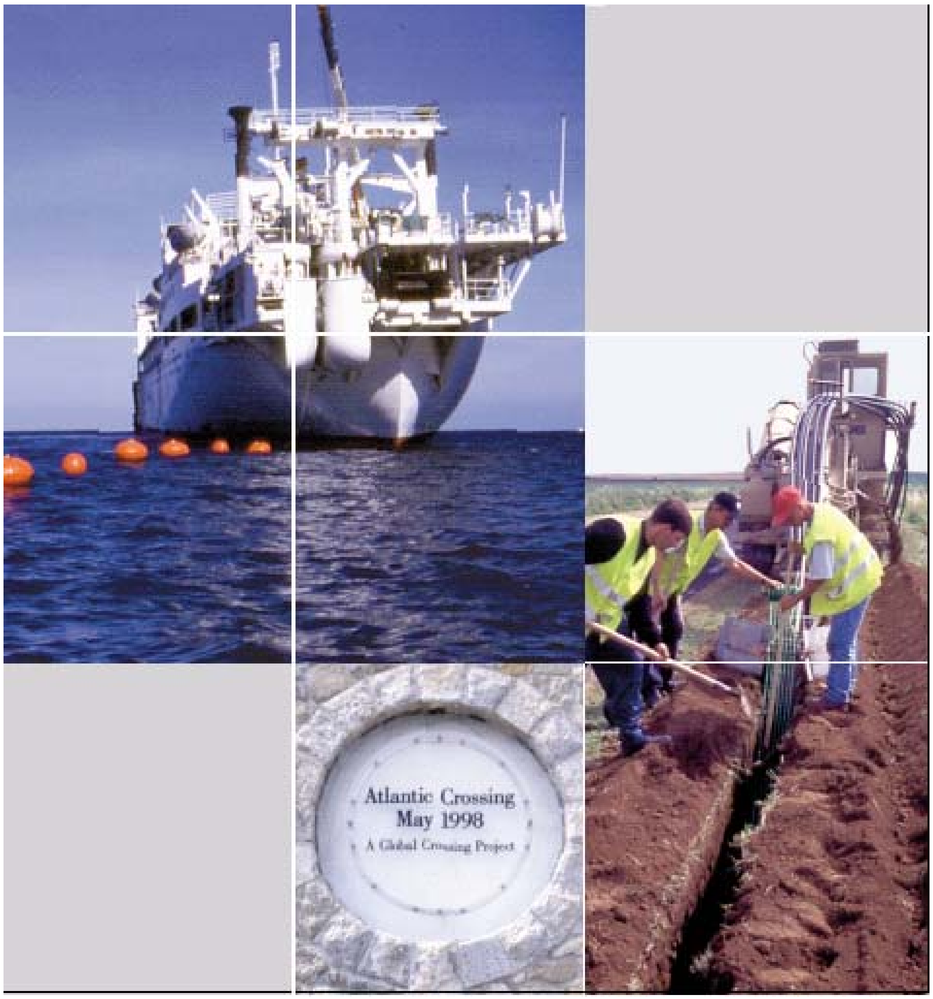
Global Crossing (Condensed)



"*We are building the world's first seamless fiber optic network – connecting oceans, continents, and cities of the world and setting new world standards in bandwidth capacity, technology, and pricing. Global Crossing is creating a global information highway for use by all who live on this planet*." Gary Winnick, Founder. Annual Report 1998.

 This case was written from public documents and interviews with various industry observers and experts. It was prepared by Professor Richard P. Rumelt with the assistance of Olivier Costa, M.B.A. class of 2002, The Anderson School at UCLA.

As 1998 drew to a close, Gary Winnick, Chairman of Global Crossing, could look back on two years of stupendous achievement. In that time he had guided a project to build a new state of the art transatlantic fiber optic cable from dream to reality. The cable, the AC-1, was operational, and sales of capacity had more than returned the cost of its construction.

The next step seemed obvious to most observers—"do it again!" With plans underway for AC-2, and cables in the Pacific and South Atlantic, growth seemed assured. The more complex questions arose around the construction or acquisition of terrestrial networks. Could Global Crossing continue its focus on building undersea capacity and selling it to giant telecommunications carriers? Or, did it have to integrate forward, buying or building terrestrial networks that linked its cables with cities, and cities with one another, and offering corporate customers end-to-end global network services?

The stock market seemed to be giving Winnick the go ahead to build more network. Analysts described Global Crossing as an "emerging" attack carrier, with low unit costs and great potential to take business away from sleepy old-line telcos. On December 31, 1998, Global Crossing's common stock closed at $45.75, implicitly valuing the company's common equity at $18.8 billion.

Winnick knew that he and his team had great entrepreneurial talent and zeal, but he also knew that they had no proprietary technology, had no established brand name, and had no established base of customers. Instead, their enterprise was harnessed to a number of titanic forces that were reshaping telecommunications. These were (a) deregulation and new competition, (b) the rise of the Internet, (c) the diffusion of personal computers, (d) dramatic advances in fiber optic technology, and (e) an ebullient capital market, especially for new technology-based ventures. To chart the strategy of Global Crossing, Winnick had to understand these forces and attempt to foresee their interplay and their future trajectories.

Deregulation, Convergence and the Internet

In the late 1990s the telecommunications industry was in turmoil. Deregulation of traditional telephone monopolies was proceeding at a measured pace. However, the unexpected rise of the Internet was changing the very nature of communications.

In 1992, the Internet had been a text-based system for moving files and information from one user to another. Internet users, mostly academics, used the ftp protocol to move files, the telnet protocol to time-share a distant computer, and Gopher to search for files on the web. In 1993, the concept of the World Wide Web was developed and within a year the Mosaic browser was released, realizing the concept of the WWW. The browser was the seminal invention that pushed the Internet into popular use. It made networking easy and fun. As the rapidly growing PC business put modem-enabled computers pre-loaded with browsers into the hands of more and more people, the Internet virtually "exploded." The number of web sites increased from 130 in mid-1993 to 2738 in mid-1994, 23,500 in mid-1995, and 230,000 in mid-1996. Before the browser, most Internet traffic was ftp file transfers. In 1994, WWW traffic was 6% of total Internet traffic; in 1995 it was 25%. At about that time, AOL and Prodigy began to sign up millions of PC owners, introducing them to the Internet and browsers. From 1996 on, most Internet traffic was Web traffic.

The Internet backbone functioned like arteries—it carried the traffic amalgamated from smaller sub-networks and from most ISPs. The central arteries carrying traffic amalgamated from individual ISPs was called the 'backbone.' Reliable data on backbone Internet traffic was collected up through the middle of 1995, at which time the original NSFNet moved to a new architecture and government subsidy and control ceased. Exhibit 5a shows the NSFNet count of terabytes per month moved over their backbone, which was thought to account for about 70% of total Internet traffic. It shows traffic doubling each year through 1994. Data for 1996-98 are for the major backbone carriers that replaced NSFNet. Exhibit 5b graphs this information on a logarithmic scale; 1995 is not plotted because data for that year were unavailable.

Traffic data for periods later than 1995 were difficult to obtain, as private companies carried the bulk of Internet traffic. Consequently, beginning in 1995, opinions about the growth of the Internet varied widely. For example, some AT&T analysts thought that backbone Internet traffic in the U.S. increased from about 1.5 to 3.0 petabytes per month in the 12 months ending December 1997. This would represent a doubling in one year, or a growth rate of 100% per year. By contrast, John Sidgmore of MCI WorldCom's UUNet was widely quoted as saying that "Internet bandwidth demand doubles every three to four months." Doubling every three months implies expansion by a factor of 16 each year, or 1500% growth per annum. Doubling every four months implies expansion by a factor of 8 each year, or 700% growth per annum.

A very influential statement on Internet traffic growth appeared in a report to the Department of Commerce, "The Emerging Digital Economy," posted on the Department's website on April 15, 1998. On page 2, the report stated "Traffic on the Internet has been doubling every 100 days."[2] This and other statements in the report spread rapidly, becoming the foundation for hundreds of articles and studies. Among the most frequently repeated statements in the report were these:[3]

1. Fewer than 40 million people around the world were connected to the Internet during 1996. By the end of 1997, more than 100 million people were using the Internet.
2. Cisco Systems closed 1996 having booked just over $100 million in sales on the Internet. By the end of 1997, its Internet sales were running at a $3.2 billion annual rate.
3. In 1996, Amazon.com, the first Internet bookstore, recorded sales of less than $16 million. In 1997, it sold $148 million worth of books to Internet customers. One of the nation's largest book retailers, Barnes and Noble, launched its own online bookstore in 1997 to compete with Amazon for this rapidly growing online market.
4. In January 1997, Dell Computers was selling less than $1 million of computers per day on the Internet. The company reported reaching daily sales of $6 million several times during the December 1997 holiday period.

Another influential forecast was Forrester's 1998 graph showing B2B e-commerce revenues growing at 100% per year from 1998 to 2003, and B2C e-commerce growing at 68% per year over the same period.

---

[2] The source was a 1997 "White Paper" by Inkotomi, promoting their network caching technology. Inkotomi, in turn, quoted Mike O'Dell, chief scienties of UUNET, one of the largest Internet backbone providers.

[3] The Emerging Digital Economy, U.S. Department of Commerce, www.ecommerce.gov

A somewhat more conservative opinion was expressed by Lehman Brothers. In 1998, Lehman[4] forecast residential Internet demand to grow at 145-191% per annum in the period 1998-2002. Lehman expected business Internet demand to grow at 92-130% over the same period.

> In the short term, we see increasing penetration of Internet services in the home and office driving up demand.... IDC estimates that currently 35% of all businesses (over 50% when weighted by number of employees) and 20%-25% of homes (23 million homes) are connected to the Internet. Driving volume beyond these levels will come from (1) increased penetration to the 40% range for the homes and 80% for business by 2002, (2) the demand for higher bandwidth services that will allow faster response time and (3) increased usage. We have assumed that 10% of all homes will have T1 level (1.5 Mbps) Internet service by 2002 using either ADSL (asynchronous digital subscriber line) or cable modems, both of which have theoretical one-way capacity of 4.5 – 9 Mbps. Using the IDC and other forecasts we predict that the average speed of a business connection will increase from 167 Kbps today to over 500 Kbps by 2002.

Lehman estimated that the theoretical capacity of 1998 U.S. terrestrial fiber systems was 70 times the 1998 working capacity (the increase would come from lighting dark fiber and from increasing the number of wavelengths carried, along with bit rates per wavelength). Lehman observed that this capacity would be used if Internet users moved to higher speed access and more usage per day:

> In order to drive a 70 times increase in capacity, bandwidth demand must increase 53% per year for 10 years. In order to begin to fill the potential capacity, bandwidth needs per user, number of users and usage/month have to increase. If every phone line in the country were upgraded to a T1, then network capacity would have to increase just 24 times (at constant usage levels). Therefore, in order arrive at 70 times increases even higher speeds and greater usage is required......
>
> We also believe that electronic commerce will grow exponentially helping to drive demand for higher bandwidth for Internet and data services. PC industry pundits see the day when every person has electronic agents constantly in the network pulling down data to the PC that is customized to the individual user. In addition, there is potential for connecting virtually every appliance with a chip to the Internet to increase the usefulness of the appliance and communicate information to users and manufacturers.

Lehman went on to conclude that “capacity glut concerns are overblown” and that “new entrants, with low share and low cost position, we believe, have attackers advantages (i.e., they can outrun pricing pressures).”

Demand for the transatlantic link between the U.S. and Europe was also forecast to be mainly driven by Internet growth. Global Crossing executives forecast that demand on this route would rise from 10.5 Gbps to 233 Gbps in 2003, a factor of 22 in 5 years, implying an annual average growth rate of 86%. To put their forecast in perspective, Global Crossing executives liked to compare their “factor of 22 in five years” to the five-year factors implied by Internet growth forecasts from Forrester (factor of 100), WorldCom Chairman Bernie Ebbers (factor of 1000), and John Sidgmore of MCI (factor of 10,000). In one 1998 study, Internet traffic consultant Tom

---

[4] Garrahan, Bath, and Stricker, “Emerging Network Companies: Exploiting Industry Paradigm Shifts,” Lehman Brothers, October 27, 1998.

Soja reported that traffic under the Atlantic had recently been growing at 100% per quarter for two quarters.

Fiber Optic Technology

Early attempts to use optical fibers for communications foundered on the very high rate of attenuation. Then, in 1970, Corning Glass Works made a breakthrough enabling usable optical fibers. In the same year, AT&T's Bell Labs and the Ioffe Physical Institute in Leningrad discovered how to make room-temperature semiconductor lasers. By 1986, the major long-distance operators were replacing coaxial and microwave backbones with new fiber-backbones on continental telecommunications routes. In the U.S., all major cities were linked by optical fiber pathways carrying 0.4-2.0 Gbps per fiber. These networks relied on a complex system of regenerators and amplifiers. As light pulses traveled over long distances, they became less distinct, losing their shape. Each regenerator detected a light pulse and re-transmitted it, as it had originally been transmitted. A long fiber-optic cable typically had amplifiers every 80-120 km, and regenerators every 200-300 km.

The second key breakthrough occurred in 1986, when Bellcore demonstrated the first "wave division multiplexing" (WDM) network. In the demonstration system, each of 18 different colors of light carried 2 Gbps of information over the same strand of fiber, all at the same time. Thus, the one strand had a total data rate of 36 Gbps. With this innovation, the key economic bottleneck in fiber systems became the converting-repeaters.

The third key piece fell into place in 1987. David Payne at the University of Southampton, developed the first erbium-doped fiber amplifiers. His invention involved placing a small amount of the chemical erbium into otherwise pure optical fiber. When excited by a laser, the doped region acted as an amplifier, sending on stronger light pulses than were arriving. This innovation meant that simpler solid-state repeaters could be easily inserted into fiber optic cables, eliminating the need for the conversion of light pulses to electrical pulses for amplification.

To many observers, the combination of solid-state optical amplifiers and WDM set the stage for a "Moore's Law" type of continuing exponential improvement in fiber communications.

Exhibit 6a shows the rate of improvement in state-of-the-art installations of fiber communications systems. The reports from laboratories were well in advance of installations. In 1998, for example, laboratories were reporting terabit data rates on a single fiber. At 1 Tbps, a single fiber could carry all of the coast-to-coast long distance voice communication in the U.S.

As can be seen in Exhibit 6a, the arrival of WDM technology produced a significant acceleration in the data capacity of state-of-the-art (SOA) fiber systems. In 1998, the data rate for a single wavelength had been 2.5 Gbps (1 STM-16) for a number of years, but the newest systems were capable of 5 Gbps, and this was expected to increase to 10 Gbps in mid-2000. From there, engineers thought it might rise to 40 Gbps by 2003. This increase in data rates was driven by two underlying factors: the number of wavelengths carried on a single fiber, and the data rate possible on a wavelength. With regard to wavelength density, the number of wavelengths carried on a fiber had increased from 4 in 1995, to 8 in 1996, and 16 in 1997. Engineers expected that 1999 installations would be 32x2.5 (32 wavelengths each carrying 2.5 Gbps). Looking further ahead, technologists expected the year 2000 to bring 80x2.5 and 40x10 technologies. By 2001, 160x2.5 and 80x10 would be available, and by 2002 engineers hoped to deploy 160x10 and 40x40 technologies. By 2007, 160x40 might be achieved. Beyond that, it seemed that new breakthroughs would be required. Theorists believed that the ultimate capacity of a single fiber strand was in the area of 50-100 Tbps, but no one had a clear picture of how that would be achieved. Exhibit 6b shows Global Crossing's prediction for the future evolution of single-strand fiber data rates.

A key economic aspect of WDM was that it allowed older fiber to be upgraded by changing the head-end equipment and the regenerators. The costs of WDWM equipment varied with the number of wavelengths being carried and the data rate being handled per wavelength. Taking equipment handling 1x2.5 technology (1 wavelength at 2.5 Gbps) as having a cost index of 1.0, 40x2.5 technology had a cost of 8 and 80x10 technology had a cost of 22.

Optical Undersea Cable Systems

Undersea cable systems differed in a number of respects from terrestrial systems: (1) repair was more difficult, (2) repeaters could not easily be upgraded, (3) landing sites were costly, but rights of way under oceans were free, (4) the cost per mile of laying undersea cable was much lower than the cost per mile of installing terrestrial cable.

Undersea cables are built around pairs of fibers—one fiber carrying traffic in each direction. The first undersea fiber optic cable was the TAT-8, laid under the Atlantic in 1988, connecting New Jersey to England and France. The TAT-8 used regenerating repeaters; each repeater converted the optical signal to an electrical signal, amplified it, and converted it back into an optical signal for the next leg of the cable journey. An undersea repeater was a device 3-6 feet long, about 1 foot wide, weighing about 1000 lbs, and costing about $500,000 to $1 million. Undersea repeaters had several layers of redundancy built into them and required about 1 ampere of current to operate. Forcing 1 ampere through a 7500 kilometer cable required a 10,000 volt power supply on one end and a power conductor running the whole distance.

In 1996, the TAT-12/13 cable was laid, using all optical amplifiers. Each repeater performed direct optical amplification, without the need for signal conversion. The technology used was erbium-doped fiber amplification (EDFA). To compensate for the fact that no regeneration of the pulse was taking place, the optical amplifiers were placed closer together than converting amplifiers.

TAT-12/13 was the first fully backed-up "self-healing" loop. It took 2 fiber pairs, each pair with a capacity of 5 Gbps, from the U.S. to Europe, and then 2 more fiber pairs of equal capacity returning via a different route from Europe to the U.S. When it entered service in 1996, its 10 Gbps rated capacity[5] represented 60% of the total North Atlantic undersea cable capacity. The total project had cost the consortium about $750 million.

The length of a cable was the most significant driver of cost. A state of the art trans-Atlantic cable cost about $750 million, whereas a trans-Pacific cable cost on the order of $1.25 billion.

Historically, most of the telephone and data traffic carried under the Atlantic was on a series of cables named TAT-1 through TAT-12/13. These cables were built by con-

---

[5] A self-healing cable loop had at least two separate legs. Each leg carried traffic in both directions, each direction handled by a separate fiber strand. Traffic in one direction on each leg was kept at 50% of capacity or less so that the other leg could take over in case of an outage. Rated capacity, therefore, refers to one-half of the full capacity of one leg in one direction.

sortia of national teleco carriers (10 to 20 participating in each). The consortia members planned the TAT cables well in advance of need, shared construction costs, and divided up the capacity non-competitively. For example, capacity on TAT-12/13 was made available to consortium members in units of 155 Mbps, called an STM-1. The 10 Gbps cable had a total capacity of 65 STM-1s. Members paid $20 million for a 25-year IRU[6] for one STM-1 on this cable.

Consortia members were regulated in most countries as "common carriers," meaning that they were required to sell or lease capacity to other companies at rates close to full cost. The catch was that capacity on a trans-Atlantic cable was not of much use unless a company also had access to "back-haul" capacity to move the signals from the landing to cities and buildings. Such capacity was normally leased from national carriers in small increments. Prices were set at the carrier's "cost" plus a reasonable profit, with the cost being established by the consortium's internal resale price.

The developments in WDM technology allowed the consortium to double the capacity of TAT-12/13 by simply changing the equipment at the landing stations, so that the cable carried two wavelengths instead of one. This new equipment came on line in July 1998. Installation of a third wavelength was planned for July 1999.

PTAT was the first transatlantic cable not built by the "club" of national telcos working as a consortium. PTAT connected Manasquan NJ, Bermuda, Ireland, and England, and was built in 1990 by Cable & Wireless, Mercury and Sprint. It had a capacity of 420 Mbps.

The next non-consortium Atlantic undersea cable was the Gemini joint venture, owned by WorldCom and Cable & Wireless. Construction was by Alcatel Submarine Networks and Cable & Wireless Marine. The Gemini cable was a modern self-healing loop with a rated capacity of 30 Gbps on 2 fiber pairs. Gemini started service in late 1997, and more than doubled the undersea bandwidth connecting North America and Europe. Its construction costs were estimated to have been $600 million. The joint venture partners were each building terrestrial networks in direct competition with local telephone companies. Consequently, they had also invested in constructing "back-haul" capacity to tie the submarine cable to a number of major U.S. and European cities.

Suppliers

Cable was laid by specialized vessels. There were about 30 of these ships in the world. The largest could install thousands of kilometers of cable in a single operation and cost upwards of $100 million to build and launch. The deep holds in such ships were filled over a period of weeks and cable was laid at a speed of about 7 knots. Cable could be placed in depths up to 7000 meters. Closer to shorelines, cable had to be ploughed under to protect it from trawlers and anchors, forcing a reduction in speed to about ½ knot.

Cable ships used computers that were programmed to follow a specific route using GPS navigation. The routes were based on comprehensive topographical analysis and try to avoid undersea canyons, earthquake faults and fishing areas. The cable ships were huge and carried some of the heaviest winches in existence. They also deployed undersea plows to bury cable near shorelines, and robotic submarines to find

---

[6] An IRU was an indefeasible right of use, and had a lifetime of 25 years. The owner of the IRU had the rights to 1 STM-1 of capacity for 25 years. The owner was also obligated to pay annual maintenance fees.

and repair cable damage. Laying a transatlantic cable (one-way) took about 2-3 months.

The three major cable installation firms were also manufacturers of submarine cables. KDD Submarine Cable Systems, part of the Japanese KDD Group, was an important actor in the Pacific region. Alcatel Submarine Networks and Tyco Submarine Systems dominated the Atlantic region. Tyco (TSSL) had been spun-off from AT&T in 1997.

Cables were also manufactured by firms that did not participate in installation activities. Among these firms were Fujitsu, NEC, and Pirelli. Fiber was manufactured by Corning Glass, Lucent, Alcatel and Sumimoto. Marine maintenance and repair was dominated by Cable and Wireless Marine.

WDM equipment was developed and manufactured by a large number of companies. Nortel Networks led in this area with about 25 percent of the market. Also important were Lucent and Fujitsu, followed Tellabs, Alcatel, Cisco, NEC, Ciena, and Sycamore.

Global Crossing

After graduating from Long Island University with a business degree, Gary Winnick's first job was selling restaurant equipment. He soon left that job behind, joining Burnham & Company (a precursor to Drexel) on Wall Street as a trainee. After some divergence of opinion with his superior (Michael R. Milken), he left Drexel in 1985 to start his own venture and investment company: Pacific Asset Holdings. The company was later renamed The Pacific Capital Group.

Pacific bought RB Furniture and Ortho Mattress in 1988. Both firms were bankrupt within three years. Pacific did better with OpTel, Inc., a company providing satellite TV services to apartment buildings. Having invested $12 million, the firm was sold for $100 million to Le Group Videotron. Pacific Capital, along with Morgan Stanley, Goldman Sachs, and Union Labor Life Insurance bought Playa Vista, the site of Steven Spielberg's planned DreamWorks development in West Los Angeles. Unfortunately, environmental and political issues kept the development from fruition.

In 1997, Pacific Capital Group was directed by Gary Winnick, Abbot Brown, Barry Porter, and David Lee. The four had learned of a venture being planned by William Carter and Wallace Dawson, called "Atlantic Crossing." Carter had been with AT&T for 30 years, including having been CEO of AT&T Submarine Systems Inc, AT&T's submarine cable subsidiary (later spun-off to Tyco). Carter had championed the idea of a new wholly-AT&T Atlantic cable. Top management had, however rejected the idea. Carter, together with Dawson, who also had been a manager in the Submarine Systems Division, left AT&T to pursue this vision. In addition to the basic idea, they brought with them a turnkey contract with AT&T for the construction and maintenance (over 25 years) of the proposed cable project.

Carter and Dawson had talked to GE Capital about financing the project, but the Pacific Capital Group worked more quickly to put together a financing package for the venture. Once again, Union Labor Life Insurance played an important role and Winnick also turned to the Canadian Imperial Bank of Commerce, where former Drexel colleagues had senior positions. All told, $75 million in equity capital was raised ($17 million directly from Winnick and $3 million from his three partners at Pacific Capital). Senior notes for $150 million, $100 million in preferred stock, and a $410 million line of credit with a syndicate of banks completed the financing deal.

Global Crossing (then Global Telesystems) was formed to hold Atlantic Crossing, with Gary Winnick as its Chairman.

The first CEO of Global Crossing was Jack Scanlon, formerly president of Motorola's Cellular Networks and Space sector. Scanlon had 24 years of experience in telecommunications with AT&T and Bell Labs. William Carter, the original champion of Atlantic Crossing, took charge of network development at Global Crossing.

The AC-1

On March 20, 1997, Global Crossing announced its plans for the AC-1. This new Atlantic cable would connect Brookhaven NY to Whitesands Bay (western UK), continuing on to Sylt (Germany), and looping back to Brookhaven. Exhibit 7 shows the cable's route. The total route distance would be 8,886 miles (14,300 km). The cable carried 4 pairs of fiber, contained 258 repeaters, and was designed for a physical life of 25 years. Each fiber on AC-1 was rated to carry 10 Gbps—four wavelengths each carrying 2.5 Gbps. With four pairs in the cable, the maximum capacity was 40 Gbps.[7] AC-1 was designed to be a self-healing ring: it crossed the Atlantic twice, and each side of the loop was available to pick up the traffic on the other should there be a cut or other failure. Consequently, each side of the loop could only be loaded to one-half of rated capacity: thus, the two sides of the loop together had a rated capacity of 40 Gbps.

It was anticipated that the capacity could easily be doubled by the end of 1999 through WDM techniques, for a total rated capacity of 80 Gbps, yielding a planned sales capacity of 512 STM-1 circuits.[8]

The initial construction of AC-1 was budgeted at $667 million. With accrued interest, the capital cost of the project was $750 million. The upgrade to double its capacity was budgeted at $52 million. Membership in the Atlantic Cable Maintenance Agreement would cost about $30 million annually. Other expenses associated with the operation of the cable might add another $20 million to annual expenses.

Breaking down the $667 million cost of the AC-1, about $175 million was for the fiber cable itself, $225 million for the repeaters, $87 million for cable installation, $50 million for the landing stations (rights plus construction), $90 million for landing-station head-end electronics.

In looking to future cables, one undersea cable executive commented "A transatlantic cable seems to cost about $750 million—looking ahead, the capabilities grow, but the total cost of the project doesn't change that much."

Tyco Submarine System Ltd. (TSSL) was to provide Operations, Administration and Maintenance (OA&M) support on behalf of AC-1 for a term of eight years following the commencement of commercial operations. There were two sequential options for contract renewal with TSSL, each covering 8-1/2 years, so that the full 25-year life of the cable was potentially covered. As of December 31, 1997, Global Crossing was committed under the initial AC-1 OA&M Agreement to make payments totaling approximately $263 million.

---

[7] Capacity was rated in one direction. A fiber pair could actually carry up to 10 Gbps in both directions simultaneously.

[8] 80 Gbps/155.52 = 514.5. Selling 512 STM-1 circuits left 2.5 for systems management and spot rental.

On May 26, 1998, AC-1 began carrying voice and data communications, increasing the total capacity in service under the Atlantic Ocean by 65% (see Exhibit 10). Early on, the cable had problems: shunt faults were reported by the repeaters, the undersea sand banks around the Whitesands landing site kept shifting and exposing the cable to trawlers. But these early teething problems were solved and the demand for capacity grew rapidly. By September, 1998, demand for capacity across the Atlantic had already exceeded internal forecasts, triggering an acceleration of the planned upgrade from 40 Gbps to 80 Gbps.

"The demand for bandwidth across the Atlantic is being driven by the European growth of the Internet, multinational Intranets and e-commerce," said Global Crossing's CEO Jack Scanlon, in late 1998. "By accelerating the AC-1's capacity upgrade by 18 months, we are confident that we will be able to meet this increased level of demand," Scanlon added.

Strategy and Pricing

Unlike previous trans-Atlantic cables, the AC-1 was available to "anyone." Of course, telcos would remain the primary customers for bulk capacity. To remain consistent with the ideal of being a "carrier's carrier," the decision was made to sell capacity in large chunks: 25-year IRU to STM-1s. These IRU sales were called Capacity Purchase Agreements (CPAs). Upon execution of a CPA, the seller received a downpayment (normally 10% of the purchase price). The full balance remaining was due on the RFS (ready-for-service) date for the segment. Each purchaser of a CPA also signed an OA&M (maintenance) agreement, committing to either pay a fixed a fixed share of total maintenance costs, with a cap on the amount.

There was little history to work with in pricing trans-Atlantic bandwidth. One simple fact was that the TAT-12/13 internal consortium price was about $20 million for a 25-year IRU for an STM-1. The last STM-1 circuit sold prior to Global Crossing's appearance on the market was on the Gemini cable—it was priced at $18 million. It was rumored in the industry that Gemini's going-forward price would be $12 million per STM-1 on additional capacity sales.

There were no lease contracts for trans-Atlantic STM-1s. However, some capacity owners had offered leases for smaller chunks of capacity—E-1s and E-3s. In 1998, a transatlantic E-3 could be leased from a Gemini capacity holder for one year for $1-2 million (1 STM-1 yielded 4.5 E-3s). The relationship between E-3 and E-1 lease rates showed a distinct bundling discount: although an E-3 had 22 times the capacity of an E-1, lease rates for E-3s were typically 3-5 times rates for an E-1.

Global Crossing's initial schedule set a price of $8 million for the first STM-1 purchased, with lower prices on each additional unit, down to a minimum of $5 million. Some sales included options to buy capacity in the future. The low price created intense market interest. Maintenance contracts were priced at share of maintenance plus 10%, or $250,000, whichever was lower, annually. Looking forward, Global Crossing's management knew that prices for capacity would drop in the future. Their internal plans reflected an expected decline of 25% per year.

Between October 1997 and May 1998, Global Crossing signed contracts with about 20 carriers (including Deutsche Telekom, Teleglobe, Swisscom, PTT Telecom BV, Telia AB) for an amount slightly over $400 million (receiving deposits of $15.1 million).

Initial Public Offering

In mid-1998, new telecom carriers were hailed as being an integral part of the "new economy." Companies such as WorldCom, Metromedia Fiber Network, Qwest and

Telegent were positioned as “attack” companies. They were widely seen as having radically new business models, quick execution, low prices, and cutting-edge technology. For example, a Morgan Stanley Dean Witter reported stated: [9]

> We believe natural selection will not only weed out the slow moving dinosaurs of the telecom industry—those that are still munching on the succulent leaves of 45% EBITDA margins, unaware that the velociraptors of the industry are devouring them—but will also create an almost limitless range of species and sub-species . . .

An additional aspect of the business environment was a large appetite for stock in new-wave telecom firms, especially Initial Public Offerings (IPOs). In 1997, there were 27 emerging telecom equity IPOs which raised over $3.6 billion; Qwest alone counted for $300 million.

Global Crossing chose to work with Salomon Smith Barney for its IPO, dealing directly with its “kingmaker” analyst/banker, Jack Grubman.

During the period leading up to the IPO, progress was rapid. By April 21, Global Crossing had signed $400 million in capacity purchase agreements (CPAs). By June 30, total CPAs on AC-1 were $550 million, representing 19% of total rated capacity. At the same time, management firmed up its plans for further undersea cable projects. By the time of the IPO it had signed construction and/or initial debt arrangements for three additional cables: Mid-Atlantic Crossing (MAC), Pan-American Crossing (PAC), and Pacific Crossing (PC-1). MAC would connect Brookhaven with Florida and the U.S. Virgin Islands in the Caribbean. PAC would connect Grover Beach (California), Mexico, Panama, and Venezuela, eventually linking to MAC. PC-1 would connect Grover Beach to Japan, with a return loop to Harbor Pointe, Oregon. Exhibit 10 shows the expected cost and capacities of these cable projects.

On August 14, 1998, Global Crossing completed its initial public offering of common stock to the public at $19 per share, raising $399 million. The stock closed that day at $25.5 per share, implying a total market capitalization of $5.15 billion.

By December 31, 1998, aggregate CPAs for the AC-1 had reached $950 million, representing 35 percent of its capacity of 512 STM-1s. The financial results for the twelve months ending on that date are shown in Exhibits 13a and 13b. Global Crossing’s annual report for 1998 featured a glowing essay by telecommunications-Guru George Gilder, stating that Global Crossing was a juggernaut riding the bandwidth explosion to a position of dominance in the new “worldwide web of glass and light.” [Exhibit 11]. The stock price of $45.75 implied an enterprise equity value of $18 billion.

Backhaul

Although Global Crossing’s initial intention was to be an undersea carrier, the problem of backhaul kept management involved in terrestrial network issues. “Backhaul” was a term used to describe the connections between a cable landing site and a national network. As a prime example, the busiest transatlantic traffic route was between New York City and London. AC-1, however, did not directly link these cities. It connected a shoreline spot in New York State to a beach in the western tip of England. Backhaul capacity from Whitesands to London, purchased from British Telecom or NTL, might cost a customer an additional $2.25 million.[10] And in the U.S., back-

---

[9] *The Competitive Edge*, February 5, 1998.

[10] This included Global Crossing’s margin of 10-20%.

haul from Brookhaven to New York City, purchased from suppliers like LightPath or Cablevision, might add another $500,000 to the customer's cost. This meant that on the NYC-London route, 30% or more of the customer's costs were backhaul.

Global Crossing's technical staff estimated that the backhaul from Whitesands to London should cost about $500,000 per STM-1 to build from scratch. Management, therefore, believed that both the company and its customers were being "held-up" by backhaul suppliers, particularly in Europe. To deal with this issue, Global Crossing began to see a need to own terrestrial network. The first step in this direction was the agreement with Unisource. The second was taken early in the spring of 1998: Global Crossing swapped four STM-1s on the AC-1 in exchange for capacity commitments on Qwest's terrestrial Metro Capacity Fiber Network. Qwest's planned domestic 16,285 mile fiber network would serve 125 U.S. cities.

In October, 1998, Global Crossing announced the development of Pan European Crossing, a fiber optic network that would link 18 European cities[11] with the U.S., and through its undersea cables, cities in Asia and South America.

Competition

Planning for AC-2 began in 1999. In addition to Level 3, other firms had made plans and commitments to capacity on the trans-Atlantic run. The Columbus-III (consortium of European telcos together with WorldCom) connected Florida to Spain and Sicily with a capacity of 40 Gbps. It was scheduled to activate by December, 1999.

Yellow was a project jointly financed by Global Crossing and Level 3 Communications. The new cable would connect Brookhaven, NJ, with Whitesands, England, the same points connected by the initial leg of AC-1. However, Yellow would follow a different ocean route, had a higher design capacity, and would work with AC-1 on self-healing. Yellow would contain 8 pairs, had a designed capacity of 1,280 Gbps, with an initial starting capacity of 80 Gbps. Global Crossing would own one-half of the cable; the other half of the cable would be owned by Level 3 Communications, which was also taking the lead in its construction. Global Crossing's half was called AC-2, and was scheduled to start operations in late 2000.

Due to enter service by the end of 2000, TAT-14 was the most recent cable from the standard consortium. Four fiber pairs, 16 wavelengths, and a bandwidth per wavelength of 10 Gbps would give a total capacity of 640 Gbps. The self-healing loop connection would be between NJ, UK, France, Netherlands, Denmark, and Germany. Total cost was estimated at $1.5 billion.

FLAG was a privately funded cable project, intended to go "around the world." Its first stages connected Europe to the Middle East. The FLAG Atlantic leg (FA-1) was scheduled to be completed by early 2001, and would have a capacity of 2,400 Gbps. Project Oxygen was more uncertain. Led by New Jersey entrepreneur Neil Tagare, Oxygen was to cost $10 billion and to link the world with 186,000 km of fiber cable. Its plans for the transatlantic route were a 2,560 Gbps cable. Rumblings from other potential competitors were also in the air.

---

[11] Paris, Brussels, Antwerp, Rotterdam, Amsterdam, Hamburg, Hanover, Dusseldorf, Cologne, Frankfurt, Strasbourg, Zurich, Lyon, Marseilles, Turin, Milan, Copenhagen, and London.

Exhibit 1

GLOBAL CROSSING

Metric Prefixes for Multiples

(Defined by the International Standards Organization)

Prefix	Power of 10	Non-Metric Common Name	Number
kilo-	3	thousands	1,000
mega-	6	millions	1,000,000
giga-	9	billions	1,000,000,000
tera-	12	trillions	1,000,000,000,000
peta-	15	quadrillions	1,000,000,000,000,000
exa-	18	quintillions	1,000,000,000,000,000,000
zetta-	21	sextillions	1,000,000,000,000,000,000,000
yotta-	24	septillions	1,000,000,000,000,000,000,000,000

Metric Prefixes for Fractions and Small Lengths

Prefix	Power of 10	Name of Length	Symbol	Unit Sized Object
centi-	-2	centimeter	Cm	|------|
milli-	-3	millimeter, mil	Mm	Printed period
micro-	-6	micron	Micron, μm	Bacterium
nano-	-9	nanometer	nm	Large carbon molecule 1nm = 10 angstroms (Å)
pico-	-12	picometer	pm	Large atom
femto-	-15	femtometer		Elementary particle (nucleon)

Exhibit 2

GLOBAL CROSSING

The Electromagnetic Spectrum By Powers of 10

Band	Example Use	Wavelength	Frequency
Very Low Frequency	Underwater communication with submarines	10-100 km	3-30 Khz
Low Frequency	Old ship radio	1-10 km	30-300 Khz
Medium Wave	AM radio	100-1000 m	300-3000 Mhz
High Frequency	Short-wave radio	10-100m	3-30 Mhz
Very High Frequency (VHF)	Television	1-10 m	30-300 Mhz
Ultra-High Frequency (UHF)	TV, Mobilephones, microwave ovens, radar	10-100 cm	300-3000 Ghz
Super-High Frequency (SHF)	Satellites, radar	1-10 cm	3-30 Ghz
Extreme High Frequency (EHF)	Satellite – up to 100 Ghz	1 mm – 1 cm	30-300 Ghz
Far Infrared	Radiative heat	10 microns – 1 mm	300 Ghz – 30 Thz
Near Infrared	Fiber Optics	1000-10 microns	30-300 Thz
Light	Vision	100-1000 nm	300-3000 Thz
Ultra-Violet Light	Sunburn	10-100 nm	3-30 Phz
X-rays	Medical	1-10 nm	30-300 Phz
Gamma rays, particles	Radioactivity, particles	< 1 nm	> 300 Phz

Visible light actually extends from the deep red (770 nm) to the violet (390 nm). There were three "windows" of wavelengths commonly used in fiber optic communications systems. These were 800-850 nm, 1275-1325 nm, and 1500-1550 nm, all in the infrared: close to, but outside the range of human vision.

Exhibit 3

GLOBAL CROSSING

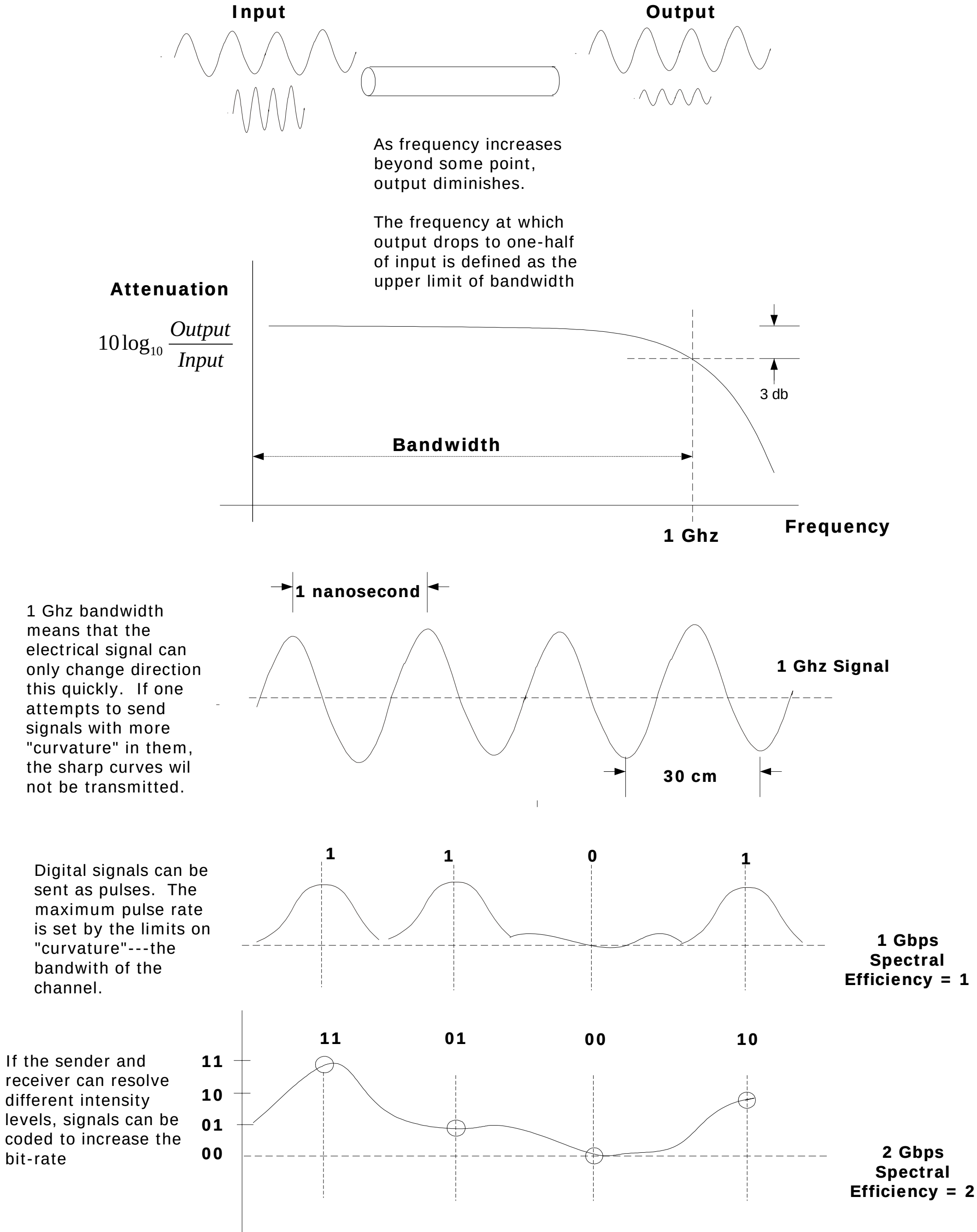
Telecommunications Industry Measures of Data Rate

Channel Technology	Data Rate (Mbps)	Number of Voice Circuits
U.S. Telephone System Standards		
DS-0	0.064	1
T-1 (DS-1)	1.554	24
T-2 (DS-2)	6.312	96
T-3 (DS-3)	44.736	672
T-4 (DS-4)	274.176	4,032
European Telephone System Standards		
E-1	2.048	30
E-2	8.448	120
E-3	34.368	480
E-4	139.264	1,920
E-5	565.148	7,680
Optical Fiber System Standards		
OC-1 (STS-1)	51.84	672
OC-3 (STM-1)	155.52	2,016
OC-12 (STM-4)	622.08	8,064
OC-24	1,244.16	16,128
OC-48 (STM-16)	2,488.32	32,256
OC-192 (STM-64)	9,953.28	129,024

Exhibit 4

GLOBAL CROSSING

One Page Summary of Communications Theory



The digital capacity of a channel depends upon its frequency bandwidth and the sophistication of the encoding that can be performed. Coding is limited by the amount of noise on the channel and in the transmitter and receiving equipment.

Exhibit 5

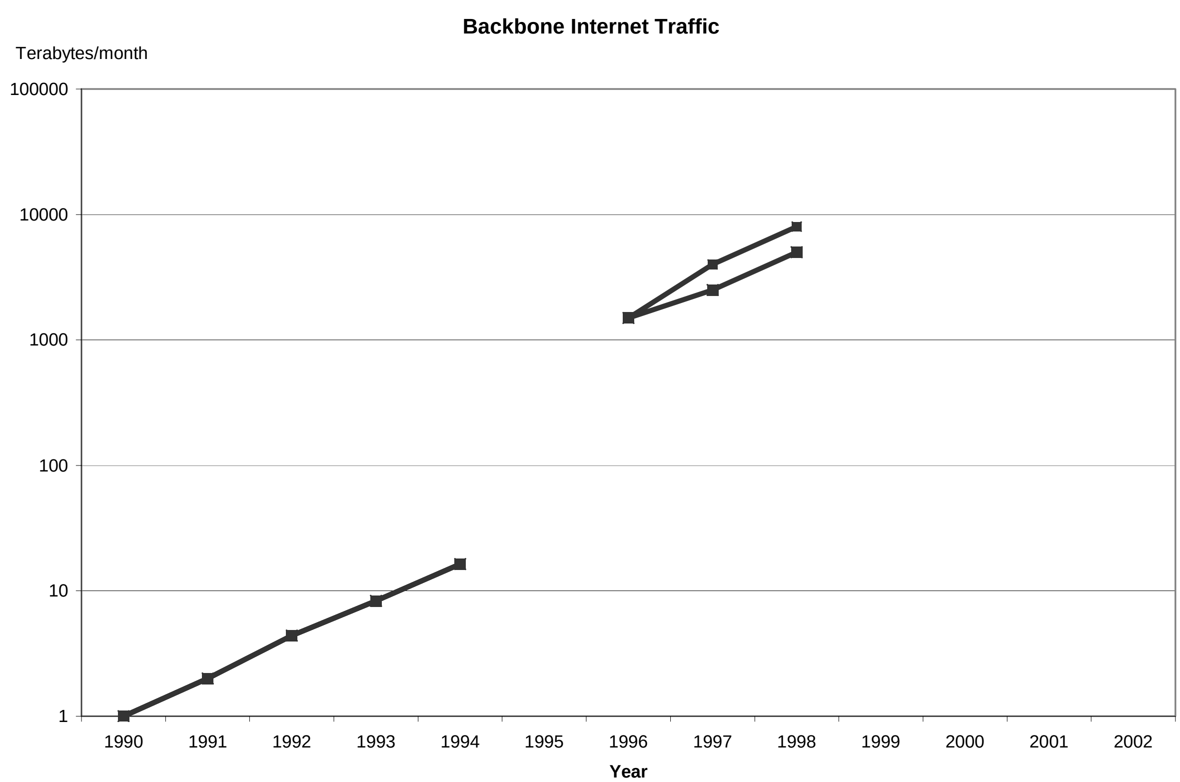
GLOBAL CROSSING

Growth in Internet Traffic: Backbone Traffic

Year	Terabytes/month
1990	1.0
1991	2.0
1992	4.4
1993	8.3
1994	16.3
1995	?
1996	1,500
1997	2,500 – 4,000
1998	5,000 – 8,000

Exhibit 5b

GLOBAL CROSSING



Source: Coffman and Odlyzko, "Internet Growth: Is There a Moore's Law" for Data Traffic, AT&T Labs Working Paper, 2001.

Exhibit 6a

GLOBAL CROSSING

Advances in Fiber Transport Capacity

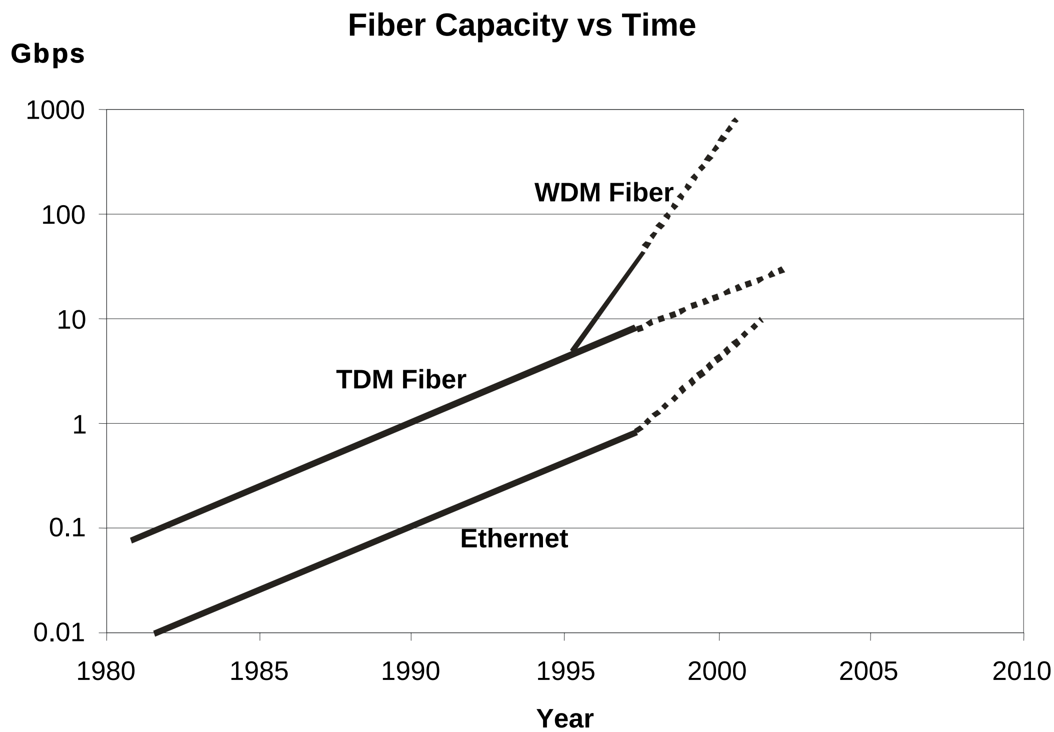


Exhibit 6b

GLOBAL CROSSING

Advances in Data Rates per Fiber Optic Pair

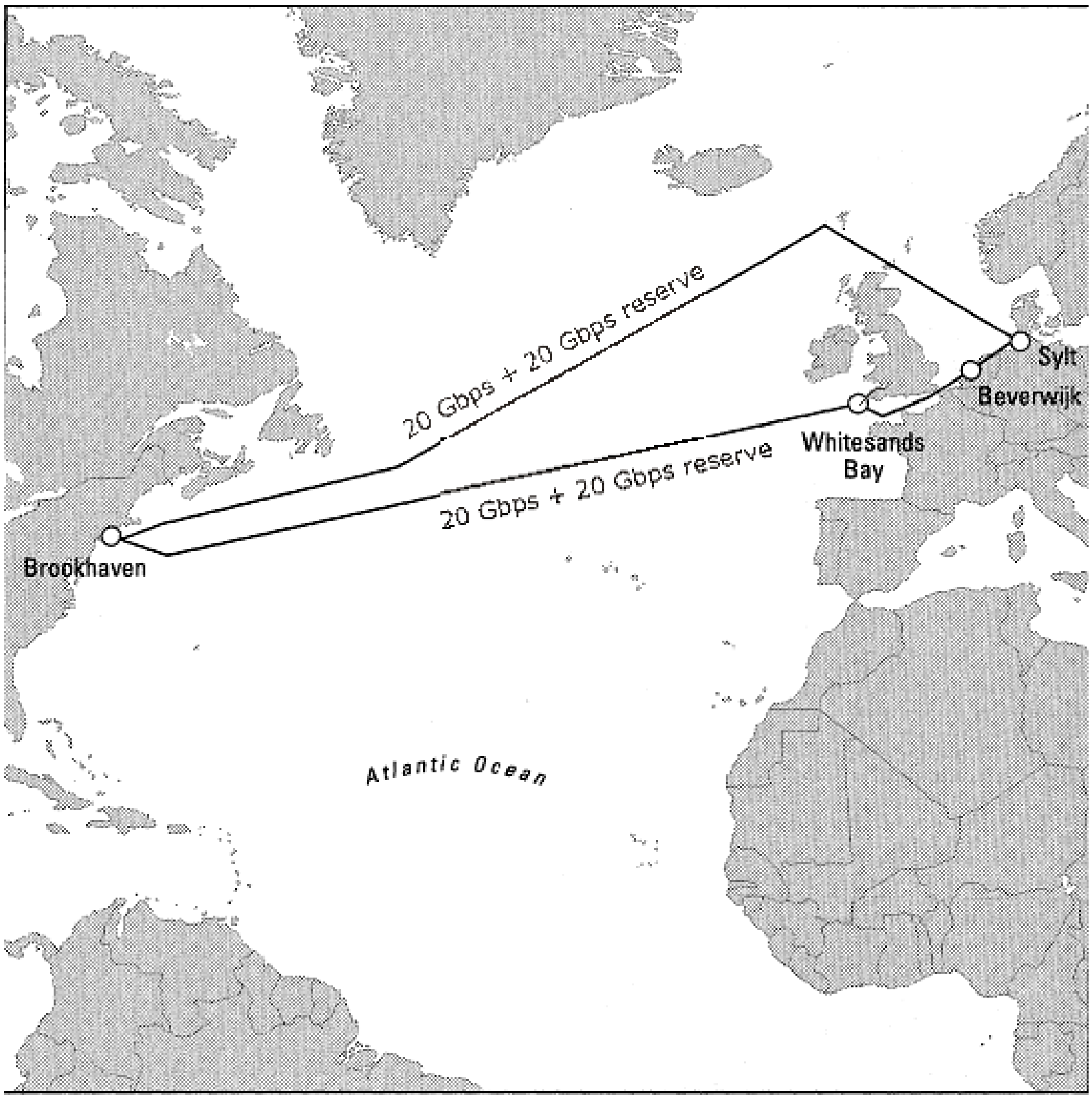
Year	Bit Rate Gbps
1988	0.28
1990	0.42
1992	0.56
1994	2.5
1996	10
1998	40
2000	160

Source: Global Crossing Annual Report, 1998

Exhibit 7

GLOBAL Crossing

The AC-1 Project



The AC-1 consisted of two separate legs, each with a capacity of 40 Gbps in each direction, giving a total of 160 Gbps in total capacity on both legs in both directions. However, rated capacity of the system (both legs) was 40 Gbps because cable capacity was stated in one-direction only and because each leg was kept below 50% capacity so it could take over the traffic from the other leg in case of an outage (self-healing action).

Exhibit 8

GLOBAL CROSSING

Planned Network as of December 31, 1998

Cable	RFS† Year	Cost $M	Capacity Gbps	Fiber Pairs
AC-1	1998	750	80	4
AC-2	2001	750	1280	8
PC-1	2000	1200	160	4
MAC	2000	330	40	2
PAC	2001	495	40	2
SAC	2000	1130	80	4
Backhaul*	1999	1040		
Total		5695		

†RFS is the date the cable was to be Ready For Service

*Backhaul capacity refers to terrestrial networks connecting undersea cables with cities in the United States and Europe.

Source: Global Crossing 1998 10-K

Exhibit 9

GLOBAL CROSSING

Projected Undersea Cable Traffic

	Traffic in Gbps		
Year	All Undersea Voice	Transatlantic Data	All Undersea Data
1997	10		6
1998	11	10.5	13
1999	12	30	41
2000	13	48.8	75
2001	15	68.4	292
2002	18	128.6	518
2003	20	232.7	992
2004	23	?	1754
2005	27	?	3241

Source: Global Crossing Annual Report, 1998 and Company presentations

Exhibit 10

GLOBAL CROSSING

Expected Data Capacity on the Transatlantic route.

Cable	RFS	Construction Cost $M	Capacity (Gbps) 1998	1999	2000	2001	2002
Operating Systems							
TAT-8	1988	360	0.56	0.56	0.56	0.56	0.56
PTAT	1989	510	1.68	1.68	1.68	1.68	1.68
TAT-9	1991	406	1.68	1.68	1.68	1.68	1.68
TAT-10	1992	300	1.68	1.68	1.68	1.68	1.68
TAT-11	1993	280	1.68	1.68	1.68	1.68	1.68
CANTAT-3	1994	302	5	5	5	5	5
TAT-12/13	Feb-96	750	10	10	10	10	10
Gemini	Feb-98	500	30	60	60	60	60
Columbus 3	Dec-99	240		40	40	40	40
AC-1	May-98	750	40	80	80	80	80
Future systems							
TAT-14	mid-2001	1500			640	640	640
AC-2	late-2000	800				2560	2560
Flag	mid-2001	1200?					2400

Source: Global Crossing

Exhibit 11

GLOBAL CROSSING

Excerpt from Global Crossing 1998 Annual Report to Shareholders

George Gilder, perhaps the most respected commentator writing about the telecommunications revolution, believes Global Crossing plays a pivotal role in that change. We have excerpted the following text from an essay by Mr. Gilder that appeared late in 1998 in the influential Gilder Technology Report.

Peter Drucker has said that the largest profits go to the company that provides the crucial missing element that completes a system. The crucial missing elements in the global Internet are last-mile bandwidth and undersea fiber. The crucial undersea bandwidth will be supplied by Global Crossing.

Bandwidth Explosion

A pure Telecosm play, Global Crossing artfully exploits the defining abundance of the era—the bandwidth explosion of wavelength division multiplexing (WDM) over fiber optic thread - to bypass fragmented national networks with their overloaded switches and optoelectronic converters and their multi-layered tariffs. Tying together a global fiber network among the world's largest cities, it transcends the technical muddle of hybrid networks and the regulatory briar patch of national telopolies and consortia. Using a centralized operations and maintenance support system, it will offer an integrated global network, with one-stop sales and service, connecting Europe, the U.S., Asia, and Latin America. Rather than leaving its customers stranded on the beach to make deals with local telcos, Global Crossing will complement its undersea facilities with terrestrial ramps directly into more than 100 major urban areas. With connections through Panama, Global Crossing will be able to link London to Tokyo without offloading the traffic to any outside carriers or toll taker. Rather than requiring an ISP (Internet Service Provider), for example, to contract with a phone company in London to reach a trans-Atlantic cable and then contract with a telco in the U.S. to cross the American continent, before contracting with yet another carrier or two to connect to the party in Tokyo, Global Crossing's customers will have a one- stop shop. They will even be able to shift bandwidth from one to another span of the Global Crossing Network.

A Four Millionfold Advance

According to GTG analysis (based on the total capacity in bits of the entire network if filled to the brim with bits), terrestrial fiber bandwidth has risen some 2,000-fold since 1990. Turbocharged by WDM, current plans suggest another 2000 times rise over the next three years. This means a four millionfold advance between 1990 and 2001 during a period when Internet traffic overall will have also risen several millionfold (from 1990s hundreds of gigabytes per month to hundreds of petabytes per month). These are admittedly raw estimates—give or take a hundred petabytes—but they convey the general picture. Meanwhile, undersea capacity increased some 42-fold since 1990 and will rise another 82 times over the next three years. That's a total of 3,444 times. That means that between 1990 and 2001, terrestrial capacity will have increased by a thousand times more than undersea capacity. Between 1998 and 2001, existing plans suggest that terrestrial capacity will rise 25 times more than undersea capacity will. Assuming that global Internet traffic will prove to be growing at less than the million fold every six years projected by UUNet, the expansion will still be huge. While current growth comes chiefly through the spread of dialup 28.8 modems, the next wave will feed on the power of cable modems and digital subscriber line links, most of them always on, running between 500 and 1,000 times faster. Not only will this technology increase the flow of bits, it will also sharply reduce the hassles and frustration of the World Wide Wait, thus greatly spurring demand. . . . .

I have to tell you that I have a personal interest in this company. For the last ten years, I have been looking for projects of a scale and inspiration that could change the shape of an industry, or even an economy. I didn't find any - until now.

A Worldwide Web of Glass and Light

Just as MCI pioneered single mode fiber in the U.S., TCI transformed cable, and McCaw launched a national wireless system, Global Crossing will pioneer the first integrated global fiber optic network, fulfilling the prediction in Microcosm (1989) of a "worldwide web of glass and light." Like MCI, TCI, and McCaw—it will change its industry, and the world economy as well.

Exhibit 13a

GLOBAL CROSSING

Income Statement, 12/31/1998

	$(000)	Percent
REVENUES	424,099	100
EXPENSES		
Cost of Capacity Sold	178,492	42.1%
OA&M	18,056	4.3%
Sales & marketing	26,194	6.2%
Network development	10,962	2.6%
General & admin.	26,844	6.3%
Stock related expense	39,374	9.3%
Prov. For doubtful accts.	4,233	1.0%
Termination of Advisory		
Services Agreement	139,669	32.9%
TOTAL	443,824	104.7%
OPERATING LOSS	(19,725)	-4.7%
EQUITY IN LOSS OF AFFILIATES	(2,508)	-0.6%
INTEREST INCOME (Expense)		
Income	29,986	7.1%
Expense	42,880	10.1%
LOSS BEFORE INCOME TAXES	(35,127)	-8.3%
Provision for taxes	(33,067)	-7.8%
LOSS BEFORE EXTRAORDINARY ITEMS	(68,194)	-16.1%
Extraordinary loss on retirement		
of senior notes	(19,709)	-4.6%
NET LOSS	(87,903)	-20.7%
Pfd stock dividents	(12,681)	-3.0%
Pfd stock redemptions	(34,140)	-8.1%
NET LOSS TO COMMON STOCK	(134,724)	-31.8%
Per Share	(0)	
Shares outstanding	358,735,340	

Exhibit 13b

GLOBAL CROSSING

Balance Sheet, 12/31/1998

ASSETS	$(000)
Current Assets	
Cash	806,593
Restricted Cash	77,190
Accounts receivable	71,195
Other assets	47,137
Total Current Assets	1,002,115
Restricted cash and cash equiva	367,600
Accounts receivable	43,315
Capacity available for sale	574,849
Construction progress	428,207
Deferred finance and org. costs	45,757
Investment in affiliates	177,334
Total Assets	2,639,117

LIABILITIES	$(000)
Current liabilities	
Construction costs	129,081
Accounts payable	31,990
Accrued interest	10,053
Deferred revenue	44,197
Income taxes payable	15,604
Current portion of LTD	6,393
Current portion under inland services agreements and capital leases	14,572
Total current liabilities	251,890
Long term debt	269,598
Senior notes	796,495
Deferred revenue	25,325
Obligations under inland services agreements and capital leases	24,520
Deferred income taxes	9,654
Total Liabilities	1,377,482
EQUITY	
Preferred stock	487,375
Common stock	862,383
Accumulated deficit	(88,063)
Total equity	774,320
Total liabilities & equity	2,639,117

Exhibit 13, Continued

Notes

1. Revenues from the sale of capacity are recognized in the period that the rights and obligations of ownership transfer to the purchaser, which occurs when (i) the purchaser obtains the right to use the capacity, which can only be suspended if the purchaser fails to pay the full purchase price or fulfill its contractual obligations, (ii) the purchaser is obligated to pay Operations, Administration and Maintenance ("OA&M") costs and (iii) the segment of a System related to the capacity purchased is available for service. Customers who have entered into CPAs for capacity have paid deposits toward the purchase price and such amounts have been included as deferred revenue in the accompanying consolidated balance sheets.
2. Cost of undersea sales in any period is calculated based on the ratio of capacity revenues recognized in the period to total expected capacity revenues over the life of the System multiplied by the total costs incurred to construct the System. This calculation of cost of sales matches costs with the value of each sale relative to total expected revenues.
3. Customers pay for 110% of ACL's cost to operate and maintain AC-1 based on their pro-rata share of total capacity subject to annual maximum amounts per circuit purchased of $250,000 per transatlantic circuit and $50,000 per European circuit. Their pro-rata share is effectively calculated by taking the weighted average of purchased capacity over total capacity multiplied by 110% of actual costs incurred.
4. ACL entered into the ASA with PCG Telecom, an affiliate of PCG which is a shareholder of GCL. Under the ASA, PCG Telecom provided ACL with advice in respect of the development and maintenance of AC-1, development and implementation of marketing and pricing strategies and the preparation of business plans and budgets. As compensation for its advisory services, PCG Telecom received a 2% fee on the gross revenues of the Company over a 25 year term, subject to certain restrictions, with the first such payment to occur at the AC-1 RFS date. Advances on fees payable under the ASA were being paid to PCG Telecom at a rate of 1% on signed CPAs until the ASA was terminated. Fees paid under the ASA to PCG Telecom were shared amongst Union Labor Life Insurance Company ("ULLICO"), PCG, CIBC, and Messrs. Winnick, Cook, Brown, Lee and Porter, all of whom are shareholders of GCL. Effective June 1998, GCL acquired the rights under the ASA for common stock and contributed such rights to the Company as the ASA was terminated. This transaction was recorded in the consolidated financial statements as an increase in additional paid-in capital of $135 million and a charge against operations in the amount of $138 million.