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Cuban Telecommunications, Computer Networking, and U.S. Policy Implications

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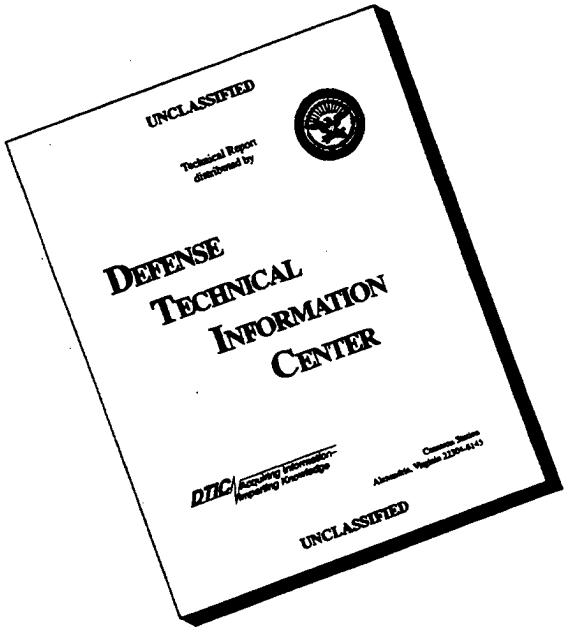

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PREFACE

The rationale for this study traces back to a 1992 RAND study -- Edward Gonzalez and David Ronfeldt, *Cuba Adrift in a Post-Communist World* (RAND, R-4231-USDP, 1992) -- which recommended the development of a U.S. information and communications policy to help open up Cuba's closed system and foster the emergence of an independent civil society. This recommendation was reiterated in a second study -- Edward Gonzalez and David Ronfeldt, *Storm Warnings for Cuba* (RAND, MR-452-OSD, 1994). The third study in this series -- Edward Gonzalez, *Cuba: Clearing Perilous Waters?* (RAND, 1996, in print) -- elaborates further on the importance of developing proactive U.S. policy measures to help foster independent civil-society actors in Cuba, and continues to note the importance of information and communications for this. Meanwhile, a companion study -- John Arquilla, *A Decision-Modeling Perspective on U.S.-Cuba Relations* (RAND, MR-337, 1994) -- provided additional analysis about moving in these directions. Other RAND research, not specifically about Cuba, also implies that information and communications should be developed as a new dimension for U.S. policy and strategy.

This study by Larry Press was solicited to improve knowledge about the telecommunications situation in Cuba, particularly the prospects for expanding computer networking via the Internet. It was commissioned as a background paper for a project on "Actors, Outcomes, and U.S. Policy for a Cuba Undergoing Change" that Edward Gonzalez and David Ronfeldt co-directed during 1994-1995. The paper contributed to the preparation of the 1996 study by Gonzalez.

The client for the project was the Office of the Assistant Secretary of Defense (International Security Affairs/Inter-American Affairs), in the Office of the Undersecretary of Defense for Policy. The project was conducted under the International Security and Defense Policy Center of RAND's National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff and the defense agencies.

In expanding our knowledge of Cuban telecommunications and computer networking, this study begins to identify, in preliminary fashion, some implications that a more open, deliberate information and communications policy may have for Cuba, U.S.-Cuban relations, and U.S. interests. It thus lays groundwork for new research on this emerging issue area. Would such a policy put Fidel Castro on the defensive? Weaken his grip on Cuba's political, military, economic, and social systems? Benefit reformist elements in his regime? Foster independent nongovernmental organizations (NGOs) in the realm of civil society? Aid the rise of private businesses, and independent labor and professional associations? How would such a policy affect U.S. relations with other Latin American nations regarding Cuba? And how would it affect the Cuban exile community in Miami, and the roles Cuban-Americans may play in future U.S.-Cuban relations? Of course, the answers to such questions would depend in part on what kind of a U.S. information and communications policy could be adopted toward Cuba, and how it would be implemented. Identifying and assessing the best options and initiatives is another important task for research that we hope will materialize to build on this background study by Larry Press.

The study should be of interest to all audiences inside and outside the U.S. government, who want to be better informed about implications that the information and communications revolution may have for Cuba and U.S.-Cuban relations. Comments are welcome and may be sent to the author, me (David Ronfeldt), or Edward Gonzalez at these addresses:

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SUMMARY

Information and communications is becoming a strategic factor in U.S.-Cuban relations. Its importance is increasingly recognized by research analysts and by U.S. policy makers and legislators. Yet there is a dearth of knowledge about the telecommunications situation in Cuba, and about its implications for the formulation of future U.S. options in this policy area.

This study surveys the current telecommunications situation in Cuba, with an emphasis on computer networking. Cuba already has four networks with international connections to the Internet and three X.25 networks. In spite of extreme economic problems, Cuban networks have grown substantially in size and sophistication since 1992, mainly because the Cuban government has allowed and funded their growth.

The Internet is expanding globally, and there is evidence that a small investment in computer networks can have a relatively large impact in developing nations that is positive for U.S. interests. Thus, a major conclusion of this report is that U.S. policy should encourage Cuban computer networking. Seven specific recommendations emerge from the study:

- Encourage Cuban Internet connectivity;
- Reduce administrative bottlenecks regarding bi-directional travel for technicians and new communication offerings;
- Avoid the posting of blatant propaganda on the Internet;
- Utilize the Internet to communicate balanced news and analysis;
- Avoid legislative restrictions on telecommunications;
- Permit direct investment in Cuban telecommunications and computer networks by U.S. firms;
- Foster Internet usage by Cuban NGOs, universities, and other Cuban users.

As the Cuban Democracy Act of 1992 begins to recognize, improved communications can be used to benefit U.S. interests in promoting free

and fair elections, civil liberties and human rights, the growth of an independent civil society, and a market economy. However, an effort to improve communications may pose dilemmas for both the United States and Cuba.

On the one hand, it would require a significant departure for U.S. policy, and the resulting improvements in Cuba's communications infrastructure could attract new foreign investments and help the Cuban economy grow, thereby assuring the Castro regime's survival. On the other hand, improved communications would present Castro with the "dictator's dilemma." Cuba needs modern communication systems for economic growth, but, as Castro has recognized, they would facilitate greater internal and external freedom of expression -- and that could undermine the regime's control over society.

ACKNOWLEDGMENTS

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1. INTRODUCTION

While the economic embargo has long been the centerpiece of U.S. policy and strategy toward Cuba, information and communications issues and measures have never been ignored. For example, there were reasons to maintain U.S.-Cuban telephone connections to some degree, and pre-embargo connectivity was preserved by letting AT&T continue to operate its existing (and ultimately quite limited) undersea cable to Cuba. The power of information was also recognized in the Radio Broadcasting to Cuba Act of 1983, which established Radio Marti. But such measures were piecemeal, not yet part of a comprehensive policy or strategy defined by the emerging information revolution.

Today, it is increasingly recognized that the information revolution can serve to open closed systems and promote democratic trends, in part by enabling the rise of nongovernmental organizations (NGOs), components of an independent civil society. In 1991-1992, research at RAND began to recommend that Washington develop an information and communications policy toward Cuba that reflected this dynamic [17, 18]. Studies elsewhere, notably by Gillian Gunn [21, 22], and more recently the Interamerican Dialogue [26], also urged Washington to move in this new direction. Meanwhile, the Cuban Democracy Act of 1992, which issued from the offices of Rep. Robert Torricelli (D-N.J.), wrote into policy that telecommunications connections and information exchanges should be improved between the United States and Cuba in order to increase the potential for change in Cuba.

A comprehensive information and communications policy and strategy would have many elements. It might take account of conventional elements like the printed materials available in a country, radio and television broadcasting, the roles of journalists and news bureaus, etc., as well as electronic technologies like modern telephone and fax services and Internet-based email, mailing lists, information servers, etc. These can play significant roles enabling new political, economic, and civil-society actors to communicate and coordinate internationally and intranationally. The elucidation of a comprehensive policy and

strategy lies beyond the scope of this study, but it aims to contribute to the understanding of an important element.

This study focuses on Cuban telecommunications and computer networking. The emphasis on computer networking is motivated by the rapid growth of the Internet and other computer networks connected to it. Computer networks are strategic components of the emerging global information and communication infrastructure. While ninety percent of the Internet hosts are in North America and Western Europe, there is also considerable networking activity in developing nations, including Cuba. There is also evidence that a small investment in computer networking can have a relatively large, positive impact in a developing nation [56]. The report proceeds in three sections[1]:

- The first provides a background survey of Cuban telecommunications conditions and other areas related to computer networking.
- The second describes the current state of computer networking in Cuba.
- The third section identifies resources necessary for improving computer networking, and posits some policy and action measures for facilitating Cuban networking that might be advisable for the United States to pursue.

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[1]There are also appendices with details about the Cuba-related servers on the Internet and computer networking terms and technology for readers who are unfamiliar with this field.

2. COMMUNICATIONS BACKGROUND

This section looks at telephone infrastructure and other factors related to Cuban communications and networking. It discusses international telephone links to Cuba, the internal Cuban telephone infrastructure, Radio and TV Marti, the Cuban software industry, Cuban informatics conferences, the short-lived outbreak of pirate TV antennae in Havana, and two key communication-related industries, tourism and biotechnology.

INTERNATIONAL TELEPHONE LINKS

Phone service between the U.S. and Cuba began in 1921 with AT&T's installation of an undersea cable between Florida and Cuba (see the timeline in Figure 1). AT&T dominated international telephony to Cuba until the 1990s. After the embargo, they were allowed to continue serving Cuba with the general policy that existing service continue, but new capacity not be added. Cuban long-distance revenues were deposited in an escrow account, and calls from the U.S. were routed through an operator. The FCC estimated that less than 1% of the 60 million annual call attempts were completed [11]. Cuban pressure and the rapid growth of Canadian companies providing call-back service in the U.S. led to the State Department issuing guidelines calling for increased service in compliance with the 1992 Cuban Democracy Act [4] which allows an embargo exemption in support of "efficient and adequate telecommunication service between the United States and Cuba." Today we have direct dialing to Cuba and 953 authorized voice-grade (64kbps) circuits. Of these 504 are in use. See Table 1.

WilTel (WorldCom) has applied for permission to construct a 210 kilometer, 2.5 gigabit fiber optic cable that would have roughly 41 times the currently authorized capacity. (John Williams, a founder of WilTel's parent company, was born in Cuba, and his family had business there until 1956). While this is clearly excessive capacity today, video traffic and an evolved Internet could one day use that and more.

Figure 1: US-Cuban Telecommunication Timeline

April, 1921: Long distance service established through a submarine cable between Florida and Cuba.

July, 1950: AT&T replaces original cable.

August, 1957: Service enhanced by addition of over-the-horizon radio between Cuba and Florida.

October, 1966: AT&T is exempted from the 1962 trade embargo for humanitarian reasons.

April, 1987: Cable system fails, and service is diverted to radio relay towers.

April, 1989: AT&T replaces the failed cable system, but Cuba-U.S. terms of agreement differences keep it inactive.

August, 1992: Hurricane Andrew incapacitates the radio system in Florida City, and calls are routed through Italy.

July, 1992: The Cuban Democracy Act authorizes telecommunication facilities "in such quantity and of such quality as may be necessary to provide efficient and adequate telecommunications services between the United States and Cuba."

February, 1993: A Cuban-Mexican cellular joint venture is formed.

July, 1993: Cuban government cuts calls from the U.S. from approximately 20,000 minutes/day to 20,000 minutes/month.

July 22, 1993: U.S. State Department issues guidelines for long-distance companies doing business with Cuba.

July 27, 1993: The FCC issues notice of acceptance of applications for Cuban service. (Report No. I-6831).

March 9, 1994: WilTel agrees to construct an undersea fiber cable.

October 4, 1994: The FCC authorizes five carriers to provide switched voice and leased private-line services to Cuba: WilTel, MCI, LDDS, Sprint, and IDB. (WilTel, IDB, and LDDS subsequently merged to form WorldCom), and AT&T service is improved. (Report No. CC-588, Memorandum Opinion, Order, Authorization & Certification DA 94-1098)

December 7, 1994: The FCC authorizes the resale of switched services to Cuba. (Report No. I-7079)

March 10, 1995: A State Department letter states they have no objection to Sprint offering direct packet data service via Canada or to GTE's Dominican Republic subsidiary CODETEL acting as a transit point for US-Cuban telecommunications traffic.

June 19, 1995: An FCC letter authorizes AT&T Puerto Rico to temporarily operate 150 voice grade circuits pending approval of their permanent request.

Table 1

Voice Channels from U.S. to Cuba (64 kbps)

Carrier	Link	Authorized by the FCC	In Use
AT&T	undersea cable	143	114
AT&T P. R.	Intelsat	150	150
MCI	Intelsat	150	120
Sprint	Intelsat	120	30
Worldcom	Intersputnik Intelsat Columbia	390	90
Totals		953	504

The Worldcom figure is the sum of the authorizations of WilTel (120), LDDS (150), and IDB (120), which were merged. Further compression can increase these figures. WilTel (WorldCom) also has permission for occasional use of 2 satellite video links via Intelsat.

Source: Troy Tanner, Attorney-Advisor, FCC, Report No. CC-588, Memorandum Opinion, Order, Authorization & Certification DA 94-1098, and a letter from the State Department to AT&T dated June 19, 1995.

While motivated to some extent by current demand for calls (perhaps $250 million per year [25]) between U.S. family members and Cuba, WilTel is clearly looking forward to post-embargo expansion. Haines [25] writes:

> WilTel Technology Ventures president, Jerry Seller, feels Cuba could play a key role in the development of communications in the Caribbean, emerging as a "very interesting hub to tie in the United States." Some U.S. analysts have gone further, suggesting that Cuba could become a center for cable Communications between the U.S. and the Caribbean, later becoming the hub of a U.S./Caribbean/Central America/South America loop.

The WilTel application was made to the Commerce Department, which referred it to the State Department for an opinion. A positive opinion was given in November, 1994, and the application is back in Commerce [31]. WilTel says the cable can be in operation a year after they receive approval [25].

Sprint also confirmed that they plan to offer leased, private-line service [60]. Though they would not comment on price at this time, this would support full Internet connectivity if it could be afforded.

There is also a $41 million joint venture between Cuba (51%) and Italcable (49%) which provides long distance and international service through five portable earth stations in major tourist areas [25, 27]. I was unable to ascertain the capacity, but according to the Cuban Communications Ministry there are 1,109 total circuits. Italcable may account for the difference between this and the U.S. circuit count. In any case, the majority of voice traffic is to the U.S.

While there is unused capacity for current voice traffic, demand would increase dramatically if the trade embargo were revoked. Still, a fiber cable would allow for much more voice traffic as well as video and other high-bandwidth data types and services. The antiquated internal Cuban infrastructure is a greater constraint on Cuban telecommunications than international connectivity.

INTERNAL CUBAN TELECOMMUNICATION INFRASTRUCTURE

Cuban telecommunication infrastructure lags behind much of the world and the Caribbean region. Table 2 compares the number of main lines -- telephone lines connecting a customer's equipment (e. g., a phone or fax machine) to the public, switched telephone network -- in Cuba with larger Caribbean nations and nations in various income groups and geographic regions. Cuba has fewer telephone lines as a proportion of population and GDP than any Caribbean nation but Haiti, and is closer to the low-income nations than the lower-middle group in which it falls.

Armando Coro, a telecommunications expert and University of Havana professor states that "The US embargo has had a devastating effect on Cuba's telecommunications." [64] The interruption of supplies of spare parts from Eastern Europe after the Soviet dissolution and a lack of hard currency has exacerbated the problems. Table 3 shows that Cuba has added some main lines since 1992, but that growth is much slower than in other developing nations or the world.

Table 2

Caribbean and World Main Lines

	Pop (mil)	GDP '93 ($ bil)	Mains (000)	Mains/ 1000 Cap	Mains/ mil GDP
Cuba	11.0	12.9	349.5	31.8	27.2
Bahamas	0.3	3.1	76.2	282.2	24.6
Dominican Republic	7.5	7.3	474.4	63.3	65.0
Jamaica	2.4	3.8	250.5	103.1	65.9
Puerto Rico	3.7	35.8	1,314.8	360.2	36.7
Haiti	7.0	2.6	45.0	6.4	17.3
Low income nations	3,147.2	1,276.0	46,522.2	14.8	36.5
Lower middle	1,110.6	1,616.6	93,189.7	83.9	57.6
Upper middle	508.4	2,242.8	71,893.4	141.4	32.1
High income	838.9	18,850.2	435,521.7	519.2	23.1
Africa	700.62	422.2	11496.6	16.4	27.2
Americas	764.96	8422.2	213495.1	279.1	25.3
Oceania	27.97	341.5	10810.9	386.5	31.7
World	5605.01	23985.6	647127	115.5	27.0

Source: "World Telecommunication Development Report," International Telecommunication Union, March, 1994. Updated Cuban figures were supplied by the Cuban Ministry of Communications, and vary slightly from the published version.

Table 3

Change, 1992-1994

	Pop (mil)	GDP ($ bil)	Mains	Mains/ Cap	Mains/ mil GDP
Cuba	1.89%	-14.27%	4.03%	2.10%	21.34%
Bahamas	-10.00%	-6.06%	-4.15%	6.50%	2.03%
Dominican Republic	0.00%	0.00%	0.00%	0.00%	0.00%
Jamaica	-2.80%	-2.56%	49.02%	53.31%	52.94%
Puerto Rico	1.39%	59.11%	29.52%	27.75%	-18.60%
Haiti	3.53%	0.00%	0.00%	-3.41%	0.00%
Low income nations	-2.18%	28.22%	80.36%	84.39%	40.67%
Lower middle	40.62%	39.04%	67.27%	18.95%	20.31%
Upper middle	-20.36%	-0.24%	-16.51%	4.83%	-16.31%
High income	1.45%	8.52%	7.19%	5.66%	-1.22%
Africa	2.38%	1.81%	14.10%	11.44%	12.07%
Americas	2.91%	13.65%	10.36%	7.23%	-2.90%
Oceania	2.45%	-1.56%	7.81%	5.23%	9.52%
World	2.42%	10.14%	12.75%	10.09%	2.37%

Source: "World Telecommunication Development Report," International Telecommunication Union, March, 1994. The Cuban figures were supplied by the Cuban Ministry of Communications after publication, and vary slightly from the published version.

Table 4

Cuban Telecommunication Indicators

Indicator	1992	1993	1994
Population	10,785,800	10,855,700	10,989,400
Havana population	2,142,100	2,158,800	2,175,200
Homes	3,031,000	3,120,000	3,146,681
Gross Domestic Product	15,009.9	12,776.7	12,868.3
Main telephone lines	336,945	349,000	349,471
Main lines Havana	153,287	155,100	156,937
In Havana	45%	44%	45%
Installed capacity	447,340	455,708	459,168
Capacity used	75%	77%	76%
Lines to automated COs	99.0%	99.0%	99.2%
Lines to digital COs	1.0%	1.0%	1.0%
Residential lines	63.0%	63.5%	64.8%
Public telephones	10,003	7,508	5,814
International circuits	262	442	1,019
Telex subscribers	4,728	4,523	4,337
Fax machines	392	na	na
Cellular subscribers	234	600	1,152
Radio paging subscribers	632	734	859
Private leased lines	1,006	na	na
X.25, 28 subscribers	na	na	266
Faults/year/100 lines	14.9	25.1	29.2
Internat. calls (MM min.)	7.5	7.5	11.2
Residential installation	$100.00	$100.00	$100.00
Residential installation	$100.00	$100.00	$100.00
Monthly residential charge	$6.25	$6.25	$6.25
Monthly commercial charge	$9.25	$9.25	$9.25
Charge per 3 min	none	none	none
Cellular installation	$120.00	$120.00	$120.00
Monthly cellular charge	$40.00	$40.00	$40.00
Cellular charge/3 min.	$0.40	$0.40	$0.40
Full-time employees	16,900	17,363	15,686
Total revenue, $ million	221.5	241.4	283.8
Annual investment, $MM	26.7	na	na
TV sets	1,918,000	2,061,000	na
Satellite antennae	na	na	260

Note that prices shown assume 1 dollar per peso, but this is unrealistic. Cuban residential service is paid in pesos, but lines to the digital office (33 prefix), and cellular fees are paid in dollars.

Source: Minister of Communications, Havana Cuba, provided by the ITU, September, 1995.

Table 5

Cuban Telecommunications in a Global Context

Indicator	Cuba	Low Income	Lower Middle Income	Upper Middle Income	High Income	World Average
Basic Indicators						
Population (m) 94	11	3,506	956	496	839	5,606
Density (per km2)	96	86	23	22	25	41
GDP (bil. $US) 93	13	1,400	1,535	2,210	18,850	23,994
GDP per capita	1,331	433	1,619	4,555	22,617	4,360
Main telephone lines						
Lines, 1984	257	8,947	43,485	31,619	304,793	388,844
Lines, 1993	349	47,205	92,590	70,084	424,141	634,019
CAGR (%) 84-94	3.5	18.1	7.9	8.3	3.4	5.0
Lines/100 inhab. 84	2.6	0.3	5.3	7.6	39.6	8.2
Lines/100 inhab. 93	3.2	1.4	9.6	14.1	50.8	11.4
CAGR (%) 84-94	2.5	15.9	6.2	6.4	2.5	3.3
Local telephone network						
Capacity used (%) 92	75.1	65.2	84.9	84.8	89.6	85.5
Automatic (%) 92	99.0	97.5	97.6	99.8	100.0	99.5
Digital (%) 92	1.0	75.0	29.7	55.3	67.4	61.6
Residential (%) 92	63.0	55.6	73.9	74.3	73.3	72.7
Faults/100 lines/yr. 92	14.9	170.6	50.0	33.3	10.1	23.8
Tele-accessibility						
Residential lines (k) 92	217	13,315	62,154	48,320	276,868	400,657
Households (k) 92	3,031	382,798	174,162	97,332	277,539	931,831
Lines/100 households 94	7.2	2.9	28.5	41.8	98.9	37.5
Payphones total (k) 92	10	317	676	1,109	4,479	6,581
Payphones/1000 pop. 94	0.9	0.1	0.7	2.3	5.4	1.2
Urban concentration						
Pop. in capital (%) 94	19.8	4.7	11.6	16.8	7.8	8.2
Lines in capital (k) 94	157	4,517	21,673	18,336	30,150	74,677
Lines in capital (%) 92	45.0	29.7	25.8	31.2	8.9	15.0
Capital teledensity 94	7.2	4.8	20.2	23.3	56.1	22.4
Rest of nation 94	2.2	0.6	7.6	10.4	48.4	11.2
National teledensity 94	3.2	0.8	9.0	12.5	49.0	12.1
Text communications						
Telex subscrib. (k) 88	4.3	109.7	167.1	317.1	959.7	1,553.5
Telex subscrib. (k) 92	4.7	129.4	185.5	246.4	457.2	1,018.6
Telex CAGR 88-94	2.3%	4.2%	2.7%	-4.9%	-16.9%	(10.0)
Fax machines (k) 92	0.4	284.5	512.5	1,641.3	23,439.4	25,877.7

Data communications						
Leased circuits (k) 92	1.0	39.9	80.4	591.5	19,540.2	20,252.0
Mobile subscribers						
Cellular phone (k) 92	0.2	1,756.2	1,913.3	3,339.4	42,243.8	49,252.7
Cellular as % phones 94	0.1	4.3	2.1	4.7	13.3	9.5
Radio paging (k) 90	0.6	481.0	39.9	516.1	18,771.2	19,808.1
Radio paging (k) 92	0.6	1,742.5	1,832.1	2,750.2	44,239.3	50,564.0
Radio paging CAGR 90-94	6.5%	38.0%	160.3%	51.9%	23.9%	26.4
International traffic						
Million minutes 92	5.3	1,880.0	3,558.6	4,032.1	38,402.1	47,872.8
Minutes per capita 94	0.5	0.6	4.2	8.5	46.0	9.1
Minutes per line 94	32.1	54.1	44.5	61.6	90.8	79.5
Int'nat. circuits (k) 92	0.3	30.5	103.7	75.5	413.2	623.1
Telecommunication staff						
Staff (k) 92	16.9	1,293.1	1,327.5	511.6	2,080.7	5,212.9
Lines/employee 92	19.9	28.0	66.0	135.0	203.0	118.0
Telecommunications revenue						
Total revenue (m$) 94	284	14,091	18,895	42,262	400,388	475,635
Revenue/cap. ($) 94	25.8	4.3	20.7	87.0	479.6	86.7
Revenue/line ($) 94	812.1	304.0	233.0	620.0	946.0	764.0
Revenue/employee (k$) 94	18.1	11.4	14.7	81.8	195.6	100.9
Telecommunications investment						
Investment (m$) 94	27	11,138	6,621	17,473	93,449	128,681
Investment/capita ($) 94	3.5	3.6	7.3	36.0	112.7	24.2
Lines added (k) 93-94	0.5	14,407	6,772	4,525	12,170	37,874
Invest. as % revenue 94	0.1	0.8	0.4	0.4	0.3	0.3
Television						
Total sets (m) 93	2	371	175	116	500	1,161
Sets/100 inhab 94	18.9	11.4	18.3	23.9	59.9	21.0
Sets CAGR (%) 84-94	1.1	21.8	2.9	5.7	2.6	6.2

Source of non-Cuban data: International Telecommunication Union, World Telecommunication Development Report, October, 1995.

Source of Cuban data: Cuban Ministry of Communication, September, 1995.

Table 4 shows selected telecommunication indicators, several of which illustrate continuing deterioration. For example, the number of public telephones has dropped by nearly 50%, the fault rate has doubled, and investment figures are no longer reported. Table 5 shows Cuban telecommunications in a global context.

Enrique Lopez, a principal of the AKL Group, a telecommunications consulting firm with wide experience in Cuba, reported that central office equipment dates back as far as the 1930s, and calls are very difficult to make. The poor infrastructure causes echo and disconnects, and hinders both voice and fax calls [32]. Haines [25] estimates that 40% of the Cuban telephone systems was installed in the 1930s and 1940s. Professor Coro confirms this, and states that Cuban equipment comes from Alcatel and Thomson-CSF (France), Western Electric and GTE (U.S.), Northern Telcom and Mitel (Canada), and L. M. Ericsson (Scandinavia), East Germany, and Hungary [61, 64]. This mix, the embargo, and a lack of hard currency make interoperability and maintenance difficult.

There is a digital central office in Havana, identifiable by the "33" phone number prefix. These 33 numbers are available for dollars, and are used by phone company officials, foreign business people, diplomats, and so forth.[2] They are readily available, but cannot be afforded by Cubans. Cubans can theoretically have phones installed for 6.25 pesos, but in practice, they are not available. Those with 33 numbers can directly dial international calls, but others must request a call from an operator who places the call and calls them back when the connection is established. CIGBnet, and presumably other computer networks, pay for their domestic lines in pesos, but there is fear that may change.

Some developing nations have been installing cellular systems as a substitute for decrepit landline systems. Cubacel is a joint venture partner with Iusacell ($8 million investment [7, 25]), owner of the Mexico City cellular franchise. Calls are routed via satellite through Italy. Demand is low, and thus far there are only 1,152 cellular

[2]The increase in main lines between 1992 and 1994 may be attributable in part to this office. I have been told informally that it is virtually impossible to get a new line installed paying in pesos.

subscribers in Cuba (Table 4). Cellular charges are also in dollars, and they are only affordable by a few businessmen, diplomats, etc.

The major hope for improving the Cuban telephone infrastructure rides on a joint venture between the Monterey, Mexico holding company Grupo Domos Internacional (Domos) and the Empresa de Telecomunicaciones de Cuba, S. A. (ETECSA).

In June, 1993, Cuba decided to privatize telecommunication, and invited proposals for joint venture partners. Iusacell was selected first, but withdrew to concentrate resources for competition in Mexico when the Telmex monopoly ends in 1997. (Dolan [7] speculates that there may also have been fear of interference by the Cuban bureaucracy).

In June, 1994 Domos, through their subsidiary CITEL (Corporation Interamericana de Telecomunicaciones), agreed to purchase a 49% interest in the Cuban phone system for a reported $1.5 billion [3]. ETECSA was separated from the Ministry of Telecommunications, and established as a private joint venture. The Ministry regulates the phone system, sets rates, and does paperwork, and one can assume there are close ties between them and ETECSA. ETECSA will be jointly managed with four Cuban Vice Presidents, three Mexican, and one Italian. It will be interesting to see how the management of the operation and its relationship to the state evolves

Billed as the first large scale privatization in Cuba since the revolution, the agreement was announced during a one-day trip to Cuba by then Mexican President Carlos Salinas, who also took the opportunity to speak against the U.S. embargo. In April, 1995, Domos announced "completion" of the purchase, and the sale of 25% of their interest to STET International Netherlands, N. V., a wholly-owned subsidiary of the Italian State Telecommunication Company for $291.2 million. Dolan [7] states that Domos is seeking further equity investment, in order to reduce their share of ETECSA to 25%.

According to Domos spokesman Hector Cuellar [6], ETECSA has a concession for 25 years (the first 12 on an exclusive basis) with two possible 12-year extensions to provide local, domestic long distance, and international telephony, data transmission, telex, public telephone, trunked radio communication, subscription TV, paging, and other value-

added services (not cellular telephony). The agreement "valued" ETECSA at $1.442 billion, but promised investment "on the order of" $1.5 billion, including cancellation of Cuban debt to Mexico of $300 million.[3] Domos says they will invest an additional $700 million in the next 7 years for expansion and modernization of telecommunications, like the digitization of the network, refurbishing 200,000 existing lines, and expanding the network to a total of a million lines. The goal is to have 11 lines per 100 people (20 in Havana) in 7 years. Dolan [7] estimates that ETECSA already handles 20,000 international calls averaging 12 minutes daily.

Domos paints an optimistic picture, but I was unable to determine anything specific about their long and short term plans or actual improvements currently under way. I had many questions on the technology, money flow, and actual financial terms and commitments. When I asked, Cuellar referred me to a contact at ETECSA, and I also contacted the Cuban Interest Section in Washington. Both invited me to submit follow-up questions (see Table 6) via fax, but neither has answered despite several follow-up calls. One cannot infer from this that there are no concrete plans, but it is not encouraging.

I made informal contact with an ETECSA employee who does not wish to be identified. He said there were plans for some renovation with digital switches in Havana, and that $3 million had been allocated for a 64kbps X.25 network. (See Appendix A for an explanation of "X.25" and other networking terms). The choice of X.25 instead of current techniques was the result of a lack of technical expertise. He also stated that generally nothing had changed within the company. There is still a lack of funds for investment in modern technical infrastructure, and no competitive approach. Top management is not market oriented. They are conservative, and trying to maintain the current voice infrastructure, rather than starting over from scratch in the data communication business with a market orientation. He also mentioned reports of a plan for a national VSAT network in support of tourism,

[3]Domos refers to the debt swap as $300 million, Haines [25] as $200 million, and Dolan [7] as a $200 million payment for debt with a face value of $300.

though he had no details. This would be designed for telephony, not data.

Table 6

Questions Regarding Grupo Domos' Investment Plan

1. Will competition be allowed after their 12 year exclusive arrangement expires?

2. You state you will invest $700 million over the next 7 years, but did not provide details on how it would be used, for example:

- What percent will be in Havana as opposed to other cities?
- Which cities will be connected with fiber?
- What percentage of Havana will be connected with fiber and digital switches?
- Has anything been done so far?
- What is the timetable for the expenditures over the 7 years?

3. Has there been any joint planning with CENIAI or other Cuban Internet organizations?

4. Has there been planning with key industries like tourism or biotechnology?

5. Are there plans for services such as ISDN, frame relay or ATM?

6. Is there an overall communication infrastructure plan?

Perez-Lopez [45] argues that while investments are important to Cuba, they may be of less than face value for a number of reasons. Several of these -- multi-year disbursement, contingency of the investment upon future events, use of existing assets rather than fresh investment, payment for management of existing facilities rather than new construction, debt for equity swapping, supplier credits rather than equity investments, and business delays -- might apply in the case of this joint venture.

An additional cloud hangs over the Domos investment. ETECSA has inherited assets of the nationalized Cuban Telephone Company, an ITT subsidiary, and ITT has an outstanding claim for $131 million against the Cuban Government [43]. Freer [13, 14] feels the ITT claim will be strengthened if the Cuban Liberty and Democratic Solidarity Act of 1995

is enacted in its current form. (It passed the House by a 294-130 margin [30]).

To summarize, the internal Cuban telephone infrastructure is obsolete and deteriorating. While investment has been promised, the details -- questions like those raised in Table 6 -- are not specified. For some time, voice and data communication within Cuba will continue to be poor, and there may be opportunity for further investment.

RADIO AND TV MARTI

On October 4, 1983, the Radio Broadcasting to Cuba Act, stated that it is "the policy of the United States to support the right of the people of Cuba to seek, receive, and impart information and ideas through any media and regardless of frontiers," and established Radio Marti. Radio Marti began broadcasting to Cuba in 1985, and TV Marti in 1990. Both programs are part of The Office of Cuba Broadcasting of the Bureau of Broadcasting of the United States Information Agency (USIA)[4]. The stations are overseen by The Advisory Board for Cuba Broadcasting, appointed the President with the approval of the Senate.

Radio Marti broadcasts from Washington studios 24 hours a day on from 2-8 frequencies depending on the time of week. TV Marti broadcasts from Washington around 2.5 hours daily, and signals are relayed from a balloon tethered 10,000 feet above Cudjoe Key, Florida and from a satellite. Radio Marti literature states that:

> The programs provide the Cuban people news and information not available to them through the government-controlled media of Cuba. News and other programming emphasize information about events occurring on the island as well as international concerns relevant to the Cuban audience.

On May 20, 1995 Radio Marti introduced a new strategy focusing on human rights, news from and about Cuba, and international coverage. New programs will increase emphasis on democracy-building, civil society, and market economics in Cuba, sector-specific programming focusing on

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[4] The USIA also sponsors the Voice of America and Worldnet television, but Radio Free Europe and Radio Liberty are part of a different agency.

culture and the arts, youth, women, rural and spiritual life, and public-service announcements like messages from U.S. family members. Live interviews and news slots and international coverage were also increased [59].

Radio Marti has been embroiled in controversy since its founding. For example, A 1986 New York Times editorial called for its abandonment in order to ease tension over Mariel prisoners, but only 10 days later, a second Times editorial reversed its stand, crediting Radio Marti with significant contributions in Cuban AIDS awareness and policy [41, 42].

More recently, there has been controversy over content and station control. There tend to be two camps [33]. While both are anti-Castro, and working for change in Cuba, the more hard-line group completely discredits the Castro regime, and wants aggressive action against it. Hard-liners such as Modesto Castaner of the exile group Unidad Cubana feel Radio Marti is controlled by leftists who oppose the U.S. embargo and favor dialog with Castro. There have been charges that the staff is plagued by Communist sympathizers, incompetents, and Castro-Communist infiltration [33].

The more liberal viewpoint is illustrated by the remarks of Radio Marti staff member J. Richard Planas who feels the editorial "guidelines are routinely ignored in deliberate attempts to favor a specific political agenda" stressing commentaries that are critical and derisive of the Cuban regime, while downplaying favorable evaluations and statements of support toward Cuba, stressing the "hard line" policy toward Cuba while downplaying criticism of the U.S. embargo or views favoring negotiations with Castro, presenting favorable aspects of Cuban American political leaders who support the "hard line" policy while downplaying or even censoring criticism of these leaders, emphasizing the deficiencies of the Cuban regime while de-emphasizing its accomplishments, and favoring broadcasts of opinions and views about, or calls for, the imminent fall of the Cuban regime [8].

The situation is exacerbated by the fact that the Chairman of the Presidential Advisory Board, Jorge Mas Canosa, is also Chairman of the Cuban American National Foundation (CANF), the nation's most powerful Cuban exile organization [44, 58]. Mas Canosa is also a business

affiliate of Jeb Bush, son of the former president, and is on record as having interest in becoming the first president of a liberated Cuba [29, 56]. It has been asserted, though denied, that struggles for conservative control of the station resulted in the ouster of Ernesto F. Betancourt as director of Radio Marti in 1990 [44, 58]. It has also been asserted that CANF has used Federal research funds for contributions to sympathetic legislators rather than the human rights projects for which the funds were intended [66]. This is also denied by CANF.

Advisory board terms are nominally three years, but the board has been chaired since its inception by Mas Canosa, and all the members have served beyond their nominal expiration dates. The Miami Herald [39] and Epstein and Sullivan [8] have called for a new Advisory Board Chairman and rotation of Board membership. The Herald spoke strongly: "This linkage between a Federal agency and the politically ambitious head of a politically active foundation should be severed. It's unacceptable in principle, and it's damaging to Radio Marti's credibility." [39]

The tension between liberal and hard-line camps reflects the division of opinion within the U.S., and may be productive, if uncomfortable. However, the Radio Marti guidelines call for "objective, accurate, and balanced programs." [59] An official, who wished to remain anonymous, told me he felt he was doing his job well when both the hard-liners and liberals were angry with him.

There is also controversy over the viability of TV Marti. Its detractors point out that it is restricted to 3:30-6:00 AM to avoid interference with Cuba's channel 13, and it is jammed so few people see it. Supporters counter that TV Marti is in the process of switching to UHF broadcasting, which will allow daytime broadcasting and will be more difficult to jam. (Twenty five-35% of Cuban TV sets are capable of UHF reception [5]). Defectors who worked on jamming, claim Cuba spends $2-4,000 per hour operating two helicopters used in jamming TV Marti, and employs people and uses power in 10 Havana sites and 15-20 in adjacent provinces [57]. As fuel and power are in short supply, this is a significant cost to the Cubans. The TV Marti satellite feed is also played in several other Latin American nations as news.

A USIA survey showed that 4% of Cubans reported regularly watching TV Marti for more than five minutes, and 38% had attempted to tune it in [8]. Several Cuban colleagues told me they have never seen it. While it is seldom seen now, this situation may improve with the switch to UHF (though Cuba has already begun construction of facilities for UHF jamming).

Radio Marti is listened to much more frequently. Though reliable figures are difficult to obtain, the Miami Herald estimates 70% of Cubans are regular listeners, tuning in at least once per week [33]. A report prepared for a Congressional Advisory Panel on Radio and TV Marti found that "... an overwhelming number of Cubans clearly consider Radio Marti to be the most authoritative source of news and information in Cuba." [5]

The Marti research staff has also prepared considerable material for publication on the Internet, and continues this work. For example, they are the source of the Castro Speech (1959-present) library at the University of Texas, and an indexed database of the Cuban newspaper, Granma, from 1965-1992, on the USIA Gopher (document) server. This work is continuing, and they could publish more of their background research reports if they had funding.

The importance of Radio Marti has increased during the Cuban economic crisis since other media have been cut back for conservation. Since 1989 there has been a reduction of 65% in radio and television air time, nearly 80% in newsprint, 90% in book titles, and 70% in newspaper and magazine circulation [5].

Table 7 summarizes 1995 funding and 1996 requests for the total USIA and for Broadcasting to Cuba. It appears that 1996 funding for Broadcasting to Cuba will be $24.8 million (11.2 for TV Marti and 13.6 for Radio Marti), which is less than requested, but a slight increase over this year. In today's budget climate, an increase is rare -- Broadcasting to Cuba enjoys congressional support.

Table 7

United States Information Agency Budget, Millions $

	1995 Approp. After Resciss.	USIA Budget Request	House Author. Allow.	1996 SFRC Author. Allow.	House Approp. Allow.	Senate Approp. Comm.
Broadcasting To Cuba	24.7	26.1	24.8			24.8
Total USIA Federal Funds	1,392.2	1,299.6	116.3	1,181.0	1,083.9	1,031.1

Source: Radio Marti, September, 1995

THE CUBAN SOFTWARE INDUSTRY

Cuba, like many nations, considers software export a potential source of income and employment, and they have established an organization to market educational and other software developed at Cuban universities [40]. By 1994, they had 20 Spanish-language programs for sale in Latin America, but they have been hampered by a lack of capital for development systems, marketing, user interface development, documentation, packaging, distribution, and other factors needed for a robust software export industry [54].[5] If these were not sufficiently difficult obstacles to overcome, the U.S. trade embargo has nailed the distribution coffin shut.

Cuban intellectual property practices are also inhospitable to software industry. The government officially handles the distribution of pirate software [38], and, more fundamentally, the concept of intellectual property is not promoted in communist ideology.

It is unlikely that software export will ever become a major part of the Cuban economy. Developing nations such as India and Chile have a long history of software development, encouragement of export, and vast

[5]According to the Software Publishers Association, Latin-American software sales of $40.8 million in the first quarter of 1995 were 21% higher than the same period last year. Brazilian sales were up 91% and Mexican sales down 43% [62].

resources compared to Cuba, yet they are barely noticeable in the world market, and software export is not a large part of their economies [20].

On the other hand, an internal software industry could flourish, particularly after economic reform. The development of an internal software industry and market, along with demanding users, will eventually result in export products in niche areas particular to Cuba. This has been the Chilean experience [49, 54] with software for the lumber and banking, and we might eventually see Cuban software exports in biotechnology and medicine. As they are already working in the area, Spanish-language education software may also turn out to be a Cuban niche, but it will require a good deal of increased investment and user sophistication for these products to succeed in the export market.

INFORMATICA CONFERENCES

Cuba hosts a week-long information processing conference event each year. (I have attended in 1992 and 1994). They alternate between "Informatica" (even years) which has a computer science orientation, and "Info" (odd years) which has an information systems and library science orientation. These are comprehensive events held at the Palacio de las Convenciones (convention center) and PabExpo, a pavilion for commercial exhibits. These are modern, well-maintained facilities, approximately 1 km apart in Havana. Their condition is noteworthy, since nearly all Cuban buildings are in very poor condition, but Informatica and other such events bring in hard currency.

Info 1995 registration fees were: delegates, $310, accompanying attendees, $150, students, $180, and exhibition booths cost $130/square meter. Attendees also generate hotel and other business. There are also a number of satellite events, held at the same time, with separate registration fees.

The professional program includes keynote speeches, round tables, seminars, workshops, panels, and scientific conferences and papers. It is comprehensive, with tracks on various computer science disciplines, commercial applications, and application areas like health care and tourism. There are typically a dozen or so simultaneous conferences,

for example, Informatics in Education, Informatics in Development, and Artificial Intelligence.

The Exhibition includes booths from government agencies, networking organizations, commercial hardware and software manufacturers (mostly Cuban, but some foreign during the years I attended), and retail distributors (with products from U.S. manufacturers HP, Compaq, AST Research, Moore business forms, Seagate, Western Digital, Logitech, Microsoft, Paradise, Micropolis, Intel, Novell, and others). Several application areas were singled out for special representation, for example, tourist, biological, medical, artistic, and cultural informatics. The emphasis on tourism and biomedical applications is not surprising as they represent economically strategic areas, but emphasis on the digitization of the collection of the Havana Museum of Art or applications in film making, reflect broader social goals.

Table 8

National Origin of Booths at Informatica '92

Cuba	83
Spain	22
Panama	6
Chile	2
Germany	2
Italy	1
Mexico	1
Yugoslavia	1

Table 8 shows the breakdown of booths by nation. There were also joint venture booths with organizations from Spain, Lithuania and several Latin American nations. The 1994 Exposition was of roughly the same size.

U.S. TV USING SMALL PARABOLIC ANTENNAE

The Cuban government relays a U.S. satellite TV feed from the top of Havana's Habana Libre Hotel (the ex Hilton). (The government claims to pay for this signal, but others claim that is not so). This signal was intended for tourist hotels, but, as they say, information wants to be free, and people soon began deploying settop boxes and small

parabolic antennae to intercept the signal. These were sold (for around $150) or assembled from schematics which were widely available.

In February, 1994, I spoke of this with Pedro Urra, Director of the InfoMed network, who estimated that there might have been as many as 100,000 such antennae deployed around the city, and casual observation as one walked the streets lent credence to his estimate -- they were visible from many buildings and windows. In May, 1994, the government began scrambling the signal, and many people removed them. However, pirate decoders soon became available. The Cuban Government finally banned the private ownership of these antennae, giving people 60 days to remove them, and fining violators. (The antenna removal deadline was September 13, 1994.)

It is unclear what the impact of these antennae was or of the reasons for their banning. They carried standard cable TV -- B movies, MTV, Mexican soap operas, cartoons, etc. -- not political propaganda, and most of the programming was in English. Perhaps MTV and the violence depicted in the movies were seen as undermining Cuban cultural values. It may have been motivated by the judgment that pirating is immoral. A more mundane explanation may be that the government discouraged pirating in order to collect revenue from hotels and others who pay for the signal.

TOURISM AND BIOTECHNOLOGY: KEY, COMMUNICATION DEPENDENT INDUSTRIES

The tourism and biotechnology industries have been singled out for investment during the current Cuban economic crisis, the "special period." Since they are closely tied to telecommunications and information processing, we will discuss them here.

Tourism requires communication technology, and is itself a form of communication. Communication technology is needed for reservations and transactions like credit card verification. Tourism is a form of communication in that people observe and talk. The potential power of this form of communication is implicitly recognized in the Cuban policy of "tourist apartheid," which keeps Cubans out of and away from tourist hotels, a policy I have observed first hand. Table 9 shows a marked increase in tourism from capitalist nations.

Table 9

International Visitors to Cuba (thousands)

Year	Total Visitors	Increase	From Capitalist Nations	Increase
1982	150.7		101.5	
1983	174.1	15.5%	124.9	23.1%
1984	218.3	25.4%	168.5	34.9%
1985	243.0	11.3%	193.2	14.7%
1986	281.9	16.0%	217.9	12.8%
1987	293.3	4.0%	237.3	8.9%
1988	309.2	5.4%	246.9	4.0%
1989	326.3	5.5%	289.4	17.2%
1990	340.3	4.3%	310.3	7.2%
1991	424.0	24.6%	398.4	28.4%

Source: [9], page 150.

Table 10

Increasing Cuban Tourism Investment and Receipts

	1985	1989	1990	1991	1992	1993	1994
Visitors (000)		326	340	424	461	546	601
No. of Rooms	13910	17578	19945	22196	23221	26358	n/a
No. of Beds	29025	35932	40526	44419	47139	53394	n/a
Receipts ($m)		204	243	387	567	720	804

Percent changes

	1985	1989	1990	1991	1992	1993	1994
Visitors (000)			4.3%	24.7%	8.7%	18.4%	10.1%
No. of Rooms		26.4%	13.5%	11.3%	4.6%	13.5%	
No. of Beds		23.8%	12.8%	9.6%	6.1%	13.3%	
Receipts ($m)			19.1%	59.3%	46.5%	27.0%	11.7%

Source: United Nations World Tourism Organization, Madrid.

The Fourth Communist Party Congress reasserted the official commitment to development of international tourism, and identified the sector as "an important source of revenues for economic development" [9]. As seen in Table 10, Cuban tourism revenues and investment are increasing.

The communication infrastructure in support of tourism is poorly documented. Several hotels and tourist agencies have accounts on the CENIAI computer network (see next section), and they have an X.25 link to the tourist network [37]. While X.25 may be the only alternative for tourism transaction processing and marketing today, this would change with a full Internet connectivity, which would allow for World Wide Web (WWW) servers in support of marketing and reservations, and secure transaction processing for payment.

Castro also designated biotechnology and medicine as priority sectors in which investments would continue despite a severe economic crisis and fiscal retrenchment [12]. Biotechnology requires telecommunication for Cuban access to scientific information and foreign scientists, for the dissemination of Cuban results, and for marketing and distribution of products. In the 1980s a large scientific-industrial complex was established around the campus of the Center for Genetic Engineering and Biotechnology (CIGB), and they have become a major builder and user of the Cuban computer networks.

It might seem surprising that a developing nation in a time of severe economic stress is pursuing a first world scientific program; however, Cuban biotechnology and genetic engineering evolved from clinical medicine, which from the outset of the revolution was a key area of development. By 1980, when Castro decided to invest heavily in biotechnology, Cuba already had a national network of health-care delivery facilities, medical schools, research institutes, and pharmaceutical and medical products factories that could be put at the service of this incipient scientific sector. Today, Cuban researchers are working on human medical-pharmaceutical products (diagnostic and therapeutic), industrial enzymes and bioremidiation (for example, the use of microorganisms to clean up oil spills), agricultural applications

(for example plant and animal genetics), and research laboratory equipment and supplies [12].

Agricultural applications have immediate impact in attempts to diversify Cuban agriculture and feed the population. For example, at Informatica '92, there was a large, prototype exhibit from The Irrigation and Drainage Research Institute of a system to control drip irrigation. Each system box could control a group of 8-15 valves, sensing soil and system (e. g. water pressure) conditions and controlling the flow of water and the inclusion of fertilizer in the water.

Informatica '92 and '94 also had significant exhibits of clinical medical equipment, like EKG, EEG, pulmonary function, and x-ray analysis systems. There was a striking contrast in the quality of brochures and contact with distribution partners between 1992 and 1994, indicating progress in understanding the business and marketing side of the industry. The booth staff also stressed that they were generating enough sales to be economically self sufficient; however, their buildings were free of rent, and there was no accounting for prior research cost.

Pharmaceuticals also require marketing and distribution agreements. These have been hindered by a lack of Cuban know-how,[6] the U.S. embargo, and disputes over intellectual property.

Key industries such as tourism and biotechnology (broadly conceived) require voice and data communication. They would be well served by Cuban Internet connectivity.

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[6]In 1992, I visited a factory that manufactured double-sided, single-layer PC boards near Havana. It had previously employed 146 workers in producing PC boards for export to Eastern Europe, and had a capacity of 75 square meters of boards per day. It had only a skeleton crew in 1992, and produced virtually nothing. The plant manager was full of pride and information about his production facility, but had no concept of trade shows, advertising, distribution channels, etc. -- he did not know how to market his services. However, I was accompanied on this factory tour by two Mexican businessmen, who stated that it reminded them of Mexico years before, and that they were prepared to work with this factory.

3. CUBAN NETWORKING

This section describes Cuban networking, based on a questionnaire (Appendix B) sent to the four Cuban networks with international connectivity, and follow-up by Carlos Armas, a Cuban colleague.

An earlier paper summarized the state of Cuban networking in 1992 [50]. At that time, there was limited international connectivity via X.25 and a single, unreliable dial-up UUCP link. All international traffic was routed through CENIAI, the Center for Automated Interchange of Information of the Cuban Academy of Sciences, which also provided gateway service for several small intranational networks. Approximately twice a week Web/NIRV, an Association for Progressive Communication (APC) affiliate in Toronto, Canada, called CENIAI and exchanged international traffic.[7] At times communication would be interrupted for a week or more because of financial or technical problems.

FOUR INTERNATIONAL NETWORKS

In spite of the economic crisis and continued deterioration of an obsolete telephone infrastructure, Cuban networks have grown substantially since 1992.[8] Today, there are four networks with international connectivity, CENIAI, TinoRed, CIGBnet, and InfoMed. Table 11 shows these four networks and some of the more important internal networks for which they are gateways.

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[7]APC was founded in 1989 to coordinate the operation and development of networks devoted to peace, ecology, human rights, and other "progressive" causes. As of August 1995, the APC has eighteen member networks, serving over 31,000 activists, educators, nonprofits and non-governmental organizations (NGOs) in over 133 countries. APC also exchanges email and selected conferences with 40 partner networks worldwide, many of which are expected to become full APC members in the future. In September, 1995, APC was granted Consultative Status, Category 1, with the Economic and Social Council of the United Nations. This means APC can have a permanent representative at the UN, and is entitled to submit written statements to the Council, to be granted hearings, and to propose agenda items for consideration by the Council and its subsidiary bodies.

[8]With the Soviet collapse, Cuba lost around $4-5 billion in aid and subsidies, foreign trade is around 25% of 1989 level, and GDP about 50%.

Table 11

Four International Networks and Selected Sub-Nets

1. **CIGBnet (950)**
   UOnet: Oriente University Network.
   COMUH: University of Havana network.
   ICID (280): Institute for Digital Research.
   RENACYT: ICIMAF/CIDET Center for Research on Telematics.
   CNCNet (250): Network of the National Neurosciences Center.
   CRC: Center for Clinical Research.
   IMRE: Reagents and Materials for Electronics Institute.
   Binanet: The network of the National Library.
2. **CENIAI (732)**
   ISPJAE/CUJAE: Instituto Superior Politecnico Jose A. Echevarria.
   REDUNIV: University Network for Scientific and Technological Information of the Ministry of Education.
   BIOMUNDI (39): Biological Information Network.
   UCLV: Las Villas University network.
   Red Granma: Center of Documentation and scientific and technological information.
   Red Yayabo (50): A regional network in Ciudad Sancti Spiritus.
   Red Holguin: A regional network in Ciudad Holguin.
   Red Perla (62): A regional network in Ciudad Cienfuegos.
3. **TinoRed (413)**
   Red David: NGO network.
4. **InfoMed (500)**
   Red Principe: Based in Ciudad Camaguey, it provides service for Camaguey University, Camaguey Medical Sciences Faculty, and some other enterprises and institutions.

Note: The numbers shown in parenthesis are the number of accounts which have been active at least once per month during the last 3 months.
Sources: Carlos Armas, CIGBnet, Jesus Martinez, CENIAI, Carlos Valdes, TinoRed, and Pedro Urra, InfoMed. Sub-network user counts were obtained by Armas.

CENIAI began networking in 1982, and has had a UUCP link to the Internet since 1991. They currently offer email, database access, mail lists, and programming and consulting services, and maintain a presence on a Gopher server located in Uruguay. CENIAI has long wished for international IP connectivity and a national backbone, and has a registered class-b IP address. They plan to offer dial-up PPP access in the near future.

TinoRed (Tino Network -- Tino, a Cuban cartoon character, is the logo) was the established by the Cuban Youth Computer Clubs, an organization with explicit support of Fidel Castro, that operates 150 walk-in computer centers throughout the nation [52]. One hundred of these have TinoRed email accounts, and approximately 80 have working (2400bps) modems. TinoRed is also a gateway for Red David, which supports at least 31 NGOs (see Table 12).

Table 12

Cuban NGOs with TinoRed (Red David) Accounts

Centro de Estudios de Africa y Medio Oriente
Centro de Estudios Europeos
Casa de las Americas
Centro de Estudios Martianos
Centro de Estudios sobre Estados Unidos
Centro de Estudios sobre Alternativas Politicas
Centro de Investigaciones de la Economia Mundial
Centro de Estudios de la Economia Cubana
Movimiento Cubano por la Paz
Grupo de Desarrollo Integral de la Capital
Memoria de los Movimientos Populares de America Latina
Centro Memorial "Martin Luther King"
Centro "Felix Varela"
Asociacion por la Unidad de Nuestra America
Radio Habana-Cuba
Centro de Estudios sobre Asia y Oceania
Grupo de Desarrollo de la Bicicleta en Cuba
Catedra "Pablo de la Torriente Brau"
Consejo de Iglesias de Cuba
Centro de Investigacion y Estudios de las Relaciones Interamericanas
Centro de Investigacion de la Economia Internacional
Centro de Informacion para la Prensa
Federacion de Mujeres Cubanas
Grupo para la Educacion sobre el SIDA
Instituto Superior Latinoamericano de Ajedrez
Asociacion Cubana de Esperanto
Alcoholicos Anonimos
Union de Escritores y Artistas de Cuba
Federacion de mujeres cubanas
Editorial Jose Marti
Consejo Ecumenico de Cuba

Source: Carlos Valdes, TinoRed System Administrator. (Valdes states there are some others, but he did not have their names at hand at the time of this message).

CIGBnet is the network of the Center for Genetic Engineering and Biotechnology and affiliated institutions [1]. They have a central site in Havana and three remote sites. CIGBnet began in 1991 and has grown to 900 users. They provide email, database access, a biological sequence server, and a mail list server. They also operate Gopher and WWW servers that are accessible only from the main center. CIGB staff have developed their own mail-based database server, off-line mail package, and sequencing server software, and they are continuing such work.

InfoMed, the network of the National System of Health Information of the Cuban Ministry of Health, has been operating since 1992. They have 500 accounts, 80% of which are shared by more than one person within an organization, and provide email, discussion groups, file retrieval, database search, and consultation. While they currently operate a single node in Havana, they are building a distributed network with 13 servers in Cuban medical schools with support from the Pan American Health Organization and UNESCO.

It should be stressed that these networks are not comparable to large university and corporate networks in North America or Western Europe. The smaller networks are typically time-sharing systems -- PCs running UNIX -- with accounts for local and remote individuals and organizations. Larger networks, like CENIAI and CIGBnet have Ethernet LANs, with Netware file servers and UNIX application servers. For example, the CIGB central location has four 486-based servers running Netware and four running UNIX. Local users may have IP connectivity to the servers, but remote users either have dial-up shell accounts or make UUCP transfers.

Client computers are nearly all PCs running DOS or Windows. For example, CIGB has 150 386 and 486-based client systems with 4-8 MB of RAM and 40-120 MB disks. (These are shared by 850 central-office users). Each of their three remote locations has a single PC running DOS, communicating with the central office via UUCP over X.25 or 2400 kbps dial-up. (These machines are shared by 100 remote users).

CENIAI, CIGBNet, and TinoRed route their international traffic through Web/NIRV. According to Riff Fullan, Web/NIRV International

Cooperation Coordinator, they call CIGBnet six times per day and TinoRed twice daily [15]. CENIAI calls Web/NIRV 2-4 times daily, depending on needs. They plan to increase the TinoRed call frequency to 6 shortly. Cuban traffic volumes in a typical month are shown in Table 13. InfoMed links through GreenNet, an APC affiliate in the UK. They did not respond to my request for traffic figures.

Table 13

Monthly Cuban Internet Traffic (K bytes)

	Receive	**Transmit**	**Total**
TinoRed	4,689.29	12,020	16,709.3
CENIAI	3,945.37	12,535.4	16,480.7
CIGBnet	4,542.86	8,897.88	13,440.7
Total	13,177.5	33,453.2	46,630.7

Source: Fullen [15].

X.25

There is also X.25 connectivity for interactive applications and the exchange of UUCP traffic between networks. In 1992 CENIAI was Cuba's connection to IASNet, an X.25 network for socialist countries operated by VNIIPAS (The All Union Scientific Research Institute for Applied Computerized Systems) in Moscow. VNIIPAS had multiple links to Western data networks, including a link to Sprint. The link to IASNet has been discontinued, but there are three X.25 networks in Cuba today, Cubanet, RENACYT, and the tourism network.

Cubanet is a commercial network serving joint-venture enterprises and some tourism. It was formed by the people who had operated the original IASNet link at CENIAI, and is operated by Intertel, S. A., the international arm of ETECSA. Cubanet connects through an X.75 backbone to DATAPAC in Canada. The prices are out of reach of Cuban academics and other domestic users. A dialup connection to Cubanet costs $32.00 per month plus usage charges of $0.31 per minute plus $0.34 per kilocharacters. These rates are high, but they provide reliable, interactive communication needed for financial transactions, credit card verification, hotel reservations, etc.

RENACYT, the National Network of Science and Technology, belongs to the Ministry of Sciences, Technology and Environment, as does CENIAI. It is an academic/research network for UUCP exchange and limited interactive access, for example to the CIGBnet Gopher and WWW servers. InfoMed, TinoRed, CENIAI, CNCnet, Biomundi, ICIDnet, all use RENACYT as well as dial-up for UUCP exchange. For example, CIGBnet uses RENACYT for exchanges with CENIAI, InfoMed, TinoRed, and some of their sub networks. In return, CIGBnet is RENACYT's international UUCP gateway. The tourism network also exchanges traffic with RENACYT. RENACYT currently covers Ciudad Santiago de Cuba, Havana, and Matanzas, and they plan to expand to the Camaguey and Las Villas provinces.

The tourism network connects tourist hotels, providing credit card verification and financial transactions and reservation support, but I have been unable to determine details. I assume this connectivity is expensive, and that it could be carried more economically over an IP network if one were available. Furthermore, modern client-server tools such as WWW servers would seem to be more powerful both for marketing and reservations and for secure transaction and credit card processing

CUBAN NETWORKS IN CONTEXT

For perspective, Table 14 shows traffic and user estimates for Caribbean networks made by Pimienta [47]. His estimate of 249 users is quite conservative, and is vigorously challenged by Hahn [24] who estimates 2,600 registered Caribbean users.[9]

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[9]The discrepancies between Pimienta and Hahn reflects inconsistency in the definition of "user." In email follow-ups, Pimienta pointed out that many of the CUnet accounts are relatively inactive. For example, of 123 registered accounts in Santa Lucia, only 34 had been active during the 30 days preceding July 22, 1995, and only 23 in the 10 days preceding July 22, 1995 [48]. Hahn countered that Pimienta's figures are only estimates based on traffic volumes and assumptions of traffic per user, while his are actual numbers of accounts. Furthermore, many users may share a single account. Both are correct. Many users make infrequent use of the Net due to cost, difficulty using the system, culture, etc.

Such differences are not idle speculation. Network statistics are similar to census data, telephony statistics of the ITU, or economic statistics, and they are used to make policy decisions and allocate resources. Of course they are not the entire picture, and we also need

Table 14

Caribbean Internet Traffic Estimates

Country	Traffic (MB/month)	Users	Population (millions)
Antigua and Bermuda	1.06	2	0.07
Bahamas	4.15	8	0.25
Barbados	8.59	17	0.26
Belize	13.74	28	0.19
Dominican Rep CUNET	3.62	7	7.00
Dominican Rep REDID	60.00	120	7.00
Grenada	0.63	1	0.10
Guyana	0.10	1	0.80
St. Lucia	11.72	24	0.14
Vincent and Grenada	0.79	2	0.11
Suriname	2.29	5	0.42
Trinidad/Tobago	17.14	34	1.30
Total	123.83	249	17.64

Source: Daniel Pimienta, "Caribbean Network Traffic Figures," gopher://rip.psg.org/, June 12, 1995.

By either estimate, Cuban networks are significant. Without counting InfoMed, international Cuban traffic is 37.7% of the rest of the Caribbean. The Cuban active user counts in Table 11 totals 3,386, and that table is incomplete. (I would expect internal Cuban traffic to be higher than other Caribbean nations). In spite of the current economic blockade and crisis, Cuba is a major Caribbean networking nation.

Cuba will eventually have IP connectivity, the only questions are when, and how it will be administered. Cuban networking began with CENIAI, and they have consistently striven for international IP connectivity. In February, 1995, they received permission from the Ministry of Science and Technology to establish an IP link for the academic community, and have a proposal pending [36], but it has not yet been funded. CENIAI and CIGBnet have both been using IP and IP-based

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studies of the actual impact of networks on the intellectual and economic life of nations.

servers internally for some time, and have sent people abroad for training.

More important, Cuba has developed a sizable networking community, with skills and applications. This has grown out of a long standing commitment to education throughout the society, and major research, development, and therapy programs in biotechnology and medicine. Cuba has the expertise to operate an international IP link, and acquiescence of the government. They are missing funding and a working agreement or plan for cooperation between the various networks, but these will eventually be achieved.

4. POLICY

I will restrict my comments to telecommunications policy, with specific focus on computer networking and telephony -- media where access and content are determined by those using the system, not a central producer or editor. I begin by outlining an infrastructure framework, delineating resources needed if a Cuban network is to succeed. Next I make several specific recommendations for strengthening Cuban communications and networking, and the final section speculates on the effect of improved communication and networking on various policy goals.

INFRASTRUCTURE FOR NETWORKING

If we are to facilitate Cuban networking, we must consider the resources necessary to support a network, and ask which are constrained. The constraints on Cuban communication are not due to external bottlenecks. There are unused U.S.-Cuba circuits today, Sprint will be offering private-line connectivity, and WilTel will be installing a fiber optic cable. Rather, the constraints are in the internal Cuban infrastructure.

I use the term "infrastructure" broadly. In addition to the basic voice-data communication facilities supplied by carriers, a computer network requires network hardware and software, trained technicians, support of the government, and a trained, demanding user community equipped with computers [55]. The Cuban situation in each of these areas is as follows.

Communication facilities: The Cuban telephone system is in poor condition, and while there is hope of concrete investment by Domos, little has occurred to date. Fortunately, computer networks are able to detect errors and retransmit data, so although slowed and limited by poor infrastructure, they are still viable, and a UUCP email network is feasible with poor communication facilities. (In fact, the marginal value of appropriate technology computer networks is high in developing nations because cheap, reliable telephone service does not exist [55]).

An interactive, IP network would require more modern facilities, particularly if it were to reach beyond Havana.

Network technicians: While trained technicians are in demand everywhere, Cuba is strong compared to many developing nations. The Cuban scientific community and education system have produced people capable of handling the technical requirements of networks, but they face obstacles in receiving training, information, and capital.

Network hardware: The networks used in Cuba (and other developing nations) are built almost exclusively using Intel-based PCs. Cuba is generally making do with 8086, 286, 386 and 486-based PCs, while in the U.S., the 8086, 286 and 386 are obsolete, and the 486 is being phased out. Still, meaningful UUCP networks can be built using these machines. As they move to interactive, IP networks, there will be demand for larger, Windows-based user PCs. Networking hardware like routers will also be needed, but properly programmed, fast PCs will also be able to fulfill some of this demand.

Network software: The network software in use in Cuba today is generally in the public domain, though it requires a good deal of maintenance and modification. Cuba has the technician resources to do this well, as exemplified by the server and communication software developed at CIGBnet. IP networks will require new software, much of which is also available at no cost, but a software investment will be needed.[10]

Government support: In a totalitarian state, government support is necessary to obtain permission to build a network and the hard currency needed to purchase software and equipment. During my 1992 visit to the headquarters of the JCCs, I saw photos of Fidel Castro at the opening ceremony, and there was a framed, handwritten note on the wall saying "I envy you -- Fidel." I was told Castro had personally allocated $500,000 to the JCCs that year [52]. As we have seen, Cuban networks have been allowed to grow significantly since 1992, so it would appear that, for

[10]In 1992, the government officially distributed pirated copies of commercial software. While IP networking software could also be pirated, a viable Cuban software writing and distribution industry will eventually require modification of this practice.

now, there is government support or at least acquiescence. The government fiscal policy is also important. If the network is seen primarily as a source of revenue rather than strategic development infrastructure, it will be hampered.

Cooperation among networks: Developing nations often have several centers of networking excellence, and Cuba is no exception. With limited national resources, cooperation between them may be beneficial -- for example, in the sharing of leased international circuits. On the other hand, if users have alternatives, healthy competition can lead to improved service.

User hardware: Generally speaking, users can get by with less powerful PCs than are needed for the network, but many more are needed. In developed nations, users typically have their own computers (hence the name "personal" computer); however, in Cuba and other developing nations, many people may share one computer. Still, even shared, obsolete computers are a constraint in a capital-starved Cuba.

User software: Users require both communication and application software. Communication software is generally in the public domain, and supplied by the network operator. As we saw above, application software was pirated and distributed by the government. I do not know if this practice continues today, but bought or stolen, users need application software.

Trained, demanding users: This is the toughest nut to crack for any nation. It requires time and culture change. The U.S. leads the world in this dimension, but it has taken 15 years.[11] Children and workers commonly use computers for games, word processing and other applications. As such, they have acquired a mental model of a computer, and are accustomed to using it. It is a small step from that point to using electronic mail, and then other network applications. By

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[11]Personal computers have been common in the U. S. since the early 1980s. (A personal computer was the *Time* Magazine "Man of the Year" in 1984, and the Internet made the covers of *Time* and *Newsweek* in 1994). Most U. S. children are exposed to computers in school. In 1994, the U. S. had 77.5 million PCs, a rate of 29.75 per 100 people. Powerful, multimedia-capable computers have found a large market in homes. The U. S. has 63 PCs/100 workers, and 90% of the Internet hosts and 92% of electronic mail boxes are in North America and West Europe. [56]

contrast, Cuba has essentially no user community and culture, so training and support are necessary for all new users. The problem is exacerbated by the fact that less powerful hardware often requires software which is difficult to use and understand [53]. (Software like that developed at CIGBnet helps in this regard). A strong education system and support for the Youth Computer Clubs mentioned above, put Cuba in a better position than most developing nations. The situation is reminiscent of Russia, where networks have grown rapidly.

RECOMMENDATIONS

This section recommends several actions aimed at facilitating Cuban networking by easing the constraints mentioned above.

Encourage direct, IP Internet connectivity

At present the Cuban connection is via dial-up phone calls to Canada or the U. K. in which data is transferred then the connection dropped until the next call. This mode of Internet connection allows for electronic mail, but not for interactive applications like searching for and retrieving information on the WWW. Furthermore, it does not allow the Cubans to place information on servers from which others can retrieve it. Full-time IP connectivity would allow Cubans interactive access to outside material and vice versa.

IP connectivity requires a leased communication link, networking hardware, and competent networking centers. The capability of providing the leased link is already in place, and Sprint has stated they will have a tariffed service available soon. Other vendors will probably follow the Sprint lead. Routers and other communication hardware and software would also be needed. CENIAI or CIGBnet would be viable connection organizations within Cuba today, and InfoMed plans a significant upgrade; however, CENIAI seems to be the organization designated by the Cubans. Since Cuba has been connecting in Canada and the U. K. to date, those would be likely external connection points; however, the U.S. National Science Foundation has a strong record of providing connection points for developing nations, and a U.S. connection should also be considered.

The U.S. should subsidize the communication link, international connectivity through NSF, and Cuban networking hardware. The cost of doing so would be very small compared to Radio or TV Marti, and would surely have a greater impact than the latter.

Reduce administrative bottlenecks

According to Cuban Desk Officer, Laura Lockman, the State, Commerce, and Treasury Departments will soon begin a review of Cuban telecommunication policy. This will probably result in some modification or extension of the current policy as set forth in the 1994 letter from the State Department to the FCC [4]. I would recommend increased administrative support and reduction of impediments.

For example, the WilTel application for permission to construct an optical cable between the U.S. and Cuba has been pending since March, 1994. This and other communication-related applications, for example applications to provide various data-related services, should be processed rapidly.

Travel and other forms of technical interchange should also be encouraged. It is difficult for U.S. researchers (in networking or other fields) to obtain permission for travel to Cuba. These applications should be processed rapidly and liberally.

Travel from Cuba for training and network management should also be encouraged. In June, 1995, the Internet Society invited three Cubans to Hawaii for its annual training workshop for network technicians and managers in developing nations and its annual conference. Two of the three were denied visas because the U.S. Interest Section in Havana considered them "possible illegal immigrants." (The third, who was admitted, was a workshop instructor who had been a student the prior year in Prague). This cost Cuban training, and perhaps more important, integration into the networking community, since this workshop and conference is an important event, bringing together networking leaders from around the world. Feinsilver [12] reports that the U.S. government has denied visas to Cuban biotechnology scientists on a number of occasions. There is some risk that Cubans attending such meetings would

defect; however, that would serve U.S. interest, since they are well educated and have valuable skills.

The administration has also restricted U.S. activists attempting to bring used computers to InfoMed. InfoMed is a purely medical network with international support. These restrictions have humanitarian cost, and provide anti-U.S. propaganda examples for the Cuban regime.

Avoid blatant propaganda

Cuban exiles have at times broadcast unsolicited, political email to Cuban mailing lists. Such activity puts Cuban networks at risk, since the government will shut them down if they feel the threat is greater than the benefits. For corroboration of this concern, we need only consider the jamming of Radio and TV Marti. Furthermore, the people receiving these messages are not naive, and are often resentful of the U.S. Cuban exile community. They will not be swayed by strident propaganda.

Utilize the Internet

There is considerable Cuba-related information on the Internet (see Appendix C). There are mailing lists, a Usenet News group, Gopher, and WWW servers operated by academic programs at universities, Radio Marti, interested individuals, and political organizations.[12] This information would be retrievable by Cubans if they had IP connectivity.

While blatant propaganda should be avoided, we can foster the publication of balanced, relevant information. For example, we could encourage the Radio Marti staff to publish and disseminate their background studies using the Internet. These are a reasoned source of objective information which could be polished for publication at very low marginal cost.

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[12]CENIAI has a Gopher server, but since they do not have IP Internet connectivity, it is not located in Cuba. The server is physically located at the University of the Republic of Uruguay, but CENIAI is responsible for providing and updating the information.

Avoid legislative restriction

The Helms-Burton Bill would, if passed, have a chilling effect on investment in communication infrastructure in general and therefor in networking. While there are many non-communication factors affecting this bill, at the very least, there should be modifications to exclude communication in the manner of the Cuban Democracy Act.

Permit direct investment in Cuban infrastructure

It is arguable that direct investment in Cuban telecommunication infrastructure by U.S. companies is allowed under the terms of the Cuban Democracy Act, since that is where the major communication bottleneck is and communication is to be encouraged. If the investment by Domos materializes, ETECSA will make significant equipment purchases, which U.S. companies could bid on. Domos is also said to be seeking additional equity partners (who may also supply equipment and service). In addition to basic communication equipment, networking equipment such as routers will be needed, and could be supplied by U.S. firms.

At the very least, we should allow direct investment in the equipment needed to support the services we offer. For example, Alan Garatt, an MCI spokesman, reported that problems with Cuban infrastructure caused difficulty and a four month delay in establishing their current service [16].

Support Cuban users

Developing nation networks typically begin in the university and research communities, with early support to government agencies and NGOs [20].[13] Cuba has followed this pattern, and at least four user communities -- NGOs, Youth Computer Clubs, universities, and biotechnology researchers, seem worthy of support. The NGOs and biotechnology researchers play a role in support of human-rights and knowledge-access policy goals discussed below, and the Youth Computer Clubs and universities can contribute directly to the training of the demanding user community necessary for a strong network. In addition to

[13]Relcom in the ex-Soviet Union was an exception to this rule, having commercial accounts from its inception [51].

training users, universities train networking technicians and trainers of users.

The U.S. could help user organizations with training, equipment, and communication costs. Since direct subsidy runs the risk of increasing the visibility of recipient organizations, indirect subsidy might be preferable. This could be channeled through a variety of international organizations, foundations and professional societies. There are many such activities in developing nations. For example, UNDP and the Soros Foundation support networking projects, and The Internet Society conducts annual workshops for networkers in developing nations. Support from private companies, particularly those in networking and computing businesses, could also be encouraged and facilitated. Again, it should be stressed that small investments can make a significant difference since Cuban networks operate on a shoestring.

IMPLICATIONS FOR U.S. GOALS

The Cuban Democracy Act sets forth a number of goals for U.S.-Cuban policy. This section delineates these and several other goals, and discusses the impact of improved communication and networking on each. We point out both advantages of improved communication and costs in terms of helping to stabilize the current Cuban regime.

Free and fair elections

The Cuban Democracy Act calls for "free and fair elections conducted under internationally recognized observers" in which opposition parties have "ample time to organize and campaign" and all candidates in the elections are permitted "full access to the media." While the Cuban government currently shows no inclination to hold free elections, they will occur at some time, and at that time, an improved communication infrastructure would be an asset for all political parties.

In general, one would expect networks to encourage democracy by providing Cubans with outside information and ideas, and by enabling them to share ideas and coordinate activity, much as the Internet was used for inter and intranational communication during the failed Soviet

Coup attempt [51]. The Internet also carried news and discussion of events in Tian An Men Square, Chiapas, and so forth.

Going beyond anecdote, Kedzie [28, 29] presents multivariate analysis showing that interconnectivity is a better predictor of democracy than schooling, GDP, life expectancy, ethnic homogeneity, or population, particularly in regions of newly emerging democracy. One could speculate that democracy causes interconnectivity or they are spuriously correlated with a third variable like development, but Kedzie's analysis does not support these suggestions. One of the implications he draws from his work is:

> To the extent that we as a nation, aim to influence the development of democracy world wide, we do so through programs to enhance economic development, education, health, legal reform, etc. The causal connection supporting these programs is no stronger, and in some instances quite a bit weaker, than can be inferred in the case of network communication technology. [28]

Increased civil liberties and human rights

The Cuban Democracy Act calls for the Cuban government to show "respect for the basic civil liberties and human rights[14] of the citizens of Cuba," and authorizes the US Government to "provide assistance, through appropriate NGOs, for the support of individuals and

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[14] The 1995 US State Department report on human rights [28] lists Cuban problems, including extrajudicial killing of people leaving in boats, routine use of arbitrary arrest and detention, and obtrusive block committees that monitor behavior and attitudes. The government does not allow freedom of critical speech, and the Cuban constitution states that electronic and print media are state property. As a visitor, one notes propaganda in the electronic media and billboards, and is aware of surveillance.

On the other hand, the State Department report acknowledges there were no reports of disappearances, no restriction on domestic travel, an easing of religious repression, and that many blacks have benefited from the social changes of the revolution. As a visitor, one is struck by the willingness of people on the street to speak openly of politics, and of cultural liberalization. For example, the movie "Strawberries and Chocolate," which presents political criticism and a sympathetic portrayal of eccentric behavior and homosexuality, played in theaters and was widely available on video tape.

organizations to promote nonviolent democratic change in Cuba." At least 31 NGOs have accounts on Cuban networks (Table 12). Gillian Gunn has conducted a study of the Cuban NGOs [12], and states that Cuban Ministry of Justice "reports explosive growth in their number from 1989 to 1993, and a leveling off in 1994." Gunn states that "Approximately 2,200 NGOs are now registered with the government and many others exist underground." She surveys the NGOs and their relation to the Government, and concludes:

> Are Cuba's NGOs government puppets or seeds of civil society? The answer is ideologically and intellectually unsatisfying. They are both, though the latter characteristic is very gradually growing.

In a September, 1995 interview, Gunn stated that since the Spring of 1993, there have been Cuban government memos stating there are too many NGOs, and calling for increased audit and control by the ministry which oversees them.

She feels email is a lifeline for the NGOs since fax and telephone are unreliable and expensive. For instance, the Georgetown University Cuba Project, which she directs, is organizing an environmental conference with two Cuban NGOs, which would have been impossible without email. I had the same experience as chairman of the 1994 Conference on The Impact of Informatics on Developing Countries, of the International Federation of Information Processing Societies in Havana, which would have been impossible without the network, as would be the report you are now reading.

While these examples involve communication between Cuba and the rest of the world, the network also plays a role in fostering open communication within a nation. An interesting example is provided by the use of Relcom, a then-Soviet network during the coup attempt [22]. Relcom functioned without interruption throughout the coup attempt, providing reports on the status of troops, protest, strikes, and so forth in various Soviet cities. (There was also considerable two way exchange with other nations, and an archive of this traffic is available to scholars at http://www.cs.oswego.edu/misc/coup/index.html).

Move toward a free market economy

The Cuban Democracy Act calls for movement toward "establishing a free market economic system," and there has been some movement in this direction, including dollar legalization, limited markets, and, most recently, a liberalization of investment laws.

In a communication-poor nation, a computer network can make a meaningful contribution to a market economy. The Relcom Network in the ex-Soviet Union, which carried commercial traffic from its inception, provides an example of this role [56].

A market economy also requires private capital, and a robust communication system is an asset in the eyes of a potential investor. There is, however, an inherent conflict between the policy of denying capital to Cuba in order to bring about a change of regime, and the communication needs of a market economy.

Maintain achievements of the revolution, and improve Cuban living standards

This is not an explicit goal of U.S. policy, but it is consistent with the humanitarian ends that policy seeks to achieve. While the price has been high, Cubans point to gains in racial equality, health care, education and science, improved life in rural communities, and so forth as achievements of the Castro regime. As Table 15 shows, Cuban basic indicators are comparable to successful South and Central American nations Chile and Costa Rica. One can argue that historical conditions and policies of pre-Castro Cuba are responsible for some of Cuba's success, or that there were alternative means of reaching the same end, but there have been important achievements which should not be lost.

To the extent that improved telecommunications will help the Cuban economy recover from its current crisis, it will help provide the stability and surplus necessary to continue social programs and investment. Additionally, improved telecommunications can bring some of the economic, educational, and cultural advantages historically enjoyed in cities to the country side, again supporting gains made during the Castro regime.

Table 15

Basic Indicators, Chile, Costa Rica, and Chile

	Pop. (mil) mid-1993	GNP per capita * ($) 1993	Life Exp. (yrs) 1993	Primary School Enroll. 1991	Illit. Rate 1990
Chile	13.80	3,170	74	87%	7%
Costa Rica	3.30	2,150	76	87%	7%
Cuba	10.86	1,537	76	97%	6%

Source: World Bank. Cuban GNP is from the ITU

It can be argued that cutting Cuban living standards will destabilize the government and lead to change; however, this is achieved at great humanitarian cost, which crosses socio-economic class lines. It also increases the danger of a violent revolution, with attendant loss of life, economic ruin, and refugee problems and political-economic responsibility for the U.S. [18]. For pragmatic and humanitarian reasons, we would surely prefer a peaceful, democratic transition as exemplified by the ouster of Pinochet in Chile, to a violent change, perhaps accompanied by the imposition of a government from exile, as in Iran.

Provide investment opportunity for U.S. companies

U.S. policy has been to pressure the Cuban government by stopping foreign investment. While we have succeeded in slowing foreign investment, we have not stopped it. Perez-Lopez [45, 46] discusses the quality, quantity, strategic value, and other aspects of foreign joint ventures in Cuba. He reports that the number of joint ventures grew from fewer than 20 at the end of 1990 to about 60 at the end of 1991, 76 in November, 1992, 180 at the end of 1994, and 230 by May, 1995 [46]. On the other hand, as we saw above, Perez-Lopez cautions that these investments are often worth less than face value to Cuba. Further evidence of foreign business and investment is provided by Table 16, which shows the number of businesses with Cuban offices, by nation.

Table 16

Foreign Firms Registered in Cuba, April, 1994

Country	No.	Pct.	Country	No.	Pct.
Spain	80	24.5%	Argentina	10	3.1%
Panama	52	15.9%	Australia	1	0.3%
Germany	17	5.2%	Austria	2	0.6%
Japan	17	5.2%	Belgium	2	0.6%
France	14	4.3%	Bermuda	1	0.3%
Mexico	13	4.0%	Brazil	3	0.9%
Canada	13	4.0%	Canada	13	4.0%
Italy	12	3.7%	Cayman Islands	2	0.6%
Argentina	10	3.1%	Chile	2	0.6%
Switzerland	9	2.8%	Colombia	4	1.2%
England	9	2.8%	Costa Rica	1	0.3%
Virgin Islands	8	2.4%	Curacao	3	0.9%
Holland	8	2.4%	Cypress	1	0.3%
Russia	6	1.8%	Czech Republic	1	0.3%
Dutch Antilles	5	1.5%	Denmark	1	0.3%
Venezuela	5	1.5%	Dominican Repub.	2	0.6%
Nicaragua	4	1.2%	Dutch Antilles	5	1.5%
Colombia	4	1.2%	Ecuador	3	0.9%
Liechtenstein	4	1.2%	England	9	2.8%
Ecuador	3	0.9%	France	14	4.3%
Brazil	3	0.9%	Germany	17	5.2%
Curacao	3	0.9%	Gibraltar	1	0.3%
Cayman Islands	2	0.6%	Greece	1	0.3%
Austria	2	0.6%	Holland	8	2.4%
Chile	2	0.6%	India	1	0.3%
Belgium	2	0.6%	Isle of Jersey	1	0.3%
Dominican Repub.	2	0.6%	Italy	12	3.7%
Uruguay	2	0.6%	Japan	17	5.2%
Gibraltar	1	0.3%	Liechtenstein	4	1.2%
Martinique	1	0.3%	Martinique	1	0.3%
Peru	1	0.3%	Mexico	13	4.0%
Czech Republic	1	0.3%	Nicaragua	4	1.2%
Portugal	1	0.3%	Panama	52	15.9%
Greece	1	0.3%	Peru	1	0.3%
Bermuda	1	0.3%	Portugal	1	0.3%
India	1	0.3%	Russia	6	1.8%
San Bartholomew	1	0.3%	San Bartholomew	1	0.3%
Denmark	1	0.3%	Singapore	1	0.3%
Singapore	1	0.3%	Slovakia	1	0.3%
Costa Rica	1	0.3%	Spain	80	24.5%
Cypress	1	0.3%	Switzerland	9	2.8%
Isle of Jersey	1	0.3%	Uruguay	2	0.6%
Australia	1	0.3%	Venezuela	5	1.5%
Slovakia	1	0.3%	Virgin Islands	8	2.4%
Total	327	100.0%	Total	327	100.0%

Source: Cuban Chamber of Commerce. Cuba had 29 firms registered.

While designed to precipitate change, our policy has had the undesirable side effect of reducing U.S. business opportunity, since the Cuban-American community and others are attracted by Cuban investment opportunities. Without addressing investment in general, it can be argued that network-related investment would be consistent with current U.S. law, and would have destabilizing effects of its own. It would also provide opportunity to U.S. business.

Develop robust Cuba-U.S. trade

While trade is illegal today, one day trade relations will be established, and good communication infrastructure will be of value.

Find new forms of management and state/enterprise relationships

We have experimented broadly during the 20th century. We have seen that a central, planned economy is less efficient than a market economy at the production of goods and services, and can inflict catastrophic environmental damage and lead to arbitrary, capricious distribution of income and power. While relatively efficient, market economies also inflict environmental damage and lead to wide variance in the distribution of income and wealth, with attendant human and moral cost. These concerns are widely held, as witnessed, for example, in the NAFTA debates in the U.S. Congress or the Pope's recent U. N. speech.

With the transition in Eastern Europe and in Cuba, we may have the opportunity for experimentation and variety in management and state/enterprise relationships. For example, the recent law liberalizing rules governing foreign investment in Cuba allows the investor to own an enterprise and its capital assets, but the employees work for the state. It will be interesting to see the results of this arrangement over time.

A robust communication infrastructure can help provide the environment needed for new forms of organization to evolve, and would also be used by these organizations. While only one component of that environment, it is significant. Again, the stability and productivity that implies runs counter to the strategy of pressuring Cuba into submission.

Protect the Environment and Conserve Natural Resources

The current economic crisis has caused Cuba to cut back drastically on energy consumption. This has caused conservation, rationing, and some reengineering and substitution, for example, increased reliance on bicycles for transportation. To the extent that communication can be traded for transportation in the economy and education system, an improved communication infrastructure might contribution to energy efficiency and preservation of the Cuban environment.

Improve Rural Life

All developing nations are experiencing rapid migration to major cities as people seek improved education, employment, and connection with the world. This migration, with its attendant social and environmental costs, may be slowed if a properly planned network can deliver these services to rural areas and small towns.

Gain Access to Cuban Information

Discussion of communication networks in developing nations often centers on the advantages to them of gaining access to information and experts in developed nations; however, this is a two-way street. For example, Cuba has strong biomedical research and therapy programs, and improved communication will facilitate access to Cuban databases and experts. Cuban science will also benefit from contact with colleagues internationally, to the advantage of all mankind. The improvement of Cuban biomedical science and access to its results would be to the humanitarian benefit of Cubans and all others, particularly Latin Americans who make use of Cuban health resources.

Cuba also has information resources in other fields, for example, the digitized Havana Art Museum collection or Spanish-language educational software.

CONCLUSION

I have argued in favor of a policy which encourages and supports the improvement of Cuban computer networks and the infrastructure needed to support them. We have seen that such communication would further a number of U.S. goals, such as free elections and respect for human

rights. It would also have economic benefit for Cuba, which would be of humanitarian value, but would be counter to the strategy of trying to force Cuba to capitulate and oust Castro. This is a our policy dilemma.

Castro and the Cuban Government also face what may be called the dictator's dilemma. Communication technology is an important resource for economic growth, yet it opens the door for freedom of internal and external expression that could threaten a regime [65]. Some governments have chosen to suppress information technology regardless of the economic cost [19], but as we have seen, Cuba has been more positive toward computer networks. Nonetheless, Fidel Castro recognized the dictator's dilemma in a speech on July 7, 1995 when he charged that his opponents might use the information-related provisions of the Cuban Democracy act to support what he regards as counter-revolutionary organizations in an attempt to destabilize his regime.

In the current energy and economic crisis, communication is difficult in Cuba. The obsolete telephone infrastructure is deteriorating, paper, copier toner and other supplies are very difficult to find, and television broadcast schedules have been cut. Computer networks may partially fill this void, making them a low-cost investment with a high marginal return.

POSTSCRIPT (MAY 1996)

This document was initially written in February 1996. Events since then have reinforced the conclusion that Cuba will have an IP connection to the Internet soon. Progress is being made in this direction, despite difficulties raised by the downing of U.S. planes, and warnings by Raul Castro and other Cuban officials that the information-related portions of the Cuban Democracy Act are loaded with subversive intent. Jesus Martinez of CENIAI stated, while attending the Forum of Latin American and Caribbean Networks in April, that there are concrete plans for an IP link to Canada. He was also elected a member of the Secretariat of that Forum.

APPENDIX A. COMPUTER NETWORKING BACKGROUND

This appendix provides networking technology background and introduces terms needed to put Cuban networks in context. "Computer network" is a very broad term, describing anything from two computers temporarily connected with a dial-up phone call to complex networks of computers that are connected 24-hours a day by high speed, dedicated communication links. Networks in developing nations typically begin with something like the former, and move in stages toward the latter. Let us begin with the goal, the Internet, and work back to lesser forms of connectivity.

THE CORE OF THE INTERNET

The core *Internet* consists of roughly 7 million *host* computers in 86 nations that are connected 24-hours a day using dedicated communication links. The links between the hosts may be any media -- cables strung by the user organization, private lines leased from a telephone company, satellite links, terrestrial wireless links, etc. The speeds of these links vary widely depending on the technology used. Slow Internet links are typically 56,000 bits per second, high-speed links are typically 44.746 million bits per second, and experiments are being run with the next generation, links running several billion bits per second.

These links may be local or run between locations. For example, the computers within a building or campus may be linked together using cables you string, forming a *LAN* or local-area network. Your LAN might in turn be connected to the Internet (a *WAN* or wide-area network) using a line leased from the telephone company. This is indeed a common progression. An organization first links its internal computers together in a LAN, and later connects the LAN to the Internet. As such, the Internet is actually a network of interconnected networks, an *internet* (with a small *i*). As we will see, developing nations go through an analogous progression.

Information typically moves between networked computers in small blocks called *packets*. If a packet fails to arrive or arrives with an error, it can be resent. The conventions used in assembling packets and checking to see they arrived at their destination in order and without error are referred to as a *communication protocol*, and the protocol used on the Internet is called *TCP/IP* which stands for Transmission Control Protocol/Internet Protocol. People often shorten this, referring to an *IP network*.

Let's take a break and summarize what we have so far. The core of the Internet consists of 7 million computers which are connected 24 hours a day, using the IP protocol for communication over relatively fast, reliable links. By contrast, the computers on a network in a developing nation may only connect for short times during the day over slow, unreliable telephone lines, and use other protocols than IP. More on that later.

THE REST OF THE INTERNET

Note that to this point I have spoken of the "core" of the Internet, but many users are not connected to the Internet 24 hours a day. They dial a computer that is on the Internet, establish a temporary connection, and hang up when they finish. During the time the connection is up, they are on the Internet. The protocols used for this sort of connection are called SLIP (serial line IP) or PPP (point-to-point protocol), and they are compatible with IP. PPP is more versatile, and therefore more common. These connections are typically made over voice telephone lines, which are relatively slow, so transferring pictures, sounds, and video may take prohibitively long. (However, they are fully capable).

There is another common way of temporarily using the Internet. You make a dial-up connection to a computer that is on the Internet, and use your personal computer as a terminal connected to that computer. The computer you connect to is typically shared by many users at once, and it, not your computer, is on the Internet. This is called having a *shell account*. A shell accounts limits what you can do. You can retrieve information and send and receive email, but you cannot provide

information to others. You are also limited to text and numeric data, no pictures, sounds or video. (There are variations on the shell-account theme that we will not pursue here).

There are also some users who are behind *firewalls* for security purposes. This means their computers are on the Internet, and, while they can send and receive email and retrieve information, they cannot be accessed by computers outside the firewall, so they cannot provide information.

There is one more important distinction among computers connected to the Internet (or any network) -- they may be *clients* or *servers* or both. A user runs client software to do a job or find some information on the Internet. For example, to find and retrieve information on the WWW, you would use client software like Mosaic or Netscape. The computer that provides the information you are retrieving is the server, and is running server software. As the name implies, the server provides a service to the network, and you need compatible client software to use the service. (The client and server must both use software that implements the service protocol).

Note that the client-server distinction is based on the software running on a host. Since many operating systems like Unix or Windows allow several programs to be active at once, a computer can be both a client and a server at the same time. Furthermore, a user may run several clients -- a WWW client, email, Gopher, FTP, and so forth. By the same token, a computer may run several server programs.

This completes our description of the Internet. While the core hosts are connected continuously, some users dial in for temporary sessions. Some dial-up users are directly on the Internet during their sessions, others work through surrogate shell accounts on shared systems. There are also clients and servers. The former are typically on the desk of a user who seeks information, while the latter may be in a closet or on the system administrator's desk, and they provide information or other services. If you are using a shell account, the client software you use is running on the computer you connect to, not your own computer.

If you are an Internet user, you might wish to consider your own situation at this point. Is your computer connected full time or do you dial in? If you dial in, do you use a shell account, or do you have an IP connection using the SLIP or PPP protocols? What is the speed of your connection to the Internet?

NETWORKS IN DEVELOPING NATIONS

Networks in developing nations begin very simply, and evolve toward Internet connectivity. For example, when I visited TinoRed headquarters in 1992, the network consisted of a single, 386-based PC running the Unix operating system. The computer had one modem, which meant that one user at a time could dial up and log in to read and leave email. This was more similar to what we would call a small "bulletin board" system in the U.S. than what we call a "network."

Cuban international traffic was exchanged every few days. A phone call would be placed from Canada to a computer at CENIAI in Havana, the messages that had accumulated since the last call were exchanged, and the phone connection hung up. This is an example of *store and forward* messaging in which email and data files are exchanged in batches.

Two store and forward protocols are common in developing nations, Fido and UUCP (Unix to Unix Communication Protocol). UUCP is most common, and is used by all the Cuban networks. While it was devised for information transfer between computers using the Unix operating system, it has also been implemented for computers using DOS, Windows, and other operating systems.

UUCP is also used internally within Cuba and other developing nations. All of the major Cuban networks exchange messages using UUCP, so a user on, say, TinoRed can exchange email with a CIGBnet user. Furthermore, a network, say CIGBnet, exchanges traffic with its client networks using UUCP.

It should also be noted that so-called *X.25* networks can be used instead of the voice telephone system for transfer of UUCP data. These are older networks established for connection of terminals to host computers, and they are expensive, but faster and more reliable than telephone connections in developing nations.

A store and forward network can transfer messages, but cannot be used for interactive applications. For example, users on UUCP or Fido networks cannot search for information on WWW or Gopher servers. They are restricted to email.[15] The same goes for people with accounts on different networks like Bitnet. They can exchange email with Internet users, but cannot run interactive applications.

As such, developing nations generally begin with a Fido or UUCP network, and also begin experiments with local IP networking. For example, CIGBnet and CENIAI have IP networks running on their LANs. That means users in their buildings who are connected to the LAN can run interactive client-server software. It also means technicians are gaining experience for the time when international IP connectivity is available.

To summarize, developing nations typically start with an intranational UUCP network, connecting a few universities or research institutes. Often several such networks will begin, and they will exchange traffic with each other. The next step is for one or more of them to establish an international UUCP link to a computer that is on the core Internet. From that moment forward, users in the developing nation can exchange email with colleagues throughout the world.

At the same time, technicians in the developing nation may be experimenting with IP-based LANs and, if the telephone infrastructure permits, IP connections between institutions or dial-up IP. (This is generally confined to large cities because of limited telephone infrastructure). The final step is the leasing of a dedicated international link to an Internet computer. At that point IP access and interactive applications become possible. Users in the developing nation can reach global servers and people and they can be reached as well. Cuba has taken all but this last step.

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[15]While this sounds like a severe limitation, email is still the most important networking application, and the opening of simple email connectivity is a boon to a developing nation. It is also possible to retrieve information from servers using properly formatted email messages, but this is tedious, error prone, and time consuming.

Appendix

APPENDIX B.
QUESTIONNAIRE SENT TO CUBAN NETWORKS WITH INTERNATIONAL CONNECTIONS

This questionnaire was sent to CENIAI, TinoRed, InfoMed, and CIGBnet.

Section 1: Coordinates

Network Contact person/point:

Postal address:

Telephone Number:

Fax Number:

e-mail address:

Section 2: Network

1. Description

   Operating since _____

   Registered users _____

   Active users _____ (connected at least once a month during last 3 months)

2. Do you charge for services Yes [ ] No [ ]

   If Yes, specify charging methods (check all that apply)

   _____ Free to end users

   _____ Fixed charges to end users

   _____ Variable (usage-based) charge to end users

   _____ Free to end institutions (such as a university)

   _____ Fixed charged to institutions

   _____ Variable (usage-based) charge to institutions

3. What is the approximate annual budget for your network

connection and/or information center? _____USA$

4. Of that budget, approximately what percent is used for

_____ communication equipment
_____ computer equipment
_____ communication charges
_____ technical staff
_____ management staff
_____ support staff
_____ facilities
_____ software
_____ overhead
_____ other _____

5. Type(s) of connection(s) or gateway(s) out of your country

_____ IP
_____ UUCP
_____ Fidonet
_____ Bitnet
_____ Other _____

6. Communication links(s) out of your country (for each link)

Speed _____
Leased or switched _____
Vendor _____
Where do you connect? _____

7. Approximately, what percent of hosts on your network run

_____ an FTP server
_____ a WWW (http) server
_____ a Gopher server

_____ a list server

_____ a news server

_____ a dial-up bulletin board

_____ a library catalogue

8. Approximately, what percent of the hosts in your network communicate via

_____ IP

_____ UUCP

_____ Fido

_____ Bitnet

_____ Other _____

Section 3: Users

1. Scope of the network (check all that apply)

Academic [ ]

General Research [ ]

Government [ ]

NGO [ ]

Commercial [ ]

Special Interest Group [ ] Specify_____

Other [ ] Specify_____

2. Approximately, what percent of your users would you estimate as being:

_____ University and research faculty staff

_____ University students

_____ Government employees

_____ Commercial employees

_____ NGO employees

_____ Employees of International organizations, e.g., (UNESCO, PNUD, OAS, IADB, and World Bank)

_____ Other _____

3. Approximately, what percent of your users have

____ e-mail only
____ dial-in access to a command line account on a host
____ dial-in SLIP/PPP connectivity
____ full-time IP connectivity

4. Approximately percent of the users of your network have

____ Personal computers running DOS
____ Personal computers running Microsoft Windows
____ Personal computers running Unix
____ Personal computers running Mac OS
____ Unix workstations
____ Other workstations
____ Unix minicomputers
____ Other minicomputers
____ Unix mainframes
____ Other mainframes
____ Other _____

Section 4: Help-desk and user support

1. Is there a help-desk or other central point for queries?

Yes [ ] No [ ]

Postal address
Telephone number
e-mail address

2. Is a general user guide available?

   Yes [ ] No [ ]

   Paper [ ] Electronic [ ]

3. User group support activities

   Describe here activities to support user groups in using the network.

4. Training activities and workshops

Describe here activities to train and inform user support staff.

5. Other activities

Describe here any other activities on your network you consider relevant. Comments (plans, etc.)

Section 5: Success stories

Could you give some examples of users or applications which best illustrate the value of your network?

Thanks for your cooperation!!!!

APPENDIX C: CUBAN RESOURCES ON THE INTERNET

Cuba-L

Nelson Valdes, New Mexico State University
nvaldes@unm.edu

This is a mailing list. Postings typically concern political and policy-related issues regarding human rights, trade, U.S. policy, and so forth. There is some overlap with other Internet sources, for example Radio Marti or Cubanet, but there is also material from other sources such as the U.S. Senate. There is an annual subscription charge of $30 (student), $60 (professional), or $80 (institutional).

CubaNet

Omar Galloso, cubanet@netpoint.net, cubanet@bcfreenet.seflin.lib.fl.us
http://www.netpoint.net/~cubanet
gopher://gopher.gate.net/11/florida/CubaNet/PRESS

Cubanet has gopher and WWW servers and a small (78 person) manually-administered mailing list. The mailing list has many Miami Herald articles in Spanish, and the top-level WWW menu is:

> Culture: music, photos, art, theater, dance, literature, cinema, radio and TV. Politics: current events, pictures of Cuba, exile History: colonial, the Spanish American war, the republic, post 1959 (dissidents' and supporters' views), Miscellaneous: customs, cuisine, rituals, other.

The gopher server is more political with news articles and communiques (from Cuba and the U.S.) organized chronologically, a long report of the Cuban National Association of Independent Economists, and a collection of miscellaneous articles and essays.

CANFNET

canfnet@icanect.net or CANFNET@aol.com
http://www.canfnet.icanect.net/index.htm

The Cuban American National Foundation established a network presence on September 14, 1995. At this point it is new, and nothing is on the server, but the organizers have a clear point of view. The following quote is from their initial announcement:

> "This is a project that we have put a lot of time, resources, and energy into because we feel that it is the wave of the future," declared Jorge Mas Canosa, Chairman of the CANF. "The information highway allows us direct access to millions of people in promoting nationally and internationally those issues which are important to Cubans, both in exile and on the island. We anticipate a lot of interest and debate as we near the final days of the Castro dictatorship."

Cuban Internet Resources WWW site

http://ix.urz.uni-heidelberg.de/%7Epklee/Cuba/
Peter Klee, pklee@ix.urz.Uni-Heidelberg.de

The top-level menu is too long to list -- it contains many single documents, However, they are on wide-ranging topics such as pointers to other Cuban resources on the Net, Cuban travel, hotels, scuba diving, music, politics (diverse opinion), networking, history, cigars, essays by Cubans and expatriates, and U.S. Government data and reports. It is also possible to search various on-line databases from this server.

> * BYU Pagina Cubana * CENIAI Cuba Gopher * CIA World Factbook 1994 * Country connectivity by ISO code * CU Cuba Study Group * CubaNet Archive * PeaceNet Cuba Gopher * URL's on soc.culture.cuba * UT-LANIC Castro Speech Database * Voice of America - Radio and TV Marti (Broadcasting to Cuba) * Search various on-line databases

CENIAI Gopher (mirrored in Uruguay)

gopher://makenda.edu.uy/00/otros-gophers/cuba

This gopher server is maintained by CENIAI. Since they have only a UUCP connection to the Internet, the information is stored on a server at the University of the Republic of Uruguay at the present time. It is CENIAI's plan to continue updating and adding to this server until they have IP connectivity. The top-level directory is:

> (FILE) Leame primero (DIR) CENIAI: Red Cientifica de Cuba (DIR) Acerca del IDICT (DIR) Mas sobre las divisiones del IDICT (FILE) Empresas extranjeras radicadas en Cuba (DIR) Revistas Electronicas cubanas (DIR) Oficina Nacional de Invenciones, Informacion Tecnica (DIR) Instituto Cubano de Arte e Industria Cinematografica (DIR) Informacion sobre Medio Ambiente (DIR) Medicina Alternativa (DIR) Servicio Especial de la Mujer (DIR) Eventos Internacionales (DIR) Algunas Redes Cubanas (DIR) Anuncios (DIR) Boletines Especializados (DIR) Instituto de Geografia

This arrangement was necessitated by Cuba's lack of IP connectivity. But even if they had IP connectivity, an argument could be made for maintaining or mirroring their information on other servers. In general an argument can be made for storing information near the mass of users of that information and in locations where connectivity is economical.

Since many people interested in Cuban information are in North America, and connectivity, bandwidth, and computers are cheap in North America, it would be reasonable for Cuba (and many other nations) to mirror their information on servers there. Ownership of and control over the information would remain in Cuban hands, but it would be physically located elsewhere. The global Net diminishes the importance of the physical location of information.

BYU Cuban Home Page

Douglas S. Mehr for Humanities Research Center at Brigham Young Univ.
http://humanities.byu.edu/spanish/mundo/cuba.html

This WWW server contains general information, Cuba's constitution, Castro's speeches, photos of Cuba, Cuba internet resources, the Cuban newsgroup (soc.culture.cuba), and CIA facts about Cuba. With the exception of the constitution, it primarily points to other sites.

CIA profile of Cuba

http://www.ic.gov/94fact/country/63.html

Basic facts regarding geography and land use, people and demographics, government form and history, the economy, infrastructure, defense forces.

Republic of Cuba W. W. W.

davide@ipruniv.cce.unipr.it
http://www.unipr.it/~davide/cuba/home.html

This is a general site, with broad information and pointers to many of the other resources listed in this report. The top-level menu is:

> FLAG History DISCLAIMER FOR THE CUBA WWW COUNTRY INFORMATION CUBA'S MAPS POLITICS & HISTORY ECONOMY CUBAN NETWORKS W.W.W. SITES GOPHER SITES E-MAIL LIST: CUBA-L (MODERATED DISCUSSION GROUP) NEWSGROUPS (UNMODERATED DISCUSSION GROUPS) E-MAIL WITH CUBA TOURISM & TRAVELS CONGRES & MEETINGS MUSIC & OTHER IMAGES: POST-CARDS & PHOTOS SEARCH YOURSELF WITH INTERNET TOOLS

Gopher server of the Cuban Research Institute Florida International University

gopher://gopher.fiu.edu/11/acadinfo/cri
Lisandro Pe'rez, Department of Sociology and Anthropology
crinst@servax.fiu.edu

The Gopher server of the Cuban Research Institute of Florida International University is clearly under development. The top-level menu is shown below. At this time, the most interesting material is not yet available, which is disappointing since the center is well-funded with a large faculty and staff.

> (FILE) About the Cuban Research Institute (DIR) CRI News and Announcements (FILE) Upcoming Events (DIR) Rockefeller Foundation Resident Fellowships in the Humanities (FILE) Academic/Cultural News from Cuba and the Cuban- American Community (FILE) CRI Affiliated Faculty (FILE) International Directory of Cubanists (in progress) (FILE) Results of the FIU Cuba Polls (not yet available) (FILE) CRI Annual Report, 1993-94 (FILE) Occasional Papers (forthcoming) (DIR) Information on Ordering CRI Publications

Peacenet Cuban gopher server

gopher://gopher.igc.apc.org/11/peace/cuba/cuba.gopher

Contains general descriptions of Peacenet and selected articles about Cuba which have been posted in Peacenet discussions in the past.

University of Texas Latin-American Studies Center Cuban Home Page

http://lanic.utexas.edu/la/ca/cuba/

The University of Texas has an extensive Latin American studies server, with information on many nations, including Cuba. The Cuban home page contains pointers to many of the other servers discussed in this report:

> Cuba Internet Resources Republic of Cuba WWW CENIAI Gopher Country Map World Factbook Background Notes (Department of State) Travel Information GDP Growth, 1987-1993 (ECLAC) Trade Data (USAID) Constitution Connectivity information (PSG) soc.culture.cuba Usenet Newsgroup Broadcasting to Cuba (Radio and TV Marti) Information from the IGC Networks Castro Speech Data Base

The most interesting information is a collection of Fidel Castro's speeches from 1959-1994. This is a searchable, full-text database of translations of many of his speeches, interviews, and press conferences, based on records of the Foreign Broadcast Information Service (FBIS), a U.S. government agency responsible for monitoring broadcast and print media in countries throughout the world. The Radio Marti research department cooperated in the digitization of this material.

The Radio Marti gopher

gopher://gopher.voa.gov/11/marti

This server is maintained by the research department at Radio/TV Marti. The top-level menu is:

> (FILE) About Radio and TV Marti (DIR) Legislation and Policy (DIR) Program and Frequency Schedules (DIR) Information about Cuba

The Legislation and Policy directory contains the following full text documents:

> Public Law 98-111: Radio Broadcasting to Cuba Act Public Law 101-246: Television Broadcasting to Cuba Act Public Law 102-484: Cuban Democracy Act of 1992 Public Law 103-121: Broadcasting to Cuba, Advisory Panel Cuban Assets Control Regulations; Exports to Cuba

These are interesting as are the Chronology files found under Information about Cuba:

> Chronology of Cuban Events, 1993 Chronology of Cuban Events, 1995 Cuba Business File Chronology, 1995

These are very short, daily summaries of Cuban events -- an annotated timeline.

The Latino Connection Cuba Web

Pedro Rumz-Garcia
http://www.webspace.com/~pedro/cuba.html

This is a general information site. It is part of the Latino Connection, which has home pages for many nations. It has little that is not on other servers. The top-level menu is:

> COUNTRY INFORMATION HISTORY & PEOPLE TRAVEL & TOURISM EDUCATION ARTS & ENTERTAINMENT OTHER WEB LINKS

PSGNet Gopher

Randy Bush, randy@psg.com
gopher://rip.psg.com/

This server has technical and other information on networking in developing nations. The Cuban section of the gopher is located at the following address:

gopher://rip.psg.com/1m/networks/connect/countries/cu

Its top level directory reads as follows:

CIGBnet: The CIGB Scientific Information Network. A Look at Cuban Networks. SEMINAR IN CUBA. How to Send News to Cuba: Email & Voice. Communication with Cuba (fwd). BIOTECNOLOGIA HABANA'95. Mexico buying into Cuban PTT. Cuba update (12.94). More on INFOMED: Cuba. Re: Cuba - CIGB contact data (8/95). Redes de informacion en Cuba. Cuba - CIGB Network (8/95)

soc.culture.cuba news group

This Usenet list discusses political and cultural issues. As with most political news groups, the discussion is often heated. Cuban exiles are active, but native Cubans do not participate since, due to cost, the list is not fed to Cuba. With IP connectivity, it most probably would be, which would be most interesting.

Participation by nation of origin for a sample of 200 messages was: U.S. 186; Chile 4; Canada 2; Austria, Sweden, Spain, Germany, Denmark, UK, Mexico, and Netherlands, 1 each. Of the U.S. postings, 40 were from America On-Line, the rest from the traditional Internet. These were taken on one day, so statistical analysis is not justifiable, but the general point is made that native Cubans do not participate on the list.

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