazilian fixed, mobile, and broadband markets.

Mexico

With the opening of the telecom market, numerous new entrants were licensed to provide services in Mexico. Nevertheless, Telmex still dominates the fixed-line market with around 90% of lines, maintaining a stranglehold over the country's last mile infrastructure. In fact, Mexico remains the last country in the OECD yet to unbundle its local loop. In mid-2008, Telmex spun off its international operations, keeping the lion's share of the company's debt and releasing its international operations from its domestic operations. Telmex reported a decline in revenues for the year ending December 2008 due to poor performance in voice services. It enjoyed robust growth, on the other hand, in its Internet segment, and in particular from data related services.

Top 10 Latin American countries for fixed lines in service – 2004; 2008

Year	2004	2008	Annual change	Teledensity
	Fixed lines in service (million)		2007/08	2008
Brazil	39.60	40.45	+3.0%	21.0%
Mexico	18.07	20.54	+4.0%	19.2%
Argentina	8.76	9.89	+4.9%	24.9%
Colombia	7.42	7.91	-0.9%	16.5%
Venezuela	3.35	5.90	+16.0%	21.2%
Chile	3.26	3.45	+1.3%	20.5%
Peru	2.05	2.81	+5.2%	9.7%
Ecuador	1.59	1.89	+4.6%	13.7%
Costa Rica	1.34	1.48	+2.9%	32.5%
Guatemala	1.13	1.44	+1.6%	10.5%

Fiber Optics Channels

The process of communicating using fiber-optics involves the following basic steps: Creating the optical signal involving the use of a transmitter, relaying the signal along the fiber, ensuring that the signal does not become too distorted or weak, receiving the optical signal, and converting it into an electrical signal.

Optical fiber is used by many telecommunications companies to transmit telephone signals, Internet communication, and cable television signals. Due to much lower attenuation and interference, optical fiber has large advantages over existing copper wire in long-distance and high-demand applications. However, infrastructure development within cities was relatively difficult and time-consuming, and fiber-optic systems were complex and expensive to install and operate. Due to these difficulties, fiber-optic communication systems have primarily been installed in long-distance applications, where they can be used to their full transmission capacity, offsetting the increased cost. Since 2000, the prices for fiber-optic communications have dropped considerably. The price for rolling out fiber to the home has currently become more cost-effective than that of rolling out a copper based network.

An optical fiber consists of a core, cladding, and a buffer (a protective outer coating), in which the cladding guides the light along the core by using the method of total internal reflection. The core and the cladding (which has a lower-refractive-index) are usually made of high-quality silica glass, although they can both be made of plastic as well. Connecting two optical fibers is done by fusion splicing or mechanical splicing and requires special skills and interconnection technology due to the microscopic precision required to align the fiber cores.

Two main types of optical fiber used in fiber optic communications include multi-mode optical fibers and single-mode optical fibers. A multi-mode optical fiber has a larger core (≥ 50 micrometres), allowing less precise, cheaper transmitters and receivers to connect to it as well as cheaper connectors. However, a multi-mode fiber introduces multimode distortion, which often limits the bandwidth and length of the link. Furthermore, because of its higher dopant content, multimode fibers are usually expensive and exhibit higher attenuation. The core of a single-mode fiber is smaller (<10 micrometres) and requires more expensive components and interconnection methods, but allows much longer, higher-performance links.

In order to package fiber into a commercially-viable product, it is typically protectively-coated by using ultraviolet (UV), light-cured acryl ate polymers, then terminated with optical fiber connectors, and finally assembled into a cable. After that, it can be laid in the ground and then run through the walls of a building and deployed aerially in a manner similar to copper cables. These fibers require less maintenance than common copper cables, once they are deployed.

Fiber optic cables in Cuba was installed first around government offices, military installations, key resort areas, but since 2004, in places such as: Villaclara, Cienfuegos, Ciego de Avila, Holguin, Santiago de Cuba, Bejucal, Wajay, Camaguey. **In total, there are 9, 850 Kms of fiber optic cable installed within Cuba.**

ETECSA has invested US$ 10,000,000 in fiber optic cable and related equipmen .to improve the company's fixed-line infrastructure The investment and work has been done in conjunction with the PRC.

For fiber optics suppliers, the opportunity in Latin America boils down to bandwidth demand: It's growing and will continue to grow, despite economic gyrations.From buildout to bandwidth, Latin America is emerging from a period of pulling itself up by its telecom bootstraps. In recent years, most major telecommunications markets in the region have been opened to competition. Attendant with these openings have been tele density and level-of-service requirements imposed by governments resulting in a transformation of Latin American telecommunications from a mishmash of individual initiatives to a cohesive region-wide infrastructure.

This region now presents attractive market opportunities, although different from the opportunities of previous years. As the long-haul buildout nears completion, the metropolitan rollout is underway. But due to its less regional nature, the worsening economy and the market downturn, metro/access deployment is beginning to slow. With this decline comes the truly hard work of telecom development in emerging regions. It's a sophisticated transition from the bull-work of the long-haul build-out when financing is easy to the deal-making finesse required of metropolitan and access deployment in economically challenging times.

The installed base of single-mode fiber in Latin America will rise to 32.6 million fiber-km in 2009 from 15.7 million in 2000. Cumulative deployment in the region will grow at a compound annual growth rate of 12 percent. The six major markets in the region: Brazil, Mexico, Argentina, Venezuela, Chile and Ecuador.

Long-haul systems account for the largest share of fiber deployment through the forecast period. However, long-haul deployment will decline as carriers shift to metropolitan markets. The Compound Annual Growth rate (CAGR) in these metro deployments will be 18 percent from 2000 to 2009; new long-haul fiber installation CAGR, in contrast, will be 12 percent. Metro/access deployment escalated during 2000-2002 but is hindered by poor economic conditions. Such deployments will account for over 30 percent of all fiber deployed in Latin America in 2009, in contrast to 23 percent in 2000.

FIBER OPTIC CABLE: FLORIDA TO CUBA

The primary objective of installing the Florida to Cuba Cable System is to provide a direct fiber optic connection between the U.S. and Cuba to alleviate bandwidth gluts, and shortages, and increase telecommunications services between Cuba, the United States, and the global community.

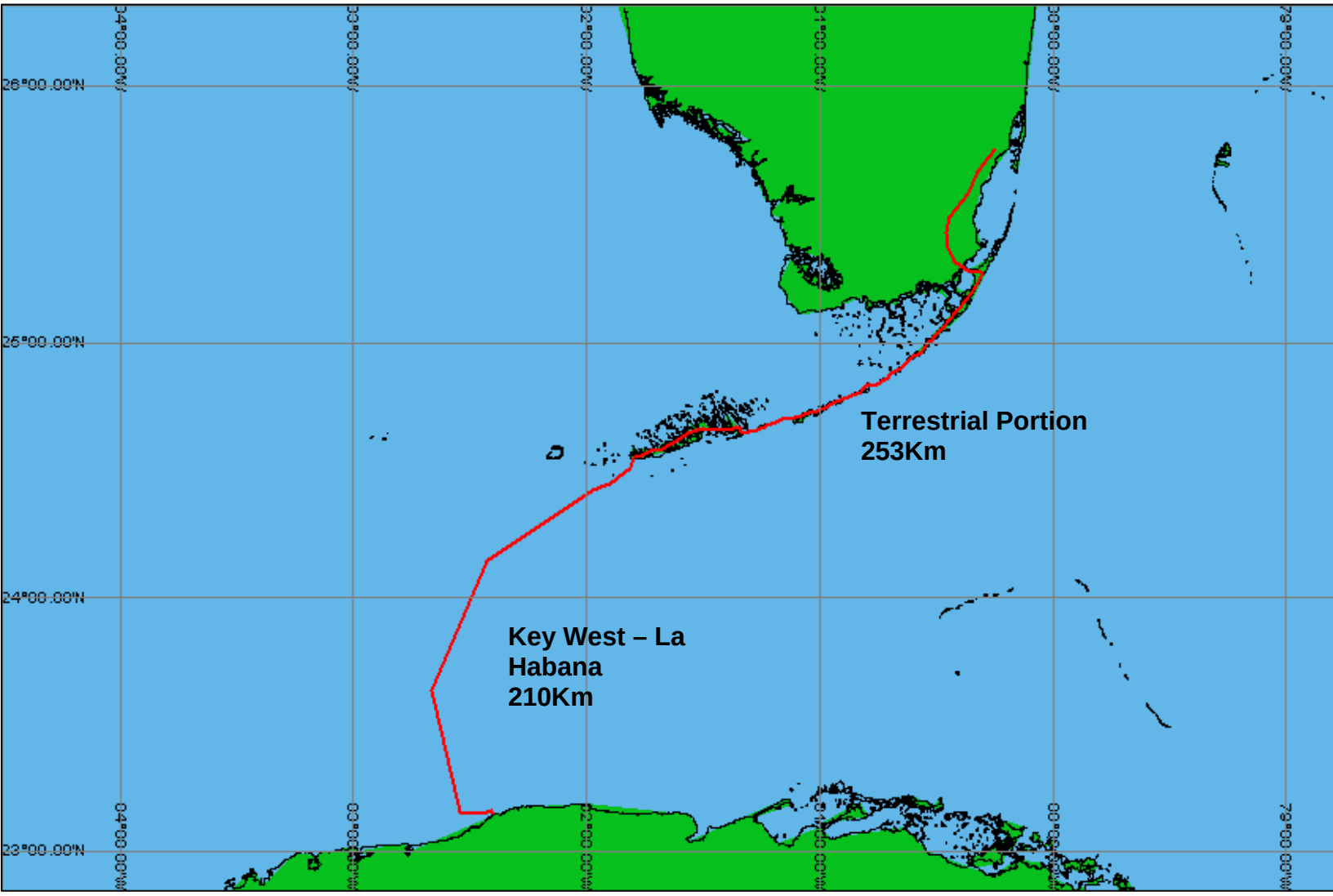
Other objectives could be to provide Miami- Dade and Monroe County bandwidth to support their applications and exceed current and future Dade and Monroe County bandwidth requirements. Also, to generate revenues through domestic and international interconnect agreements with T1 and T3 carriers.

Carriers will reduce their costs by a minimum of 20% and receive over 99.9% completion ratio at the Network Access Point (NAP) in La Habana. Currently, satellite provides only a 38% completion ratio at escalated costs to terminate in Cuba. A return on investment should occur in one year after the system is in operation.

The marine cable should be of a large core design with a diameter over 20mm that could offer a full range of protective armour types., in order to ensure that where direct cable protection is needed it will do the best performance.

Accurate route engineering should be employed in order to design the best level of burial cable protection to optimize fault protection.

A possible diagram for the system is shown below



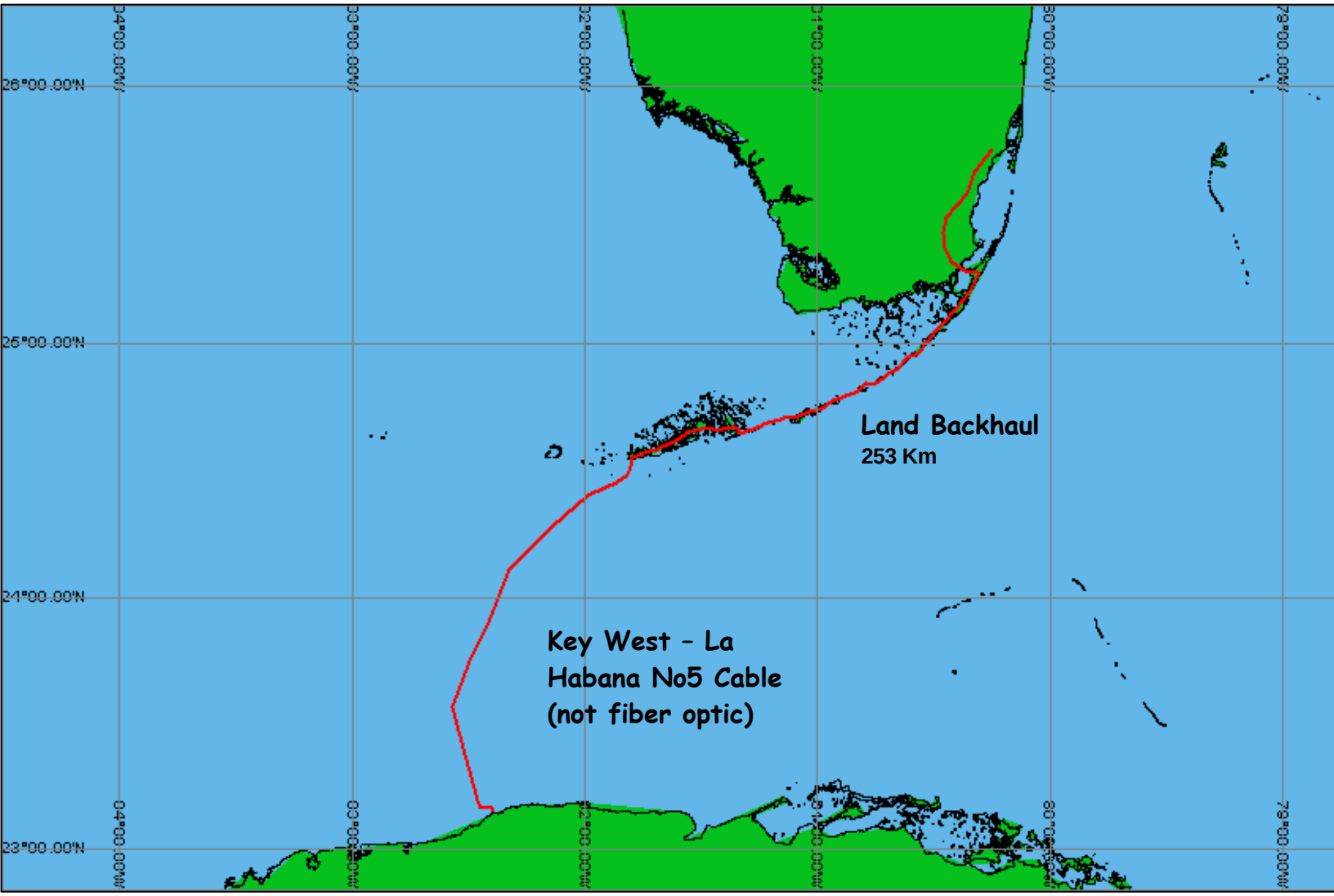
System Configuration

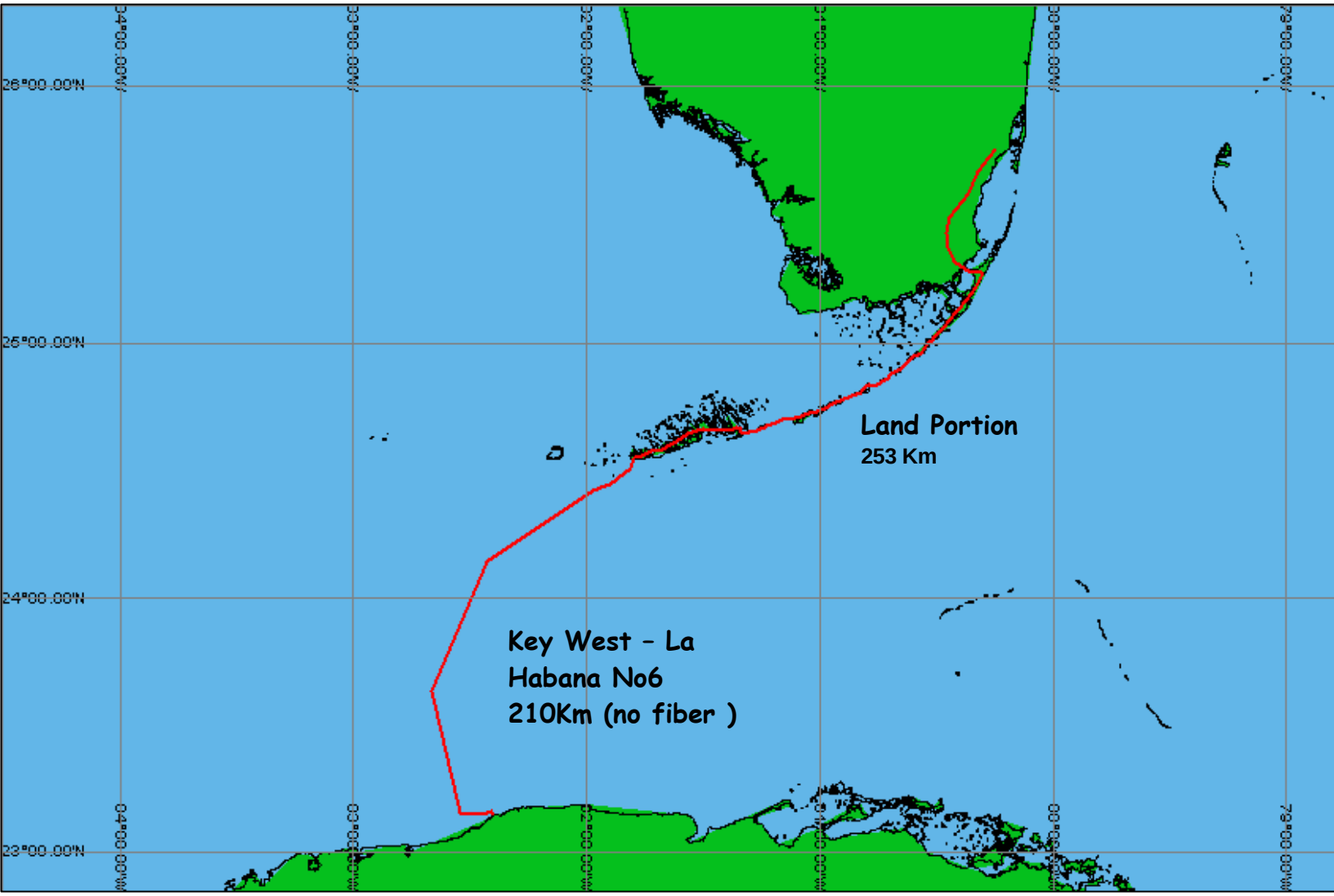
The terminal point for the marine section should be in the existing NAP in La Habana. A section of terrestrial cable, possibly using marine grade type, would have to be installed between the NAP and the existing cable at Cojimar.

The marine section should have a landing point in Key West. This section will have to be interconnected to a terrestrial system at the marine terminal and then connected to a NAP in Miami, of course, using an existing land route.

There are two other cables built before, not operational, and of course not fiber optic cables. The new fiber optic cable must probably will follow the same routes.

In a breakthrough technology for 1951, AT&T laid its Type SA Submarine Cable System between Key West and Havana (78 miles) and provided at one swoop a dozen stable, reliable analog voice channels. People were becoming more and more telephone-dependent, and the offered traffic between Cuba and the world skyrocketed. To handle this, AT&T and Cuba opened up one of the few SHF troposcatter links AT&T ever used, a 900 mHz link between Florida City (just south of Miami) and Guanabo (near La Habana) in the mid 1950's. That link could provide 600 (and more, with expansion) telephone channels, or one analog video link. Below are the layouts for the two old submarine cables, not anymore in operation.





Recent submarine fiber optic cables have a capacity that range from 1.2Tbit/sec to 320 Tbit/sec. The new fiber optic cable proposed to link USA and Cuba will be some 220 Kms long, therefore it is to be assumed no need for repeaters to be used. Most probably will be a 6-12 fiber pairs, 32 wavelengths, 10 Gbits per wavelength, for a total initial capacity of 1.9Tbits/sec.

The following points detail and summarize major advantages of the fiber optic cable:

- Reduction in network costs compared to current satellite connections;
- Scalable bandwidth options (mux or demux from T-1/E-1 -OC-3 /STM-1);
- 99.8% completion ratio in the international NAP in La Habana (currently there is a 37% completion ratio);

- The Fiber Optic system will provide retail customers with reduced costs as the result of lower telecommunications rates which would be at least 35% lower than they are currently experiencing.

- The Fiber Optic Cable would provide a clear fiber optic connection to the U.S. and Cuba. This system would not be susceptible to the kinds of damage caused by hurricanes which have resulted in the deactivation of cables between Cuba and the U.S. in the past.

NOAA is a key player in making sure this project receives proper coastal permits through the Key West sanctuary. They are under a United Nations initiative to utilize sub-sea cables and monitor loop currents. Currently, one of the most important regions in the world where there is no cable to monitor loop currents is between Cuba and Key West. The cable route will increase NOAA's data gathering to better serve humanity and predict climatic conditions.

ISSUES, PERMITS AND OBSTACLES TO OVERCOME

Permitting – OFAC /Treasury/ State Department/Cuban government

Florida Approval – Talahassee – Governor's Office

ICPC & Coastal Commission - State Level and Federal Level

EPA – Certification

Marine Sanctuary Commission

Financing

Legal Support Local and in Washington

FCC – Standard (Need approval from State Dept. first)

Justice Department

Reef Restoration

Choose the right cable installer

ETECSA will probably want a small percentage of network ownership in the cable system, maybe because the 12 miles to international water, or to allow them to maintain awareness and responsibility for their end of the cable system. This will comply with U.S. policy if ETECSA owns and operates their 12 miles of international water.

The cable system is intended to improve the international broadband (voice and data services) connections from Cuba to various international networks in Miami, and the USA. The system can provide ETECSA and US companies the ability to manage revenue streams,

Increase bandwidth capacity and provide secure, reliable services to a large customer base through clear fiber optic connectivity. The system should have the ability to scale down to E1 and T1 levels to accommodate smaller carriers and customers to increase revenues.

Network Access Points (NAP)

NAPs will have to be chosen accordingly to provide interconnects between US domestic companies and major global networks. Interconnection agreements with global providers such as AT&T, Sprint, WorldCom, Telefonica, BRITISH telecom, Qwest, Telmex, and others should be made. These agreements will reduce cost and increase profits.

The total cost of the installation is estimated in approximately $25 million dollars

2. Cellular Telephony

Cubacel

Parent Company**ETECSA (100%)**
(April 2009)
Primary Activities
Telecommunications: Mobile/Wireless
Address: **Calle 5ta y 76, Edif. Barcelona, Centro de Negocios Miramar, Playa**
Phone: **53-5-2642266**
City: **Ciudad de La Habana**
Country: **Cuba**
Website: **http://www.cubacel.cu/**
General Email: **cubacel@cubacel.com**
Regional Presence: **Cuba**
Total number of offices: 55

Cubacel is the business unit of ETECSA, and offers mobile telephony services with GSM (900MHz) and TDMA (800MHz) for national coverage and GSM (850 MHz) in the cities of La Habana, Varadero, Santiago de Cuba, Cayo Coco and Cayo Guillermo.

The beginning

On mid 1991, Luis Miguel Niño de Rivera, a Mexican businessman visited La Habana on several occasions with the purpose to introduce in Cuba cellular telephony. On September 1991 the Ministry of Communications formed a working group charged to do a feasibility study. This group made several trips to Mexico to acquire experience on the system.

As a result, on December 11, 1991 the Cuban Government signed an Administrative Concession implementing a mixed corporation, Telefonos Celulares de Cuba, S. A.-Cubacel. This is a mixed

corporation-Cuban and Mexican. On February, 1993, the first commercial operation of Cubacel started, with the Occidental Subsystem, including La Habana and Varadero.

On March, 1995 started the Oriental Subsystem, covering Santiago de Cuba. On May, 1996, the Oriental Subsystem is extended to Moa. Also, during 1996, Cubacel expanded the Occidental Subsystem by extending its coverage through the 140 Kms of the La Habana-Matanzas-Varadero expressway. Also, new radio base stations were installed through Metropolitan La Habana to reinforce and cover all metro La Habana.

On June 1997, the Central Subsystem was created, starting with Cienfuegos, and later covering all the central part of Cuba. Later on, the Oriental Subsystem was extended and presently the whole Cuba is covered by Cubacel.

- **Services**

The following services are provided by Cubacel: Cellular telephony; temporary and permanent service; voice mail; credit card validation; national and international roaming.

- **Technology and operations**

The standard for the system is AMPS. The frequency spectrum is from 824MHz to 856 MHz. The system operates in the B band. The switching is done using Ericsson-AXE Miniswitch. The initial capacity of each switch is up to 8,000 subscribers, with an average traffic of 0.07 erlang[12]s. The switch capacity can be increased to 10,000 subscribers.

Transfer repeaters are used to cover corridors between cities and urban regions of low traffic. The voice channels are analog. The radiobases are mainly omni directional. Only a few are sectorized to 120^0.

There are four centers to switch calls, CCM, two in La Habana, one in Santiago de Cuba, one in Varadero. Each with a capacity of 5,000 customers. There are 9 radiobases, in Habana Libre, Varadero, Santa Maria, Televilla, Buenavista, Cacahual, Sata Clara, Santiago de Cuba, Moa.

The system has 2,,000 voice channels with capacity for 600,000 subscribers without saturation. There are 10 repeaters located in La Habana, Matanzas, Varadero, and Santa Clara.

[12] An erlang is a unit of time it refers to the percent of an hour that the telecommunications equipment is in use. .05 earlang refers to 1/20 of an hour or 2 minutes per hour. The United States uses the Centium Call Second (ccs) to measure telecommunications use. A typical residential line in in the U. S. has a 3 ccs traffic rate. Typical Business Line has a 7 ccs traffic rate. A typical Wirless line has a 1.5 ccs rate which is slightly higher than .05 erlangs. The trunk facility networks are designed based on a Poisson probability distribution, but can be approximated the recirocal of the utilization rate experessed in erlangs. Therfore a .05 rate of use results on a traffic carrying capacity of approximately 20 customers per channel. This figure is use to estimate the number of customers in the network.

AMPS, Cubacel

Item	B Service
Switching	Ericksson-AXE Miniswitch
Transmit bands, MHz	824-856
Initial capacity/switch	8,000 subscribers
Maximum capacity/switch	10,000 subscriber
Voice channels	Analog
Number of radio bases (can be increased)	12
Total voice channels (can be increased)	2,000
Capacity (can be expanded)	800,000 subscribers

Frequency bands used in the United States

Current / Planned Technologies	Band	Frequency (MHz)
SMR iDEN	800	806-824 and 851-869
AMPS, GSM, IS-95 (CDMA), IS-136 (D-AMPS), 3G	Cellular	824-849, 869-894, 896-901, 935-940
GSM, IS-95 (CDMA), IS-136 (D-AMPS), 3G	PCS	1850-1910 and 1930-1990
3G, 4G, MediaFlo, DVB-H	700 MHz	698-806
Unknown	1.4 GHz	1392-1395 and 1432-1435
3G, 4G	AWS	1710-1755 and 2110-2170
4G	BRS/EBS	2500-2690

The usage of frequencies within the United States is regulated by the Federal Communications Commission (FCC). The US is then divided geographically into a number of Trading Areas. A mobile operator (or other interested parties) must bid on each trading area individually. A bidder can use the frequency spectrum for whatever purpose he wants. The Cellular band (869-894 MHz) is divided into 2 frequency blocks (A and B). There are 306 Metropolitan Service Areas and 428 rural service areas. Each trading area consists of one or more counties.

Frequency bands used by GSM

System	Band	Uplink	Downlink	Channel Number
GSM 400	450	450.4 - 457.6	460.4 - 467.6	259 - 293
GSM 400	480	478.8 - 486.0	488.8 - 496.0	306 - 340
GSM 850	850	824.0 - 849.0	869.0 - 894.0	128 - 251
GSM 900 (P-GSM)	900	890.0 - 915.0	935.0 - 960.0	1 - 124
GSM 900 (E-GSM)	900	880.0 - 915.0	925.0 - 960.0	0 - 124, 975 - 1023
GSM-R (R-GSM)	900	876.0 - 880.0	921.0 - 925.0	955 - 973
DCS 1800	1800	1710.0 - 1785.0	1805.0 - 1880.0	512 - 885
PCS 1900	1900	1850.0 - 1910.0	1930.0 - 1990.0	512 - 810

Cuba has also the GSM technology, which is widely used worldwide. One of the most important elements to consider in Cuba is that cellular phones in Cuba must be able to transmit and receive in the 900 Mhz band.

Digital Microwave

Microwave radio relay is a technology for transmitting digital and analog signals, such as long-distance telephone calls and the relay of television programs to transmitters, between two

locations on a line of sight radio path. In microwave radio relay, radio waves are transmitted between the two locations with directional antennas, forming a fixed radio connection between the two points. Long daisy-chained series of such links form transcontinental telephone and/or television communication systems. Cuba has incorporated digital microwave links as part of its telecommunications system

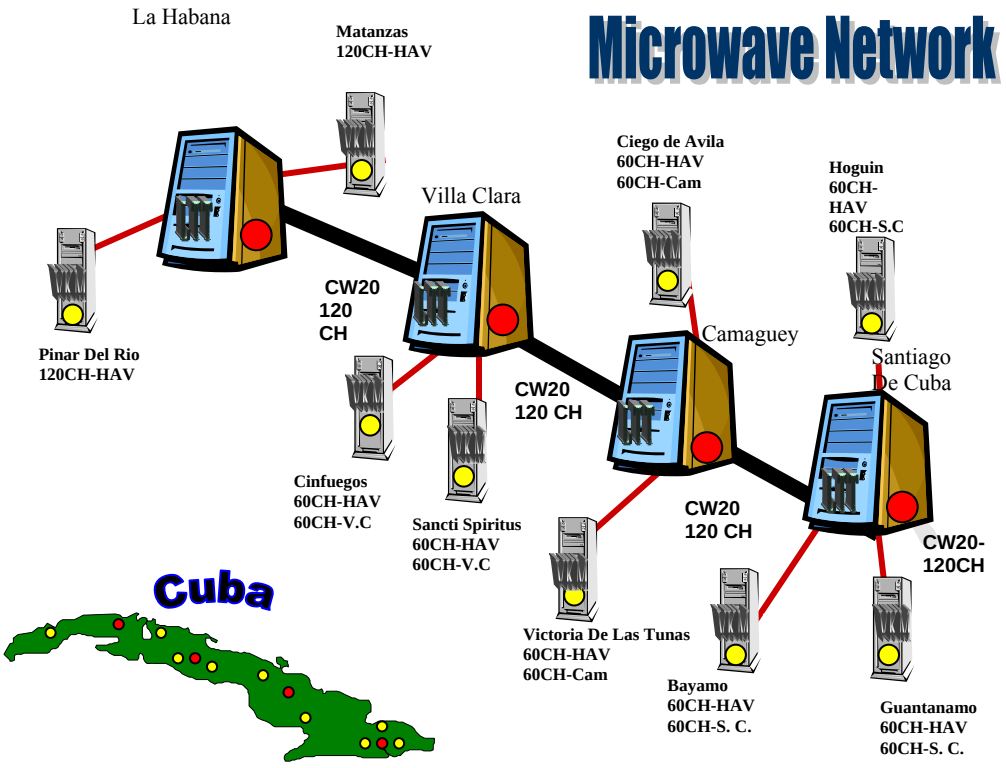


Figure 11

Main Services offered

Telephony
Caller Id
Call waiting caller ID
Caller ID block
Text messages
Call forwarding
3-way calling
International roaming
International messaging-roaming
Basic voicemail
Enhanced voicemail
Time information
Rent and auto repair

Taxi services
Hotel reservation
Tourist information
Credit card validation

Latin America and Cuba comparison

Mobile penetration in Latin America and the Caribbean was approximately 80% in early 2009, well above the world average, which was about 58%. With 458 million people owning a mobile phone in early 2009, Latin America and the Caribbean holds approximately 12% of the world's 3.97 billion mobile subscribers.

Several countries, including Argentina, Jamaica, Uruguay, and Venezuela have passed the 100% penetration threshold. The region is becoming fertile soil for 3G WCDMA services, following substantial increases in coverage and in subscriber numbers during 2008. In early 2009, there were about 5 million 3G subscribers throughout Latin America and the Caribbean.

There are vast differences in mobile development throughout the region. Apart from some first-world Caribbean island nations, the highest mobile penetration rates in early 2009 could be found in Jamaica (115%), Argentina (110%), Uruguay (109%), and Venezuela (101%). By contrast, penetration was much lower in Bolivia (48%), Costa Rica (48%), and Nicaragua (52%).

Cuba, the country with the region's lowest mobile penetration, stagnated at 2.9%. Penetration in Haiti, the second lowest country, shot up from a 4.8% at end-2005 to 41% at end-2008 thanks to the launch of low-priced GSM services by Caribbean mobile giant Digicel, which entered the Haitian market in May 2006.

Despite being relatively small markets by global standards, telecommunications has become one of the Caribbean's major growth industries. In particular, the region's mobile sector has been witnessing significant expansion in recent years. To date this growth has largely been harnessed by Jamaican-based mobile provider Digicel. This company is predicted to continue to dominate the robust mobile sector growth during 2009/10.

Investment in infrastructure during 2009 is expected to increasingly trend towards wireless broadband access and associated IP services, such as VoIP. GSM continues to be the mobile technology of choice in the Caribbean, with over 85% of mobile customers in Latin America and the Caribbean employing GSM mobile technology.

Mobile subscribers, annual change and penetration in select Caribbean countries – 2008

Country	Subscribers	Annual change	Penetration
Anguilla	24,150	+5.4%	172.5%
Antigua & Barbuda	131,600	+22.3%	188%
Aruba	112,800	+1.1%	156.7%
Bahamas	383,500	+50.9%	124.9%
Barbados	306,900	+17.1%	108.8%
Belize	176,800	+23.4%	58.7%
Bermuda	83,700	+12.0%	124.9%

Since 2003 the market has undergone a process of consolidation. Several international investors have withdrawn from the region, leaving about half a dozen major multinational operators that serve roughly 81% of the market.

América Móvil and Telefónica/Portugal Telecom compete with each other in most of Latin America's major economies. Between them, they serve about 64% of the region's mobile subscribers. América Móvil is the leader, with a 37% market share. Digicel has a small 2% market share, but is the leading operator in the Caribbean sub-region.

Major international mobile operators – subscribers and market share – 2007 - 2008

Company	2007	2008	Annual change	Market share
	Subscribers (million)			
América Móvil	143.91	171.53	+19%	37%
Telefónica/Portugal Telecom	100.54	123.39	+23%	27%
Telecom Italia	43.65	50.18	+15%	11%
Millicom	14.73	18.64	+27%	4%
Subtotal	**302.83**	**363.74**	**+20%**	**79%**
Others (national + international)	78.41	94.52	+21%	21%
Total	**381.24**	**458.26**	**+20%**	**100%**

Key highlights:

Argentina

Telefónica's Movistar, América Móvil's Claro, and Telecom Argentina's Telecom Personal run a close competition for market share. Previously, there were four mobile companies competing nationwide, but in 2005, Telefónica acquired Bellsouth's operation, and the merged company was re-launched under the trading name Movistar. One of the merger conditions imposed by the government required Movistar to relinquish 42.5MHz of its spectrum. The government is

expected to launch an auction in 2009 to award the returned spectrum to existing or new mobile operators. Nextel Argentina has a licence for trunking rather than mobile telephony, but the service it offers is similar to that of a standard mobile operator. Two associations of telecom cooperatives, Fecotel and Fecosur, have mobile licences but need spectrum to operate.

Mexico

In 2000, there were nine operators in the Mexican mobile market. By early 2009, there were only three major operators: America Movil (Telcel), Telefónica (Movistar) and Grupo Iusacell (Iusacell and Unefón). Besides these three, Nextel de México operates a mobile trunking network using iDEN technology. Telcel is the clear market leader, with a market share of around 72%, Movistar a distant second (19%), followed by Iusacell (5%). Nextel de México accounts for approximately 3%. In November 2008, the competition agency, the CFC, declared that Telcel has market dominance and that it should be subject to tariff regulation. Telcel is expected to resort to legal action to prevent such price regulation.

Brazil

Four companies dominate the Brazilian mobile phone market: Vivo (Telefónica/Portugal Telecom), Claro (América Móvil), TIM Brasil, and Oi/Brasil Telecom. Together, these four control 98.5% of Brazil's mobile subscriber base. The consolidation process, which had halted in 2003, resumed in 2007, with the acquisition of Telemig by Vivo and of Amazônia Celular by Oi. In 2008, regional incumbents Oi and BrT began the process of merging. The remaining 1.5% of the market is shared between CTBC Telecom, Sercomtel, trunking network operator Nextel Brasil, and start-up company Unicel trading as Aeiou, which began a SIM-only service in September 2008 in metropolitan São Paulo.

As far as Latin America in general, we have mobile telephony has been by far the most dynamic telecom sector in the Latin American and the Caribbean region. Prepaid services have played an important role in the sector's success, as they have made cell phones available to millions of low-income users, once excluded by monthly payments and credit checks.

Natural factors have also contributed to wireless popularity in a continent where mountainous terrain and remote rural areas make the laying of cable uneconomical, and where hurricanes and earthquakes have caused major destruction to fixed-line networks.

The region is becoming fertile soil for 3G WCDMA services, following substantial increases in coverage and in subscriber numbers during 2008. In early 2009, there were about 5 million 3G subscribers throughout Latin America and the Caribbean.

Mobile penetration has reached about 80%, well above the world average, which was about 58% in early 2009. Several countries, including Argentina, Jamaica, Uruguay, and Venezuela have passed the 100% penetration threshold.

Top 10 Latin American countries for mobile subscribers – 2007 - 2008

Country	2007	2008	Annual change	Penetration
	Mobile subscribers (million)			
Brazil	122.11	152.44	+24.8%	78.9%
Mexico	68.68	78.46	+14.2%	74.1%
Argentina	38.44	43.82	+14.0%	110.3%
Colombia	33.94	41.36	+21.9%	85.7%
Venezuela	23.82	28.21	+18.4%	101.0%
Peru	14.00	18.45	+31.8%	63.3%
Chile	14.60	15.90	+8.9%	94.4%
Ecuador	9.91	11.40	+15.0%	82.5%
Guatemala	9.20	10.50	+14.2%	76.8%
Dominican Republic	5.52	7.02	+27.2%	79.4%

Telecoms services have become an increasingly essential item not only for businesses but also for residential consumers in the Latin American and Caribbean (LAC) region. Therefore, demand should not collapse in 2009 despite the recession. Telecom revenues should continue to grow in most countries, driven by mobile telephony and broadband, but growth rates will be quite small compared with previous years.

The LAC region has been a high growth market particularly in mobile telephony, where penetration is well above the world average. A few countries, however, may be nearing mobile market saturation; about 15 nations in the Caribbean and three in South America have passed the 100% penetration threshold, including Jamaica, Argentina, Uruguay, and Venezuela.

Key highlights:

- The LAC economy grew by 4.6% in 2008. A negative GDP growth of -0.3% is forecast for 2009.
- Teledensity in the LAC region inched up from 17.9% in 2007 to 18.3% in 2008. The fixed-line market is stagnant in most countries.
- VoIP is popular and highly competitive throughout the region. Triple play is available in most LAC nations, and IPTV is starting in a number of countries. In a few markets, however, regulatory battles still rage over who can offer triple play, and whether telcos should be allowed to offer pay TV services.

· In early 2009, there were 458 million mobile phones in the LAC region, compared with 106 million fixed-line phones. Mobile penetration was approximately 80%, well above the world average of 58%.

Forecast mobile subscribers – higher growth scenario in Brazil – 2008; 2013; 2018

Year	Subscribers (million)	Penetration
2008	148.81	77.1%
2013	207.37	101.1%
2018	235.28	108.9%

Cuba Cellular System

PRESENT COVERAGE

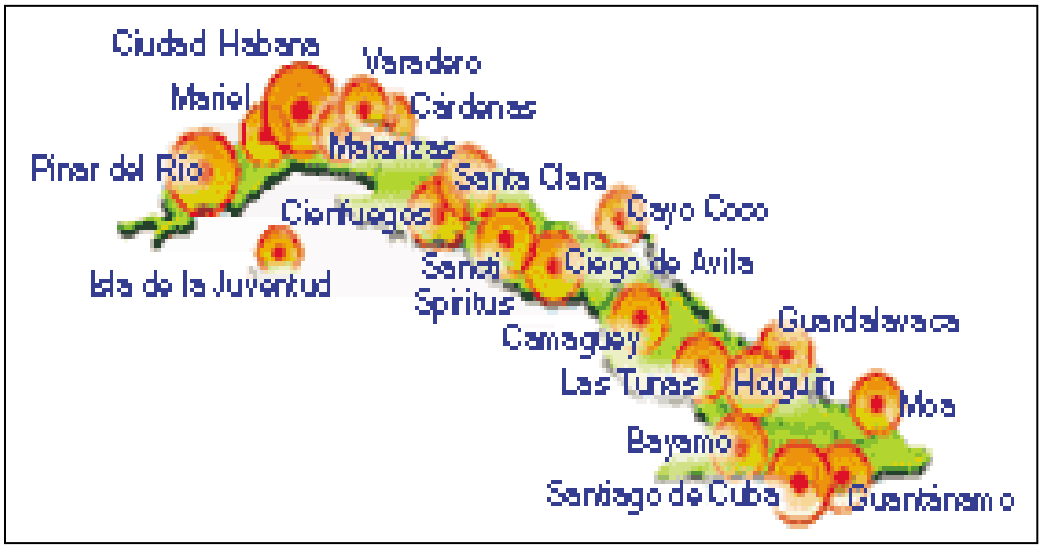


Figure 12

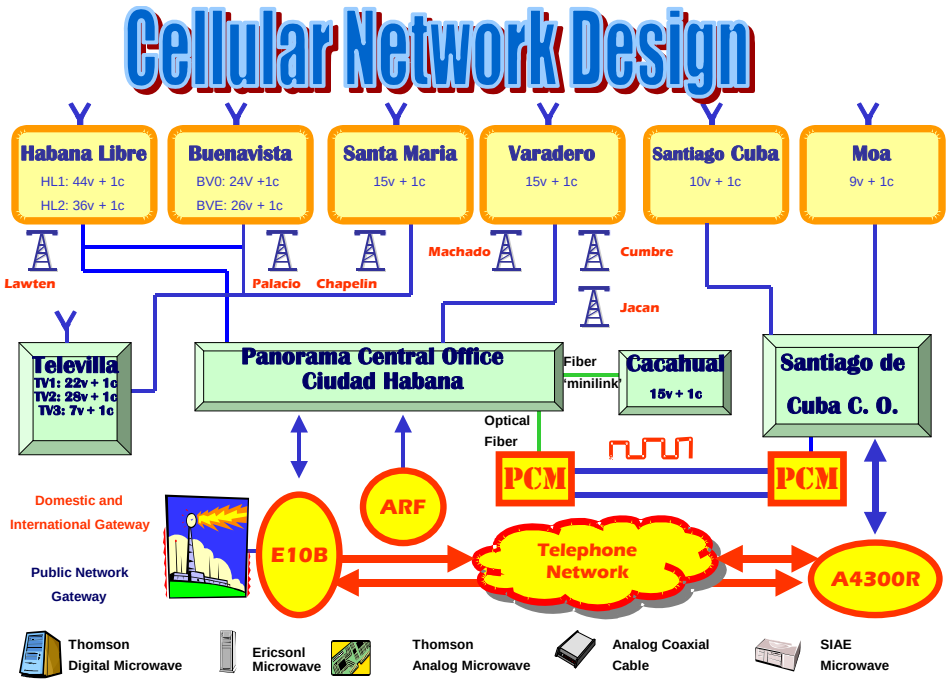


Figure 13

Cubacel has agreements with the following companies:

- Telcel and Portatel, Mexico
- T.C.P. Argentina and Telecom Personal, Argentina
- Telefonica Moviles, Spain. Through this company, services are extended to Europe, Asia, and Africa.
- Bell Mobility, Telus Mobility, NewTEL, and MT&T, Canada.
- Cell Express Rentacel, Panama
- Telefonica Moviles del Peru. Through this company services are extended to Venezuela, Chile, and El Salvador
- North-West, GSM, Russia
- Telecom Italia Mobile, Italy

RESULTS UP TO 2009

Data	2000	2001	2007	2008
Average subscribers	8,479	11,097	155,000	285,000
Growth	36%	30.4%	50%	84%
Monthly bill/customer US Dollars	324.40	303.60	450	540
Total results,US Dollars thousands	27,472	33,734	70,000	153900
Total sales and income	33,398	41,490	584,772	745,380
Total expenses	4,584	5,978	9,540	13,500
Profit in operation	11,699	13,485	15,760	18,650
Profitability	33.6%	31.8%	35%	37%
Total Revenue	11,409	13,179	135,180	145,760

The Cuban government has approved Resolution 84 where it is incorporated a plan to reach 1.6 million of subscriber in 5 years, from a total in mid 2009 of 300,000.

Cost of Calls

Presently, the cost is as follows:

Calls received by a cell phone: 0.46 cents CUC
Calls made from cel phone to cell phone: 0.50 cents CUC
Calls made from cel phone to wired phone: 0.60 cents CUC
Text messages or SMS, up to 160 “caracteres”: 0.16 cents CUC
MMS or graphic messages: 0.60 cents each
Activation cost: 60 CUC

The average use of a CUC cel line is 35 CUC per month.

CASH FLOW

Cash flow thousands US dollars	1999	2000	2001	2007	2008
Total net profit	9,151	11, 699	13,485	15,760	18,650
Working capital requirements	570	617	624	955	1,050
Flow of operations	10,704	13,374	15,636	19,679	20,435
Investment	4,320	4,584	5,978	9,540	13,500
Net cash flow	7,388	9,273	10,741	16,567	25,140

POTENTIAL MARKET COMPARISON FOR CUBA AFTER TRANSITION

Cellular telephony has a brilliant future in a democratic and free market economy Cuba. Projections for the market, after a transition in Cuba, estimates, after the first three years of the transition a total of 3.5 million subscribers for both temporary and fixed customers.

The present value of Cubacel, at the end of 2008, is $ 45,220,247 US dollars.

Privatization

A national cellular system could be part of the entire franchise, wired, wireless. The revenues from the highly profitable long distance and cellular services could be used to subsidize to some extent local telephone service. It is assumed that competition in the highly profitable international long distance service will best serve the subscribers. However, including this service in the exclusive franchise could be negotiated. Monopoly rates should be regulated and some form of incentive regulation should be used to ensure efficiency.

3. Internet, Computers

Internet Services

A. Dedicated links

A link for data transmission, line, modem for the customer. Installation cost covers first month subscription. Customer must have a proper router and the license from the Ministry of Information and Communications. Services are under the domain co.cu. If another domain is desired, it must be handled through the government agency in charge.

B. Dedicated links with ratio 1 to 4

In order to have a quality service, customers must not exceed 25% of the normal average daily traffic. The established monthly rate is valid for all dedicated links under the local perimeter closer to the node. The Table below shows the bandwidth, installation cost, and monthly rate.

Bandwidth, Kbps	Installation cost, US$	Monthly rate, US $
19.2	$350	$250
28.8	$450	$350
64	$700	$600
128	$950	$850
256	$1,800	$2000
512	$3,800	$3,800
1024	$7,200	$7,200
2048	$14,000	$14,000

C. Dedicated links with ratio 1 to 1

In this case, the customer uses without restrictions, the entire bandwidth. Refer to Table below.

Bandwidth, Kbps	Installation cost, US $	Monthly rate, US $
64	$2,500	$2,000
128	$4,500	$4,000
256	$7,500	$7,000
512	$15,500	$15,000
1024	$28,500	$28,000
2048	$40,000	$40,000

D. Commuted links

All commuted accesses to InfoCom are charged according to the time of connection to the system. The installation cost covers the following cases:

- One payment for the current month
- Installation and configuration for the software for a PC
- Training for the usage (60 minutes)
- Email services for international internet link.
- Cost is $ 70 US

E. Commuted access to Internet (search and email)

Plans, hours	Minimum rate, US $	Additional hour, US $
II up to 15	$30	$3
III up to 40	$60	$3
IV up to 100	$100	$1
V, no time limit	$250	--

Note: In the case of unlimited time, the customer must connect from one telephone number only.

F. Commuted access to (SMTP/POP), and search on Infocom web

Plans, hours	Minimum rate, US $	Additional hour, US $
5	$15	$3
10	$20	$3
40	$40	$1

Rental of space in Web servers (hosting)

There are available some high speed servers. Customers can use this infrastructure to place their web sites, e-commerce, etc Additional hard drives in 10Mb capacities cost is $2.50 US. There is also commuted access to Infocom for email usage, for national networks (SMTP/POP). Includes search on Web pages of Infocom. Also, there is access to Infocom for email interchange at the national network.

The new ETECSA division, Internet services provider has a connection network spread all over the country with the technology to offer:

- Internet commuted access
- National and international e-messaging
- Connections devoted to corporation networks

Shared usage in UNIX servers

Categories	Small	Simple	Professional	Advanced	Commercial	Corporative
Monthly rate*	$8.00	$15.00	$25.00	$40.00	$60.00	$75.00
Installation (one time)*	$50.00	$50.00	$70.00	$70.00	$100.00	$100.00
Hard drive space (Mb)	5	10	50	100	200	300
Accounts POP3	1	1	3	5	5	5
Accounts FTP	1	1	3	5	5	5
Screen names for email accounts	1	5	10	15	15	15
Site statistics	yes	yes	yes	yes	yes	yes
SSL Encryption	yes	yes	yes	yes	yes	yes
JavaScript	yes	yes	yes	yes	yes	yes
Windows Media	yes	yes	yes	yes	yes	yes
Shockwave,Flash, QuickTime,VIVO	---	yes	yes	yes	yes	yes
MIME support	yes	yes	yes	yes	yes	yes
Oracle	---	---	yes	yes	yes	yes
UPS	yes	yes	yes	yes	yes	yes

*** All Costs is US $**

Shared usage in NT Servers

Categories	Small	Simple	Professional	Advanced	Commercial	Corporative
Monthly rate*	$8.00	$15.00	$25.00	$40.00	$60.00	$75.00
One time Installation*	$50.00	$50.00	$70.00	$70.00	$100.00	$100.00
Hard drive space(Mb)	5	10	50	100	200	300
POP3 Accounts	1	1	3	5	5	5
FTP Accounts	1	1	3	5	5	5
Email screen names accounts	1	5	10	15	15	15
MS Frontpage Extensions	yes	yes	yes	yes	yes	yes
Site Statistics	yes	yes	yes	yes	yes	yes
SSL Encryption	yes	yes	yes	yes	yes	yes
ASP Support	yes	yes	yes	yes	yes	yes
VBScript	yes	yes	yes	yes	yes	yes
JavaScript	yes	yes	yes	yes	yes	yes
Windows Media	yes	yes	yes	yes	yes	yes
Shockwave, Flash,Quicktime,VIVO	----	yes	yes	yes	yes	yes
MIME support	yes	yes	yes	yes	yes	yes
SQL Server	---	yes	yes	yes	yes	yes
Oracle	---	---	yes	yes	yes	yes
Visual InterDEv,6.0	---	yes	yes	yes	yes	yes
UPS	yes	yes	yes	yes	yes	yes
MS Access	yes	yes	yes	yes	yes	yes

- US dollars

Data on Internet, broadband, computers in Cuba

In this section we will offer information, using graphs and Tables, on Cuba's internet and computers. After this section, then we can compare Latin America and Cuba.

ICTs Physical Indicators

Item	U or Thousands	2003	2004	2005	2006	2007	2008
Quantity of existing computers	Thousands	270	300	377	430	509	630
Connected to a network	Thousands	175.5	193.1	243.3	258	330	400
Internet users	Thousands	585	940	1,090	1,250	1,310	1,450
Quantity Internet sites	Thousands	0.7	1.5	2.5	2.9	3.4	3.5
Personal computers per 1,000 persons	Units	24	27	34	38	45	56
Internet Users per 1,000 persons	Units	52	84	97	111	117	129
Domains under cu.	Units	1,100	1,209	1,351	1,389	1,431	2,168

The Table below shows important data from 2006 to 2008 regarding revenues related to Internet and computers.

Cuba has the lowest Internet penetration in Latin America. Cubans cannot legally buy a computer or subscribe to an ISP without having a government permit. Until a fiber optic cable is in place, Cuba has to rely on satellites for international connectivity. Almost all Caribbean countries offer a full range of telecom services, despite being characterized by small markets in terms of population. **Liberalization agreements have been reached in most countries.**

Cuba still has the lowest Internet penetration in Latin America. Cubans can not subscribe legally to an ISP without having a government permit. The Internet has the potential to change commerce, education, the process of government in a nation, but it is also shaped by the values, laws politics, economy, of a nation. The Internet helps societies of developed, democratic, capitalistic nations. Cuba, right now, is not developed, democratic, nor free market. Cuba was late to come to the Internet. Its international connectivity is meager relative to internal network activity.

Four Cuban networks provide connectivity for organizations similar to ISPs in other nations. They have CENIAI, Cuba's oldest, and RENACYT (National Network for Science and Technology), as well as Teledatos and Infomed (National Center for Medical Sciences Information). While Cuba has international IP connectivity, it is very limited.

Infomed, www.infomed.sld.cu, established in 1992, is a project of the National Center for Medical Sciences Information of the Ministry of Public Health (MINSAP). The network consists of a primary node in La Habana, which connects to regional nodes in Villaclara, Camaguey, and Santiago de Cuba. These links to secondary nodes in the remaining provincial capitals.

Cuba, after the transition is in place, will have a strength in the software market. Software will be a feasible alternative market for Cuba. For software to be a competitive industry in a democratic Cuba, the nation should have a high qualified labor force, updated tools and programs for software development, and a politic guided to stimulate the development of software products on the internal and external markets. The sales of Cuban software products for Latin America will have a great future, mainly in the areas education, health, biotechnology.

Royalties between 15-25% could be obtained in this market, always trying to get royalties that are near half of the revenue obtained in each product. Sales procedures of software are multiples. They could be:

- Through foreign partners in different countries
- Directly by a Cuban company abroad
- Through specific courses

The first way will possibly be the most feasible one, right after a transition, because the second one implies an inmediate investment, as well as the need of searching or establishing distribution channels.

ICTs Marketing Revenues

Item	Quantity (U)	Production National (MP)	Imported (MP)	Production National (CUC)	Imported (CUC)	Exported (CUC)
year 2006						
Total revenue		**50,008.8**	**4,120.6**	**8,883.5**	**120,640.9**	**861.3**
Computational Equipment		12,560.1	3,576.2	5,047.8	105,099.1	22.7
Computers	78,039	1,912.2	1,479.6	790.6	40,850.7	-
Miscellaneous equipment		143.2	1,024.3	256.7	41,218.2	2.9
informative items*		221.7	336.4	2,020.7	9,698.3	19.8
Technical Services		10,283.0	735.9	1,979.8	13,331.9	-
Software		37,448.7	544.4	3,835.7	15,541.8	838.6
Packages and Applications		12,220.2	487.9	294.1	1,767.3	28.9
informative items		25,228.5	56.5	3,541.6	13,774.5	809.7
year 2007						
Total revenue		**122,955.9**	**495,582.4**	**36,206.9**	**3,586,535.1**	**3,410.7**
Computational equipment		66,424.2	495,479.6	33,070.4	3,583,496.4	2,216.6
Computers	85,034	51,841.0	328,935.8	4,739.2	2,742,210.1	2,215.2
Miscellaneous equipment		1,506.8	104,191.9	18,852.6	527,535.2	1.4
informative items*		300.8	62,177.5	5,455.7	313,424.0	-
Technical services		12,775.6	174.4	4,022.9	327.1	-
Software		56,531.7	102.8	3,136.5	3,038.7	1,194.1
Packages and Applications		17,674.4	-	259.7	1,985.9	294.2
Informative services		38,857.3	102.8	2,876.8	1,052.8	899.9
Year 2008						
Total revenue		**159,809.2**	**1,188,400.7**	**12,294.3**	**6,142,745.0**	**487,463.2**
Computational Equipment		98,614.6	1,187,988.5	4,669.5	6,141,439.4	485,997.8
Computers	125,090	82,301.1	393,796.4	1,870.7	1,938,842.3	330,958.2
Miscellaneous equipment		4,226.3	743,268.3	372.0	3,724,618.6	155,039.6
informative items*		56.2	50,923.8	12.1	474,605.7	-
Technical services		12,031.0	-	2,414.7	3,372.8	-
Software		61,194.6	412.2	7,624.8	1,305.6	1,465.4
Packages and Applications		22,691.4	412.2	1,738.2	1,305.6	467.4
Informative services		38,503.2	-	5,886.6	-	998.0

* Sales paper, Cds, DVDs, etc

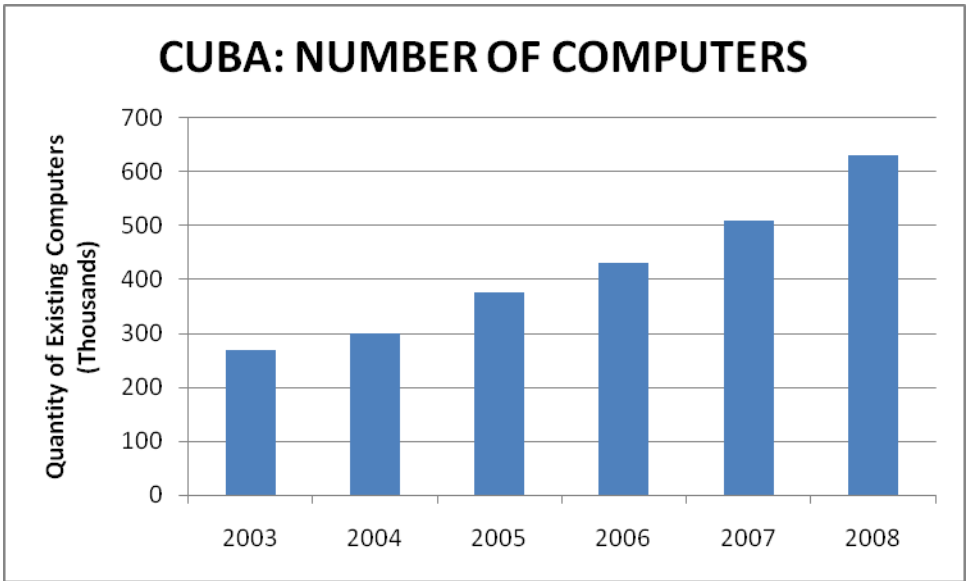


Figure 14

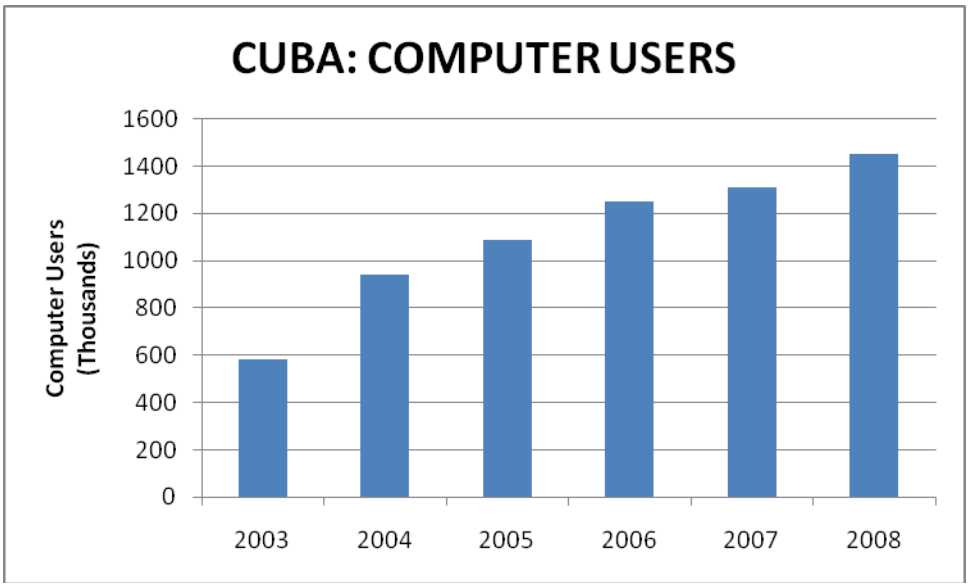


Figure 15

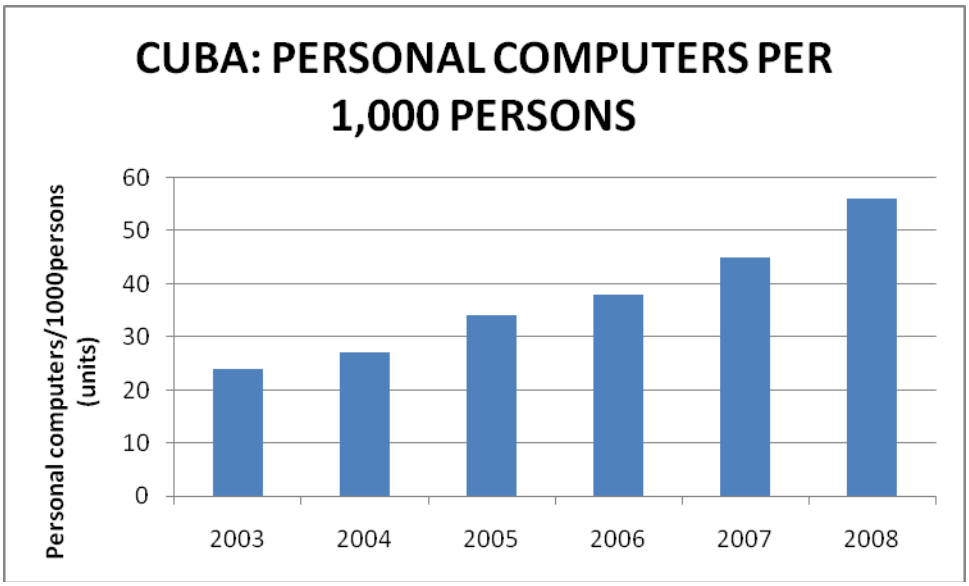


Figure 16

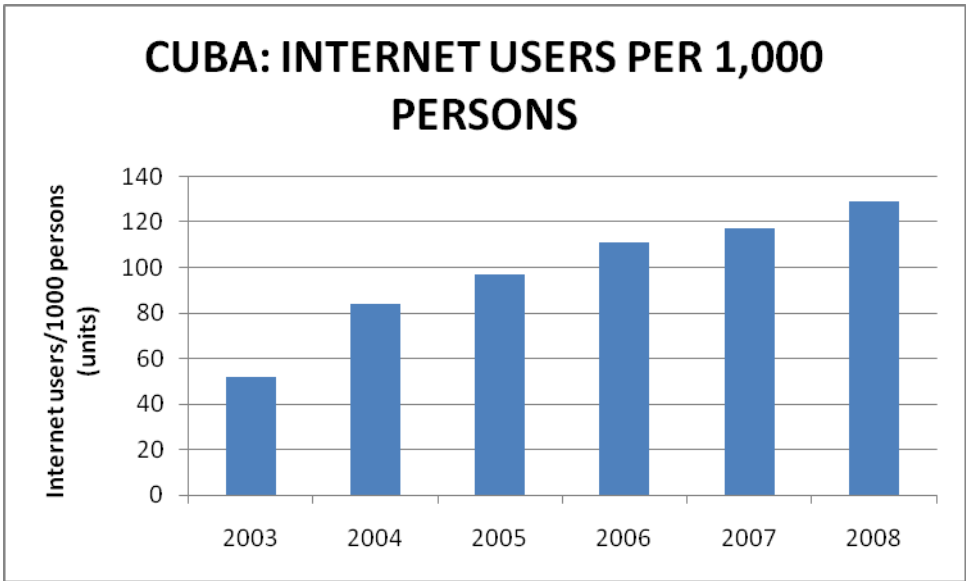


Figure 17

Figure 18

Latin America and Cuba Comparison

Internet

Internet user penetration in Latin America and the Caribbean was about 30% in early 2009. The American continent displays a characteristic North-South divide in terms of Internet users. The northern band, comprising the USA and Canada, enjoys 73% Internet user penetration, but in Central America and the Caribbean, penetration is only 20%, while in South America, it stands at about 34%.

Almost one third of the region's Internet users are in Brazil, but apart from a few first-world Caribbean islands, the highest user penetration rates are found in Jamaica, Argentina, and Chile. Argentina's 50% Internet penetration rate is even higher than Europe (including both Eastern and Western Europe), but it is well below Australia, the USA, Japan, South Korea, and northern European countries, where penetration ranges between 70% and 90%.

Broadband

Broadband penetration in Latin America is about 27% below the world average. This slow uptake has been largely due to the high prices charged by providers, which often have a virtual

monopoly in their areas of operation. Competition, however, is increasing and prices are dropping. Indeed, Latin America was the world's fastest-growing broadband market in the fourth quarter of 2008. ADSL is the prevalent technology, followed by cable modem. Mobile broadband, only two years after launch, has managed to attract about 5 million subscribers. WiMAX, on the other hand, after suffering serious setbacks due to licensing delays, has been further knocked back by the global financial crisis.

However, Latin America is becoming one of the world's most promising broadband markets, growing at a CAGR of 48% from 2003 to 2008. Competition has been increasing and prices have been dropping in most countries. Given the region's general economic indicators, there remains ample space for expansion. The region's broadband leaders are Brazil, Mexico, Argentina, Colombia, and Chile, and in early 2009, these five countries accounted for around 85% of all broadband subscribers in the region.

Convergence

Convergence offers promising prospects in Latin America, a continent with about 577 million people, a soaring broadband sector, low teledensity, relatively high TV penetration, and a growing VoIP market. Latin America, like other regions throughout the world, has shown a keen interest in developing triple play models. A growing number of pay TV companies throughout the region are seeking to expand their operations by offering voice services, most often using VoIP technology together with broadband access. Not to be left behind in the technological race, in a few countries, such as Brazil, Chile, and Colombia, the incumbent fixed-line operators have also entered the triple play arena.

Broadband subscribers and penetration – major Latin American countries – 2007 - 2008

Country	2007	2008	Annual change	Penetration per capita	Household penetration
	(million)				
Argentina	2.56	3.44	+35%	8.7%	31.4%
Brazil	7.72	10.20	+32%	5.3%	18.0%
Chile	1.31	1.45	+10%	8.6%	29.4%
Colombia	1.21	1.98	+64%	4.1%	18.8%
Mexico	4.55	6.90	+52%	6.5%	21.8%
Peru	0.59	0.74	+26%	2.5%	10.5%
Venezuela	0.86	1.28	+49%	4.4%	17.4%

Key highlights:
Argentina

Argentina's Internet market is the third largest in Latin America, after Brazil and Mexico. In terms of Internet user penetration (50.3% per capita), it is well above the regional average and more than twice as high as the world average (which was about 23% in early 2009). Argentina's broadband market is the most developed in the region and has the highest penetration rate. ADSL is the main broadband technology, but cable modem occupies a significant place with about one third of the subscriber base. The market is divided fairly equally between three players: Telefónica de Argentina, Telecom Argentina, and Grupo Clarín. While the first two offer ADSL services primarily in their regions of operation, Grupo Clarín provides cable modem broadband on a nationwide basis; this has helped to foster competition and reduce broadband prices, which are among the lowest in Latin America.

Brazil

Compared with other economic indicators, Brazil's Internet penetration is lower than expected, and there is considerable room for growth. In terms of subscriber numbers, Brazil is the regional broadband leader, but it trails neighbouring Chile and Argentina in terms of penetration. Broadband uptake has been stifled by high prices and weak competition. Broadband charges in Brazil have been dropping while speeds have been increasing, but prices are far too high for the Brazilian socio-economic environment. In fact, broadband tariffs are considerably higher than in neighbouring Argentina. ADSL is the leading broadband technology, with 70% market share, followed by cable modem with 25%, and wireless broadband with 5%. The country is considered a world leader by many in terms of e-government, and is also quite active in the area of e-education.

Mexico

Broadband is one of the highest growth sectors in Mexico's telecommunications market, with revenues continuing to record double digit growth for the fourth quarter of 2008 despite the broader economy posting negative growth for that period. Telmex's ADSL product, Prodigy Infinitum, continued to post very strong growth rates during 2008. Nevertheless, there remains significant scope for growth, as Mexico's broadband penetration is merely one-quarter of the OECD average, while its broadband prices are higher than most other OECD nations. High prices and low penetration levels are attributed to a lack of investment and competition due to, in part, foreign investment restrictions and a lack of local loop unbundling. Telmex dominates with approximately 95% of the ADSL market.

General Issues

Despite being relatively small markets by global standards, telecommunications has become one of the Caribbean's major growth industries. In particular, the region's mobile sector has been witnessing significant expansion in recent years. To date this growth has largely been harnessed by Jamaican-based mobile provider Digicel. This company is predicted to continue to dominate the robust mobile sector growth during 2009/10.

In contrast to the mobile market, the fixed-line segment remains stagnant. While in a handful of countries Cable & Wireless (which rebranded itself LIME in November 2008) still holds a monopoly in the fixed-line sector, a number of countries now have other operators offering fixed-line services at competitive prices. Investment in infrastructure during 2009 is expected to increasingly trend towards wireless broadband access and associated IP services, such as VoIP.

Global trends and Issues

The Internet has joined the road and rail networks, the postal system and the global telephone network as a vital communications system; particularly in developed countries. The principle known as 'Network Neutrality' allows Internet users to access any web content or applications they choose, without restriction or limitation. This is taken for granted by the billions of people who access the Internet worldwide. However a concerning precedent is taking place in the US, where carriers would like to be able to charge for tiered network service – and it will have global implications if it succeeds. In addition, the US has witnessed mobile operators refuse VoIP operators such as Skype access to their networks. In September 2009 the US regulator announced its intention to vote on new network neutrality rules. The new rules would remove any legal uncertainty about the FCC's ability to enforce its existing network neutrality principles which are currently being challenged in the courts.

While Google, Microsoft and Yahoo continue to focus on their core business of search services, these companies, as well as the other leading Internet media players such as eBay, AOL, Microsoft, News Ltd, Amazon etc also continue to look for other opportunities from developments in mobility, cloud computing, home media, social media, Video on Demand (VoD), infrastructure etc.

In 2009 Microsoft launched its new search engine, Bing and also entered a partnership with Yahoo based on search, advertising and technology sharing. Google is also working on improvements to its own search engine. The potential offered by the emerging market of China has also not gone unnoticed as the Internet Media companies within these markets grapple with

the many Internet-related issues still needing to be confronted, not least of which is the regulatory regime.

It has become clear that the most popular online entertainment services are gambling/gaming, online dating, online music, VoD and social media. In the next few years the overall global entertainment and publishing industry (online and offline) is expected to be worth more than $2 trillion – driven in particular by a wave of growth in online video games/gambling, music, social networking/ User Generated Content (UGC), VoD, etc.

4. Strategies for Future Development

To achieve a sustainable market-based telecommunications system, Cuba will need extensive policy and regulatory training and technical assistance to develop a telecommunications policy and a legal and regulatory structure that would attract private investment and promote competition to expand and modernize the telecommunications infrastructure at affordable prices.

The U.S. Government, through the Department of State, Federal Communications Commission, and the National Telecommunications and Information Administration could assist Cuba by:

- Providing telecommunications related legal expertise in drafting legislation
- Providing assistance in improving the spectrum management framework
- Negotiating bilateral radio spectrum agreements with the United States and new international broadcast frequency arrangements.

The World Bank, USAID, and other international donor agencies, and the private sector, in cooperation with countries in the region, and the EU, can begin assisting the Cuban Telecommunications sector as soon as conditions allow in the placing of advisors in the Ministry and inviting Cubans for training outside the country.

Regulatory and Legal Steps

1. Determine the present condition and efficiency of the existing physical plant. **A preliminary study attempting to determine this information is the main purpose of this report.**

2. Provide experts to draft laws and regulations and advise on policy and regulation by assembling an ad hoc team of U.S. regulatory experts to respond to Cuban needs

3. Participation in general training programs provided by the U.S. Telecommunications Training Institute (USTTI). The USTTI is a non-profit joint venture between leading U.S. based communications and IT corporations and leaders of the federal government and could provide Cuban telecom experts tuition-free management, policy, and technical training

4. Participation in the International Visitors Program(IVP) of the FCC, which enables foreign delegations to interact in informal discussions with FCC personnel who provide legal, technical, and economic perspectives on a wide range of communications issues involving broadcasting, cable casting, and telecommunications. During IVP briefings Cuban telecom experts could learn about the FCC's organizational structure, its multiple roles as an independent regulatory agency, including licensing, enforcement, and rule making procedures, and its statutory powers, regulations, and current proceedings

5. Participation in the Standards in Trade Workshops, which are a major activity of the Global Standards and Information Group (GSIG) of the National Institute of Standards and Technology (NIST). The workshops could provide Cuban standards officials with timely information on U.S. practices in standards and conformity assessment. Participants would be introduced to U.S. technology and principles in metrology, standards development and application, and conformity assessment systems.

We also can draw on the lessons we have learned from our experiences assisting the peoples of East and Central Europe and the former Soviet Union with their transitions from communism to democracy and free markets. And, as it was the case with the East Bloc nations, we see an important part for the multilateral financial institutions to play in Cuba's transition.

Structure of the Law

A national legal system which includes a Privatization Law and its regulations should offer all parties involved in the privatization process an opportunity to participate. The legal structure designed to implement the program should be approved by a Parliament or Congress and should become public law. For such Law to be effective and credible in the eyes of the domestic populace and workforce, in addition to domestic and foreign investors, it should clearly set forth the process that is to be followed.

The Law must also fit within the framework of the general plan for the economic reconstruction of the country, including the range of the other economic and business legislation such as the commercial, tax, regulatory, and bankruptcy codes.

Privatization Oversight Agency

The Law should create a "privatization Agency" authorized to coordinate the many stages and activities involved in implementing the program. The degree and type of powers to entrust to such an agency as well as the nature of the resources available to it are primary issues to be considered by the Parliament or Congress.

The Agency should be established as a separate ministry that draws upon the skills of other permanent agencies, or it should be housed within an existing complementary ministry, suc as Finance or Economy.

This privatization agency should be empowered to decide method, pricing and timing of the privatization of the Telecommunications system, including whether the System requires restructuring before sale.

In order to enhance the agency's stature and protect it from criticism, it should be a need to form an independent, nonpartisan committee to either run or advise the Agency, especially on technical or valuation matters.

A privatization law in the Cuba in transition must address many issues, including:

- Corporate form
- Foreign participation
- Workers' rights
- Government guarantees

Process

Valuation:
Before the Telecommunication system or a group of its assets is sold, there must be a valuation technique to determine a valuation range to prepare for negotiations with a buyer(s). This task can be undertaken by independent appraisers for the benefit of the government. The factors which both the government and potential purchasers may take into account in determining the Telecommunications system's attractiveness will include: a general view of Cuba's economic situation; the regulatory environment affecting the system; and specific characteristics such as market share, growth prospects, management quality, labor costs, international revenues, etc.

The Telecommunications System Company must have their historical financial statements restated to conform to international accounting standards. Advisors must rebuild balance sheets, income statements and cash flow statements to fairly represent their true financial condition, including stating assets values, reserves, costs, and company performance without state subsidies.

In a transitional economy, accurate valuation of assets is difficult, if not impossible to achieve. Also, in the Telecommunications sector we should look into the Latin America markets, for guidance. This report will be valuable on making this evaluation. Valuation techniques include:

- Net present Value/Discounted Flow Analysis (This report should help)
- Comparable transactions
- Publicly Traded Companies
- Strategic factors

Different valuation techniques may be appropriate for the Telecommunications sector, but it is important to perform as many types as valuation methods as appropriate before a sale.

Techniques:

Techniques to privatize the Telecommunications system depend on the speed of implementation, identification of potential purchases/investors, and amount of expected proceeds. In cases where buyers are invited to bid, as possibly will be in the Telecommunications sector, it is important to establish a screening mechanism to ensure that the potential buyer or investor can complete a transaction, among other criteria. It may be advisable to establish a 'floor" price below which the government will not proceed to sell it. It could be:

- Negotiated sale
- Auction/Bid
- Leasing Assets

Within the privatization of the Telecommunications sector, the Government can establish conditions that must be met by the buyer in the future, such as making a level of capital expenditures, and can accept various forms of consideration.

The Screening Process

The Government will have to screen potential purchasers who will be permitted to bid for or negotiate to buy the Telecommunications system. Criteria could include among others: financial strength; past record in acquisitions or privatizations; knowledge of the domestic marketplace.

Information Requirements

The speed and success of the sale of this sector depends to a great extent upon the preparation and availability of accurate and germane information for use in the sales process. The information required can be divided in two segments. First, there is information that will be included in a confidential sales memorandum to be offered to potential bidders. This should include:

- History of the company
- Description of the business
- Markets and customers
- Management and employees
- Investment considerations
- Financial performance
- Corporate/Legal matters
- Future outlook

The second type of the System related information to be prepared will be utilized in the due diligence process once potential purchasers begin to make up an in-depth evaluation. A "dataroom' or back-up data, contracts, customer lists, and detailed financial data should be made available to potential bidders who have screened in the first stage.

The most important step, however, is the establishment of long, medium, and short range objectives to achieve the final goal in Telecommunications.

Public Financial Institutions and Recommendations

The two principal institutions that might finance development in Cuba would be the World Bank and he Inter-American Development Bank. Both institutions lend primarily to governments with central bank guarantees. Even in cases where the ultimate sub-borrower may be the private sector, such as a Telecommunication company. The IDB is the largest multilateral source of financing for the Latin America and the Caribbean region

There is a shortage of capital in the world today. Cuba will carry the burden of external debt, and will find it extremely difficult to attract borrowing from commercial banks. Investors will not stand in line to rush to Cuba in large numbers until they feel comfortable with the political and economic climate and that can only come from a period of proven stability.

The International Monetary Fund (IMF) is an international multinational finance institution. Its stockholders are the governments of 155 countries. Its primary function is not development but assisting international monetary crisis of member countries in cases of balance of payment crises. Cuba could become a member once in its transition stage.

Based on an analysis of transitions from non-market to market economies in Eastern Europe, the World Bank drew some lessons and recommendations from the most successful reform policies. Key among these was the need to privatize while encouraging competitive new enterprises and discouraging the continuation of former state enterprises. They all a common denominator:

- Legal and judicial reform
- Reform of public sector institutions

Also, in order to assure a success in the privatization of the Telecommunications system, Cuba must:

- Develop a favorite climate for domestic and foreign investors
- Secure property and contract rights
- Provide basic infrastructure (Transport, Electrical Energy, Water and Sewer)
- Simplify licensing and regulatory procedures
- Develop a competitive and efficient banking system

Cuba is not a member of the institutions of the international financial community. To join these organizations requires a majority vote by the Board of Governors (or equivalent) of each institution. Membership is strictly sequential: First, Cuba would need to achieve membership in the IMF, then the World Bank, and finally its regional IFI, the Inter-American Development Bank (IDB). IMF and World Bank membership is a prerequisite for debt reduction in the Paris Club.

Lending from the World Bank and the Inter-American Development Bank is generally carried out in the context of a three-year country assessment strategy (CAS). A CAS can take up to several months, although that period could undoubtedly be expedited if Cuba were determined to have substantial needs for immediate assistance. A critical factor in determining the interest rate associated with any such lending would be Cuba's per capita income levels.

- The U.S. Government should encourage a free Cuba to rejoin the IMF, World Bank, and OAS, and join the IDB as quickly as possible.

- The U.S. Government should encourage the IFIs to engage with the new Cuban government to design and implement an effective economic strategy that includes a range of macroeconomic and microeconomic reforms to provide th ebasis for sustained growth.
- The U.S. Government should encourage the IFIs to provide a free Cuba with technical assistance in a variety of areas, including privatization, where the World Bank in particular has extensive expertise based on its study of transitions in a number of former non-market economies.

The U.S. Government and the international financial institutions should be prepared to assist a free Cuba in developing a new investment regime that fosters foreign investment and investor confidence, consistent with appropriate free market mechanisms. This will help not only in the Telecommunications sector, but in all areas of infrastructure and industry.

The U.S. Government should encourage a Cuban transition government to provide assurances that it will continue to uphold its obligations under international intellectual property agreements. Doing so early in the process would be an incentive to foreign investment and thereby facilitate Cuba's move to a free-market economy. This will also be good for the privatization of the Telecommunications system

International aspects

In the privatization of the Telecommunications sector Cuba will have to consider the factor of international competitiveness. There are three important elements in order to provide good quality service and to be international competitive:

- Who owns the Telecommunications sector
- What services are rendered
- Who is generating the technology

International long distance services should be provided by various competing carriers to optimize the benefits of competition and increase revenues.

Open networks are the next step in the evolution of telecoms infrastructure as they give users full control of the services and applications that can be made available over high-speed broadband infrastructure. Open networks also signify a democratization of the telecoms infrastructure. The topology and the architecture of the open network should be such that infrastructure, service and content providers can all offer higher quality and different 'premium' products and services.

Countries with effective and strong regulatory policies are forging ahead with a lively fiber footprint. When regulators get the bit between their teeth and take action the fiber sector gets moving, because operators are no longer put off by regulatory uncertainty. By promoting effective fiber regimes regulators are in turn supported by governments that are conscious of the

socio-economic benefits of fast broadband networks, and the consideration that such networks are vital to national infrastructure.

Regulatory policies aim to encourage fiber infrastructure investment while promoting competition.

What other nations have done

The telecommunications industry in emerging markets has been transformed from a collection of mostly state-owned, national companies to one with many privately owned, multinational corporations (MNCs). Using examples from Latin America, this dramatic reconfiguration is explained as resulting from the dynamic interplay between country and firm strategies. It is further argued that first-mover MNCs reaped greater profits than late-mover MNCs, whereas timing had the opposite consequence for host countries.

First-mover MNCs had the advantage of buying the incumbent state enterprise, enjoying monopoly privileges, making preemptive investments, leveraging political connections, and adopting entry-deterring policies to minimize competition. But early-reforming countries had to contend with the region's lack of credibility with investors by deeply discounting sale price, offering special privileges and protections, and absorbing risks that late-reforming countries were able to pass on to MNCs. The paper concludes that telecommunications no longer offers foreign investors easy riches like those enjoyed by first-moving MNCs in first-reforming countries. Late-moving firms, especially in late-reforming countries, are exposed not only to governments with higher bargaining power but also to greater regulatory and competitive risks.

Shifting boundaries have brought the telecommunications industry to one of the most critical times in its long history. **Technology boundaries are moving** with the rise of Internet Protocol. **Business boundaries are shifting** as telecom service providers expand into media and entertainment. **Organizational boundaries are changing** as fixed and wireless players recombine, and through a dynamic environment of acquisitions and divestitures. As a result, even the most savvy industry veterans are scrambling to keep up.

The advent of VoIP has given rise to new pure-play competitors. More important, it has allowed for giants in other industries - cable and internet - to stake aggressive claims on profits traditionally reaped by telecom operators. This same technology offers operators intriguing new options for growing through new services related to data and entertainment services, or those linked to the convergence of fixed and mobile services. The rapidly evolving telecom environment offers tantalizing options for reducing operating costs, albeit with many complex issues involved in migrating to next-generation networks.

Over the last 20 years, the world economy has been characterized by constant progress in the development of information and communication technologies. This has triggered a complex pattern of social and economic change. This technological revolution is shaping the process of globalization by providing new tools and infrastructures

with which to capture global opportunities. In particular, the technological progress and deregulation of the telecommunications industry has considerably lowered the marginal cost of communications. Furthermore, the growth of the telecommunications industry has allowed a huge increase in the amount of cross-border information flows, reducing transaction costs and stimulating consumer demand for world-class products, services, and brands.

Investment in communications does not always increase the size of overall communication infrastructure. In some countries, investments in mobile communication networks, boosted by the rapid market growth, are partially substituting for investments in the fixed network. Therefore, measuring the telecommunications industry performance and its impact on the economies of different countries through the evolution of the telecommunications infrastructure by means of variables such as the main lines in operation could be misleading for countries characterized by a rapid take-up of the mobile market.

The financial crisis has led to a major rethink on how the various political, social and economic systems operate. Instead of repairing broken systems new approaches are being developed, better-suited for the current environment. Telecoms investments play a key role in most economic stimulus packages. And with government involvement we can work on ways to use the telecommunications networks for the national good. A major requirement in new telecoms infrastructure is that they be based on trans-sectoral thinking, which will create a multiplier effect to benefit healthcare, education, energy and the environment, as well as commerce, media and communications in general.

Financial crisis requires new methods – don't fix broken systems, create new ones. This is the situation in Cuba. The financial crisis has given rise to a major rethink of how we operate in the world. It has become clear that without making massive changes to our political, social and economic systems we cannot sustain the lifestyle we enjoy today – nor can we improve the lifestyle of others less fortunate than us. The environment had already begun to ring alarm bells but the advent of the financial crisis has clearly showed that the systems we presently rely on are damaged beyond repair. We need to start from scratch and build a new, more sustainable future.

The crisis also brought into question the wisdom of the vested interests that have been in control for the last fifty years. In the past the power wielded by some of these entities has made them untouchable, especially in the area of finance, but their spectacular fall from grace has now opened the door for a widespread review of the way the world operates.

None of the large-scale problems we are facing can be solved by fixing broken systems. It is essential that a new approach be formulated in all sectors – healthcare, education, energy, telecommunications, environment and the economy. The new order that is being established is also making it possible for communities to wrest power from the vested interests and take control of some of these developments. Instead of a few large corporations running the show smaller grassroots entities could now become involved in the new developments.

An unprecedented level of grassroots knowledge and education is now available to do things in a different way. We also have communications systems that allow us more involvement than ever before. The Internet and associated technologies such as email, blogs, social networks, etc have given us the tools that will be crucial to recovery.

If we build new telecoms infrastructure we should make use of the multiplier effect that digital infrastructure has to offer in areas such as healthcare, education, climate change and energy. The same broadband infrastructure can be used simultaneously for all those sectors. This would allow a massive increase in the quality of these services. However these institutions need to be actively involved; they should not just be recipients of the infrastructure. Furthermore they will have to remove the internal blockages that obstruct the use of this new environment.

Fortunately the financial crisis has coincided with the communications revolution we are all experiencing at the moment. For the first time most of the world is at least within reach of communications; and many countries in Africa and Latin America have seen a telecoms-driven economic boom over the last five years. This has created an unprecedented level of connectivity between people, which has engendered significant social and economic benefits.
In the developed world no small business will be able to perform well without access to Internet, email, mobile, etc. Studies have shown that the financial benefits to customers of being online are around $150 per month. No country can afford the spiraling costs in e-health and education and we can't maintain the present level of service without the use of online networks. While telecoms can't solve these problems, none of these problems can be solved without communications (or, perhaps better, without ICT).

Labor Market

As a transitional Cuban government begins to denationalize state-owned and controlled entities, workers will encounter a new world in which the state will no longer be the provider of the paycheck, allowing for a more productive and efficient free market economy and potentially causing significant worker dislocations.

The U.S. Government has significant experience working with countries that have recently undergone or are undergoing transitions from controlled economies to market economies. This technical assistance should be offered to a free Cuba to help it establish mechanisms that can ease the transition, helping place workers in new jobs, as well as changing old attitudes about the role of government in providing employment.

The U.S. Government should also offer technical advice to a free Cuba to the extent that a transition may require changing the laws and role of the Labor Ministry to allow the free labor market to function and to improve a free Cuba's compliance with International Labor Organization (ILO) core labor standards.

The U.S. Government should also be prepared to offer its extensive experience helping countries develop their labor market information systems and infrastructure for those systems. For example, in several Caribbean countries, a U.S. Department of Labor project has installed computer software and hardware to support labor market information systems; assisted stakeholders in the development or enhancement of Labor Force Surveys, Occupational Wage The U.S. Government should also assist a free Cuba by providing a coordinated process for revising labor laws in order to promote strengthened labor management relations. This would facilitate private sector development by establishing a sound, equitable, and predictable framework for labor relations, promoting democratic participation of social partners in governance and cultivating transparent and accountable laws.

The U.S. Government should also offer extensive technical advice to Cuba in Supporting projects that promote healthy labor-management relations, a key element to a healthy and dynamic workforce.

There are many small businesses related to the telecommunications sector in the United States. The Cuban American community is especially well placed to provide support for the telecommunications sector in Cuba. The existing Cuban American firms should use their in-depth knowledge of the U.S. market to accelerate the establishment and growth of the telecommunications infrastructure in Cuba.

Bringing off rapid growth in China necessitated utilization of a vast network of wealthy and productive overseas Chinese. In many ways, Cuba has a similar resource in the 20% of its people who live abroad, especially in the United States. The potential for cooperation between Cubans on the Island and abroad in the promotion of real economic change is substantial.

Cuba's successful transition to a democratic system, private property, free enterprise, will require a major effort in all aspects of society. We firmly believe that this is necessary, not only for the Telecommunications infrastructure, but for the establishment of free market in Cuba.

Possible privatization methods

Telecommunications is an industry characterized by rapid technological innovation and externalities. The concept of critical mass and reciprocal returns in particular sets telecommunications apart from other technologies or utilities. New technologies in mobile communications, digital data transmission, Internet, proved to be significant contributors to improved efficiency and economic growth of the sector.

The telecommunications infrastructure would be one of the most important assets to be privatized in Cuba, and it could reveal much information about Cuba's approach to economic reform and development. A State company can not be able to dominate the telecommunications industry due to the dramatic changes in microwave, fiber optic, and computer technology. These

changes have made the industry to have a more flexible infrastructure with higher levels of competition.

In many countries, telephone service is artificially priced low at a level which does not allow for recovering the investment in new equipment. The result of this shortsighted policy is that, although telephone service can be afforded by more people, it is not available and potential subscribers have to wait for a long time to obtain a telephone line.

The new government in a democratic Cuba will have to initially assume the control and operation of the system to avoid a shut down. During the transition process the country will have to make a decision on how best to run the system. There exist several possibilities:

- Government owned infrastructure. This possibility will require a large amount of capital investment for the improvement of the infrastructure, that otherwise could be directed to the restoration of other segments of the economy and other basic infrastructure, such as transportation and power sector. Also, publicly owned telecommunications systems try to develop areas that are politically important to the government, ignoring the real areas in need. The Telecommunication system will eventually become a large bureaucracy that will make it operate inefficiently.
- System owned by one private Telecommunications Company. This possibility will require a large a large private investment to improve and enlarge the system.

- Fragmentation of the system in smaller companies. This can be done in two forms:

(1) By territorial areas
(2) By segments of the system. Here private investors can compete and the growth of the sector can be dictated by a well planned regulatory commission.

The fragmentation by territories is a new concept that might allow the system's growth, and put the investors in a competitive environment and it could foster the efficiency of their respective segments. Since smaller amounts of capital will be required for each segment, this possible method would attract a large amount of smaller investors, making the raising of capital easier to find.

However, the transitional government must conduct an evaluation of the initial necessary steps to maintain in operation the existing systems and establish the legal regulatory procedures, so that privatization could be accomplished in a minimum time due to the urgency of the restoration or determine if enough interest is obtained for a single franchised investor, so the legal structure can be established for that solution, or proceed with the legal base so that fragmentation by systems can be immediately established.

APPENDIX I

Bejucal: Cuba Telecommunications Intelligence Base

Background

Cuba has surprising talent and experience in the areas of electronics, computers, computer software and data processing. The country benefited from its association with the former Soviet Union, and some European countries, which turned out many skilled electrical and computer engineers, as well as technicians.

Since 1991, there has been a surplus of electrical and computer engineers in Cuba due to the closing of many industries. Many of these engineers changed their lines of work to the areas of telecommunications espionage and computer interference and disruption, in special centers created by the government.

A large group of them received specialized training in Russia, Vietnam, North Korea and China As a result, a significant engineering and technical staff is now dedicated to research, development and application on these areas.

The Beginning

Prior to the August 1991 coup attempt, the KGB was developing computer viruses with the intent of using them to disrupt computer systems in times of war or crisis. In early 1991, a highly restricted project was undertaken by a group within the Military Intelligence Directorate of Cuba's Ministry of the Armed Forces.

The group was instructed to obtain information to develop a computer virus to infect U.S. civilian computers. The group spent about $50,000 dollars to buy open-source data on computer networks, computer viruses, SATCOM, and related communications technology. These efforts have continued to be made, now in a much larger scale, and could potentially cause irreparable harm to U.S. defense system.

Several computational centers have been created at either universities or research centers through Cuba, where highly top research and development activities are conducted. The developments of software requires little in the way of resources- a few computers and an individual or group with the appropriate expertise-making a malicious software R&D program easy to support as well as to hide.

Since 1998, in spite that very little has been written about the Bejucal base in Cuba, Cuba’s system of international communications surveillance is in full operation. Most of what has been written has been ignored by US and European authoritities. Bejucal is an electronic

intelligence base used by the Cuban military intelligence to intercept and process international communications passing via communications satellites.

Other parts of the same system intercept messages from the Internet, from undersea cables, from radio transmissions, from secret equipment installed inside embassies, or use orbiting satellites to monitor signals anywhere on the earth's surface.

Dozens of advanced nations use sigint as a key source of intelligence. Even smaller European nations such as Denmark, the Netherlands or Switzerland have recently constructed small, stations to obtain and process intelligence by eavesdropping on civil satellite communications. All of them are smaller than Cuba's Bejucal, and none of them are so close to the United States.

Everything produced in the Bejucal sigint base is marked by hundreds of special codewords that "compartmentalize" knowledge of intercepted communications and the systems used to intercept them.

The scale and significance of the global surveillance system has been transformed since 1980. The arrival of low cost wideband international communications has created a wired world. But few people are aware that the first global wide area network (WAN) was not the internet, but the international network connecting sigint stations and processing centers.

By the early 1970s, the laborious process of scanning paper printouts for names or terms appearing on the "watch lists" had begun to be replaced by automated computer systems. These computers performed a task essentially similar to the search engines of the Internet. Prompted with a word, phrase or combination of words, they will identify all messages containing the desired words or phrases.

Their job, now performed on a huge scale, is to match the "key words" or phrases of interest to intelligence agencies to the huge volume of international communications, to extract them and pass them to where they are wanted. During the 1980s, the NSA developed a "fast data finder" microprocessor that was optimally designed for this purpose. It was later commercially marketed, with claims that it "the most comprehensive character-string comparison functions of any text retrieval system in the world". A single unit could work with:

*trillions of bytes of textual archive and thousands of online users, or gigabytes of live data stream per day that are filtered against tens of thousands of complex interest profiles.

Although different systems are in use, the key computer system at the heart of a modern sigint station's processing operations is the "Dictionary". Bejucal contains a Dictionary. Portable versions are even available, and can be loaded into briefcase-sized units known as "Oratory" 10. The Dictionary computers scan communications input to them, and extract for reporting and further analysis those that match the profiles of interest.

In one sense, the main function of Dictionary computers are to throw most intercepted information. The "common" automated data processing equipment (ADPE) in the Bejucal base include the following elements:

- Local management subsystem
- Remote management subsystem
- Radio frequency distribution
- Communications handling subsystem
- Telegraphy message processing subsystem
- Frequency division multiplex telegraphy processing subsystem
- Time division multiplex telegraphy processing subsystem
- Voice processing subsystem
- Voice collection module
- Facsimile processing subsystem
- [Voice] Tape Production Facility
- Software systems to load and update the Dictionary databases.

There are 10 satellite antennas at Bejucal . There were 12 at Lourdes.

New methods which have been developed during the 1990s available to recognize the "topics" of phone calls, and allow automating the processing of the content of telephone messages under the rubric of "information warfare", the sigint bases also hope to overcome the ever more extensive use of encryption by direct interference with and attacks on targeted computers. These methods include information stealing viruses, software audio, video, and data bugs, and pre-emptive tampering with software or hardware ("trapdoors").

Satellites

Satellite communications provide the relaying of data, telephone, transoceanic and national TV signals. Most communication satellites are placed in geostationary orbit (GEO), located at 22,300 miles above the equator. The most used frequencies for these satellites are: 6GHz uplink, 4GHZ downlink, or 14 GHZ uplink and 12 GHZ downlink. Each satellite has a number of transponders aboard to amplify the received signal from the uplink and to down convert the signal for transmission on the down link. Most transponders are designed for bandwidth of 36, 54, or 72 MHZ.

China has converted an ICBM base at Taiyuan, southwest of Beijing, into a satellite-launching center. China is only the third country in the world to operate recoverable satellites, which can bring photographic film and experimental specimens back to earth.

The first satellite to be launched on Earth in the 21st century was a test of the Shenzhou-2 unmanned spaceship on January 9, 2001. China has launched 20 space vehicles since January 2001 up to date. This is twice the annual rate of the 1990s.

VIEW OF BEJUCAL BASE Coordinates: 22 56'00" 82 23' 30"'

The Soviet Union maintained in Cuba the Lourdes electronic espionage base, to which Cuba did not have direct access. On 1994, Cuba and Russia agreed the construction of a similar base for Cuba. It was built in Bejucal, south of La Habana, and became operational on December 1997, at a cost of $750 million US dollars. It is known as the Bejucal Base. It is to note the importance of cybernetics for Cuba, going in only 6 years from a $50,000 budget to $750 million. Lourdes was dismantled in 2002.

This base has the capacity of listening to telecommunications in the United States, as well as to interfere in computer networks, read/change electronic files, and more important, to change output commands of computers use to control infrastructure facilities.

On 1999, the PRC and Cuba signed an agreement that allows Chinese personnel to collaborate in the Bejucal base, as well as in several other facilities that Cuba has. This agreement gave place to what is called Operation Titan. Since 2002, Cuba uses PRC's satellites in the operation of the Bejucal base.

Since 2003, the Cuban government has emphasized the training of talented young Cuban engineers in computation and cybernetics, and selected ones have been placed in key positions in all cyber facilities in Cuba. The government of Cuba has declared publicly that computers have replaced canons in the modern asymmetric war.

Below, we will briefly describe the main cyber installations in Cuba.

- Bejucal base, Habana Province. 20 square miles area. Cost $750 million dollars. 1,100 engineers, technicians and staff work here. It has three satellite/antennas groups. Capabilities of voice recognition. Computer networks can be interfered from the Base, as well as satellite telecommunications. Research and development of asymmetric electronic weapons. Two HPCs or high Speed and operation computers.DGI is in charge of the Base.

- The electronic complex, located in Vedado, La Habana, in Paseo Street, between 11 and 13 Streets. Cost $75 million dollars. Here are located the offices of the Electronic Warfare Batallion. Main task: interfereing telecommunications.
- The Cojimar electronic complex, east of La Habana. Cost $40 million dollars.
- The Wajay farm, near Bejucal.Also known as the Antenna farm. Hundreds of especial antennas are located here. Cost $15 million dollars.
- The antenna farm of Santiago de Cuba, eastern part of Cuba. Similar to the one in Wajay. Cost $15 million dollars.
- Establishment in 2003 of the University of Informative Sciences, UCI, in the place where the Russian Lourdes base had been. It has an enrollment of 10,000 selected students in a five year program.

During the Summer of 2004, Cuba interfered satellite communications from the United States to the people of Iran. This was done from the Bejucal base. This operation confirms the high technology of Cuba as well as the close ties with Iran. Cuba is the only country classified as terrorist nation, which has such high cyber infrastructure.

APPENDIX II

TELEVISION

The following is a list of all television stations in Cuba:

- Cubavisión (Canal 6) - State broadcaster
    - Cubavision International - Satellite service of Cuba Vision, broadcasting internationally
- Canal Educativo
- Canal Educativo 2
- Canal Habana
- Tele Rebelde (Canal 2)

The United States Military has a television station to serve the troops at Guantanamo Bay:

- NBW 8 (AFN), Military station of Guantanamo Bay

TV coverage in Cuba is 98%. It has radiated power of 5,280.8 MWh. There are 2.64 millios TV sets in Cuba, placing Cuba in number 62 in the world.

Analog or digital?

Digital television will soon be a reality in Cuba? Possibly, not. A technical commission was formed on June 2009 to oversee the transformation from analogue to digital television in the island.

For two days, on December 2009, national and foreign experts —including high level representatives of the European, Japanese and Chinese digital norms— will analyze the characteristics of each international norm and attend field tests to check their functioning within the Cuban context.

Selecting a norm is the first step in making the transformation to digital, a process that could take as long as 15 years given the investment it entails.

Along with better reception and quality, digital television would bring more channels, and reach silent zones. The new technology also means changing the country's television sets, a slow, gradual process.

Cuba has 2.6 million TV sets, or 21.6 TV sets per 100 population. There are not cable or satellite TV except for foreigners or tourists,

Cable TV subscribers and penetration in major Latin American countries – 2007 - 2008

Country	2007	2008	Annual change	Penetration per capita	Household penetration
	(million)				
Argentina	5.85	6.00	+3%	15.1%	54.7%
Brazil	3.23	3.80	+18%	2.0%	6.7%
Chile	0.87	0.90	+3%	5.3%	18.3%
Colombia	1.97	3.00	+52%	6.2%	28.4%
Mexico	4.36	4.82	+11%	4.5%	15.3%
Peru	0.71	0.96	+36%	3.3%	13.5%
Venezuela	1.55	1.79	+15%	6.4%	26.1%

Key highlights:

Argentina

In terms of pay TV penetration, Argentina is a world leader, with more than one home out of two being subscribed to pay TV services, but media convergence suffers from regulatory battles involving the government, pay TV companies, and telecom operators. According to Argentinean law, a telecom company is not allowed to offer pay TV, and must ally with a CATV operator if it wants to offer converged services. Telcos have been urging the government to reform the Argentine telecoms law to facilitate media convergence. The Cable TV Operators' Association, on the other hand, has urged the government not to allow telcos into the pay TV sector – at least not until CATV companies have completed the digitization of their networks. It claims that the telecom incumbents would take over the pay TV market and push CATV companies out of business.

Brazil

In Brazil, delay in legislating on the matter of convergence has led to much confusion and conflict, involving pay TV companies, telecom operators, and regulatory authorities. Incumbent telcos have been forcing the issue by entering the pay TV market before receiving authorization to do so. Although regulatory questions still await resolution, both pay TV and telephone companies have been active in developing convergence strategies, and several operators offer triple or quadruple play packages. The market leader is Net Serviços de Comunicação, controlled by Mexico's Telmex; in fact, Net is the largest multi-service cable TV provider in Latin America, with a bundled video, broadband, and voice service in 79 Brazilian cities. Brazil was the second country in Latin America to adopt a digital TV standard; digital terrestrial TV was launched in December 2007, but is experiencing slow uptake.

Mexico

Mexico's main cable TV providers, Megacable, Cablemás, and Cablevisión, are active in the triple play market, with offerings of bundled cable TV, broadband, and telephony; as a result, their broadband subscriber base and in particular their VoIP subscriber numbers witnessed healthy growth during 2007 and 2008. Telmex has claimed to have lost over 50% of the voice market in areas where cable companies offer triple play services. In 2007, it requested to have its own license modified to include pay TV services, but in late 2008, it entered into an agreement with the newly constituted Dish Mexico to distribute DTH satellite TV services. Mexico was the first country in Latin America to launch digital terrestrial TV; by early 2009 there were an estimated 38 digital channels.

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