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Cosmic Crossing: 1998's Best Opportunity

The largest profits go to the company that provides the crucial missing element that completes a system.

Sometimes the richest opportunities sneak up on you, hidden by dark headlines, masked by masses of competitors, clouded by ugly prejudices, cloaked in technical exotica, and concealed by turbulent seas. Before you can strike, they slither away to Institutional heaven, with prospective earnings discounted until 2010 and analysts touting them as "strong buys" on the basis of their prospects on the moon. "Cosmic Crossing" may seem to be such a long gone opportunity.

Better known as **Global Crossing** (GBLX), this company attained its new name for the benefit of subscribers to GTR, to convey the special enthusiasm your servant reserves for this venture. In other words, this is no **Applix** (APLX) or **P-Com** (PCMS). GBLX did slump on the market for a couple months after its IPO in August. But it is now up 50 percent and might seem beyond easy reach of the Buffett-minded among us. After all it commands a market cap of some \$6 billion and, to fiscally sensitive readers, there will seem to be red flags all over the field and an X-rated balance sheet.

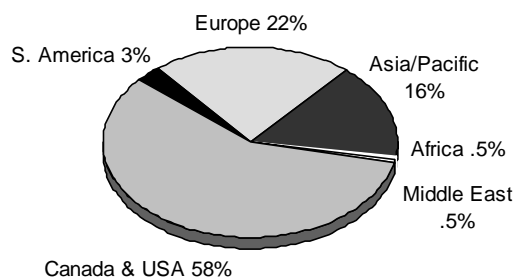
For example, it is led by Gary Winnick, Mike Milken's former right hand man on the X-shaped table in Beverly Hills (Winnick conceived the X so everyone could be near Mike). It carries \$1 billion 185 million in various forms of high yield debt and suffers from the prejudice against junk bonds and other underwater finance. Competing with some twenty-five teradollar telopolies in the undersea fiber business, it may seem overmatched and overvalued. We have mentioned it in two reports, but foolishly neglected to make room for it on the Telecom Table. This report will try to make up for lost time. (Hey, we know that's impossible).

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. Last mile bandwidth is being offered by cable modems based on technology from such companies as **Broadcom** (BRM) and by new wireless technologies, such as **Qualcomm's** (QCOM) megabit modems, to be embedded in their new pdQ cellular phones for next year. You can read about these marvels in earlier issues of GTR. The crucial undersea bandwidth will be supplied by Global Crossing.

Global Crossing began laying cable from London to New York in late 1997 and switched on the system in May 1998. It will deploy service to South America and Asia by early 2000. It will complement these undersea lines with the largest terrestrial European network and links to major US cities provided by **Qwest** (QWST) and others. Global Crossing owns

Chart 1
Worldwide Internet Users
148 Million



Source: NUA Internet Surveys

The crucial missing elements in the global Internet are last mile bandwidth and under-sea fiber.

all its current undersea capacity and will own 58 percent of Pacific Crossing, with the rest held by **Marubeni**, which will supply cheap landline links to Osaka, Nagoya, and Tokyo.

A pure Telecom play, GBLX 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 briarpatch 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 US, 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 50 major urban areas.

With connections through Panama, Global Crossing will be able to link London to Tokyo without offloading the traffic to any outside carrier or toll taker. Rather than requiring an ISP (Internet Service Provider), for example, to contract with a phone company in London to reach a cross Atlantic cable and then contract with a telco in the US 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 GBLX network.

The system consists of the already opened Atlantic Crossing, a 14 thousand kilometer ring running from New York to London, Amsterdam, Hamburg and Frankfurt, and other “crossings” around the globe. The Mid Atlantic Crossing runs from New York, through Bermuda and St. Croix, to Miami and Panama. In Panama, this Caribbean facility links with the Pan American Crossing, which loops through Mazatlán and Tijuana on the west coast of Mexico to Grover Beach, California, and hence to Los Angeles and Seattle. The west coast cities in the US link to Pacific Crossing, a 21 thousand kilometer loop which connects with two Japanese cities and other Asian destinations. Over all, the company plans an integrated global network of some 50 thousand kilometers built with

state-of-the-art undersea technology.

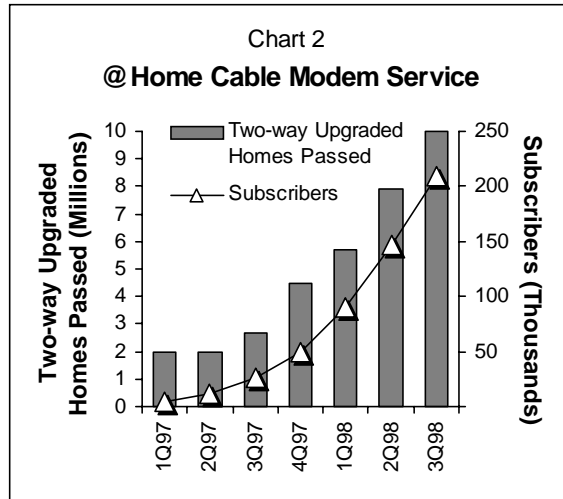
According to GTG analysis (based on the total capacity in bits of the entire network if filled to the brim with bits), terrestrial fiber bandwidth has risen some 2,000 fold since 1990. Turbocharged by WDM, current plans suggest another 2000 times rise over the next three years. This means a four millionfold 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 millionfold 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 frustrations of the World Wide Wait, thus greatly spurring demand.

In this environment, what of the 82 fold growth planned for undersea capacity? In the relatively torpid telecom world, 82 times in three years might portend a bandwidth glut. Perhaps the Internet is chiefly a national network after all. Perhaps French executives were right last year when they told me that the French see it as “an American fad.” There is possibly a limit even to the desire of US college students to ogle glossy pictures of Laetitia Casta. In any case, if necessary, emergency one way Laetitia transmissions can be broadcast from France by satellites and stored in RAID disk drives at US ISPs.

The law of locality ordains that network traffic is at least 80 percent local, 95 percent or more continental, and only five percent intercontinental. Yet the underseas bandwidth is currently under one percent of terrestrial bandwidth and is increasing only four percent as fast. This might make sense if



the web were destined to remain chiefly an American phenomenon. But the Internet is a planetary utility in a world economy that is increasingly woven together.

Reporting from October's ISPCON, the global confab of Internet Service Providers, even Jack Rickard of *Boardwatch* was startled by the rate of overseas growth. **SBC International**, an ISP from China, claimed 12 million customers in the Beijing area; a Korean ISP reported 1.2 million customers around Seoul. Together Brazil and Japan have nearly as many ISPs as the US does. With some 5,000, the US now represents well under one third of the world's 17,000 ISPs. As of September, 41 percent of the world's 148 million Internet users were outside North America and readily reachable only through undersea routes. Over the last 18 months, the North American share of worldwide Internet users dropped from over 80 percent to 58 percent.

With growth in the number of foreign Internet users rapidly outpacing US growth, undersea traffic will grow several times faster than terrestrial traffic. Take my word for it. Over the next five years, the submarine portions of the Internet will prove to be an agonizing choke point. Thus Global Crossing has a truly cosmic position as the supplier of the missing element that completes the global system.

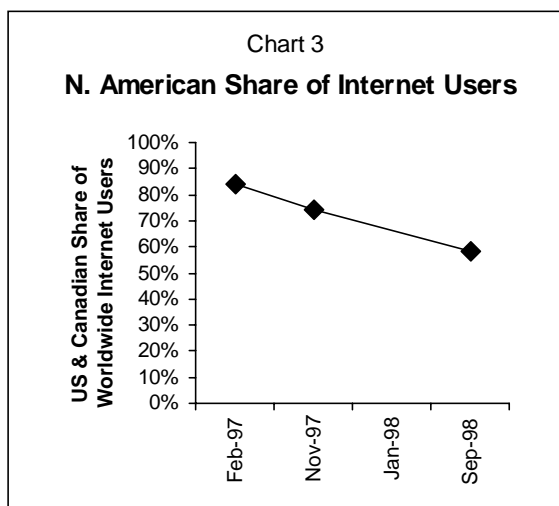
The company combines operational, managerial, and technological advantages. Plunking down a \$2 million dollar check on a table at Paolucci's on Mulberry Street in Manhattan, Gary Winnick persuaded William Carter, the CEO of **AT&T** (T) Submarine Systems to sign up with Global Crossing. At AT&T, Carter was responsible for overseeing the construction of fully fifty percent of all the world's underwater fiber infrastructure. As a result, Global Crossing commands a worldbeating capacity for fast deployment of fiber optic systems. It laid Atlantic Crossing in 10 months. Founded in March 1997, it raised \$4 billion by the end of 1998, generated a total of one billion dollars in revenues, and earned a 15 million dollar profit.

This 20 month ascent is unexcelled in the history of enterprise. A key secret of Global Crossing's stunning first year is its managerial structure. As Michael Jensen has explained in many cogent papers, the fatal flaw of most large corporations is a divergence of interests between the owners and the managers. The owners want bottom line profits while the managers want top line revenue growth, usually from mergers, acquisitions, and extrava-

gant spending of internal cash flow. The remedy is to make managers into owners and tie up the cash flow in debt service.

At the heart of the Global Crossing juggernaut is the same Milken-designed motor that impelled the early success of **MCI**, **TCI** (TCOMA), and **McCaw**: The managers own the company, but outside investors command the cash flow from the high yield issues. This means that the managers are slaves to the value of the equity and cannot rest on the cushions of internal cash flow. They must submit to the discipline of securing outside capital. Of course, raising funds is simplified by the willingness of the founders to put up some \$70 million out of their own pockets, including \$40 million from Winnick himself.

For the undersea facilities, AT&T submarine veteran Carter has mobilized leading edge wave division multiplexing technology. Atlantic Crossing currently commands eight fiber strands with a capacity of 40 Gbps, upgradeable to 80 Gbps. Pacific Crossing will have a capacity of some 160 Gbps. This compares with the 5 Gbps limit on most other underseas systems. If anything, however, technological conservatism could prove an Achilles heel for the company. If global Internet traffic continues to rise close to tenfold a year, Global Crossing's bandwidth will soon seem paltry. If other companies can deploy radically more



capacious technology (a terabit per second will be possible in three years), they may be able to achieve a marketshare coup. With larger volumes, they could push prices down faster and capture the profits currently targeted by Global Crossing.

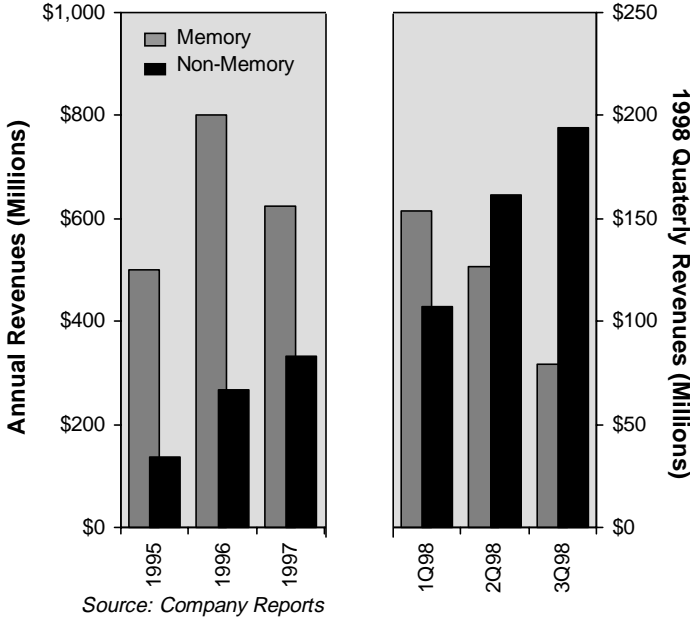
Winnick vows not to let this happen. The company's IPO prospectus declares plans to build another Atlantic Crossing within three years. But the company offers embarrassingly conservative estimates of the global growth of data traffic. The company has hired some of the best talent from the leading telcos, from Carter of AT&T to CEO Jack Scanlon, who served 24 years at AT&T before moving to **Motorola** (MOT). They may be prone to Telco nostalgia, cherishing the importance of voice and underestimating the Internet. Winnick will have to keep an eye on them.

Global Crossing faces competition. You have read of **FLAG**, **OXYGEN**, **Genesis**, **TAT 14**, and other sea stories. Supported by the **RBOCs**, the international telopolies, and other leviathans, these ventures are far too complex and bureaucratic to compete with Gary Winnick and his team. Only **Genesis**, a collaboration between **MCI WorldCom**

Last mile bandwidth is being offered by cable modems and by new wireless technologies. Undersea bandwidth will be supplied by Global Crossing.

Chart 4

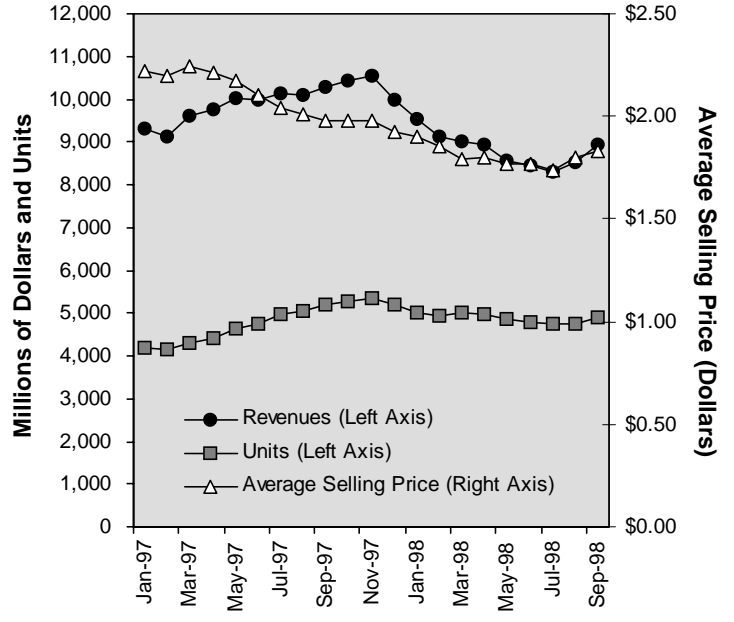
Atmel Revenue Shift



Source: Company Reports

Chart 5

IC Market Reverses Decline



Source: IC Insights 3-Month Moving Average

Atmel Transformed

Atmel is continuing the revenue shift from memory to logic products highlighted in previous GTRs (Chart 4). ASIC, RF and other logic products revenue during 3Q98 increased 20% over the previous quarter. The shift away from memory along with cost cutting also improved gross margins to 37%, from 32% in 2Q98. The ramp up of Silicon Germanium (SiGe) process technology is "on target" at Atmel's Colorado Springs facility, while Temic is commencing shipment of SiGe chips in Europe. Total revenues in the 3rd quarter (the second full quarter since the Temic acquisition) increased 14% over the previous year, but fell 5% from 2Q98 due to a 37% drop in memory revenues. Atmel reports, "While EPROM and Flash [memories] were weak this quarter, we believe these businesses have bottomed."

Chips Resurgent

IC market revenues (Chart 5) have begun to rise, according to the latest data and estimates from IC Insights. August and September (3-month average) increases in average selling prices (ASPs) and an estimated reversal of unit declines in September are the basis for the upswing. Rising PC sales in the 3rd quarter reinforce optimism for an improved IC market (see Charts 8-9, page 5).

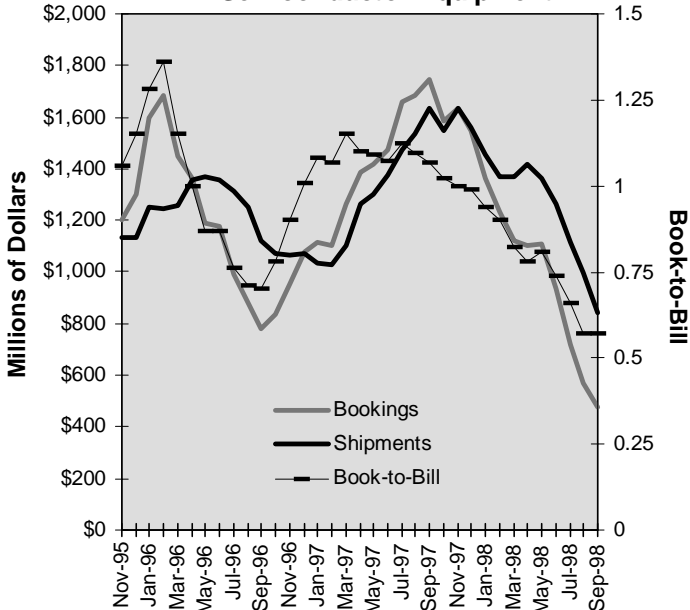
Semicon Equipment Bottoms

Semiconductor equipment manufacturers have been hit hard by IC market weakness as companies have scaled back expansion plans (Chart 6). SEMI figures for North America, however, now show a 4% increase in orders for back-end equipment. And BancBoston Robertson Stephens upgraded the semiconductor equipment industry believing the sector has hit bottom and citing upgrades to 0.18 micron processes. Due to the capital spending cutbacks, IC Insights estimates wafer capacity will grow less than 8% in 1998 and will rise only 2% in 1999. The 1999 capacity increase will be 80% lower than the 1995 increase, which was a 19% rise in total capacity (Chart 7). The 1999 capacity increase of 2% seems unlikely to meet demand from reviving PC and communications markets. Look for upside surprises from equipment makers such as Applied Materials (AMAT).

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Chart 6

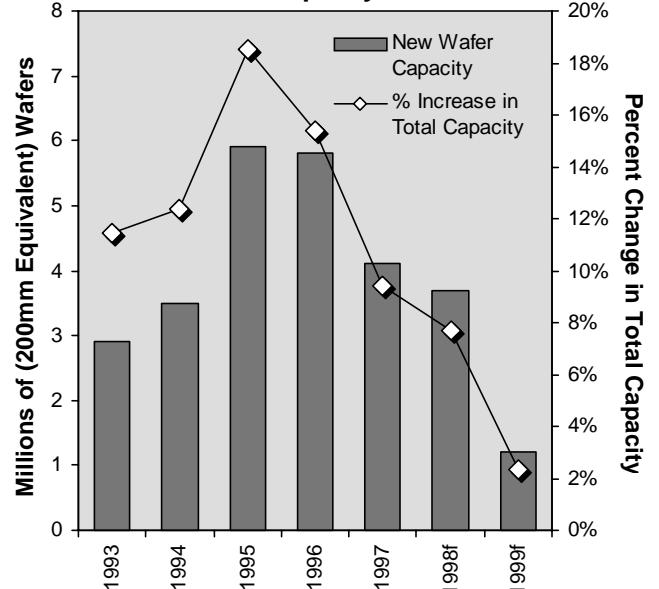
NA Semiconductor Equipment



Source: SEMI

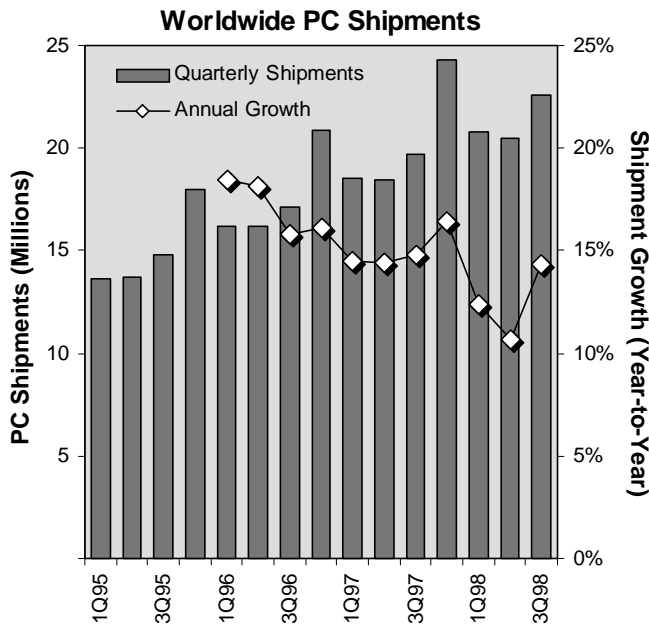
Chart 7

IC Wafer Capacity Growth



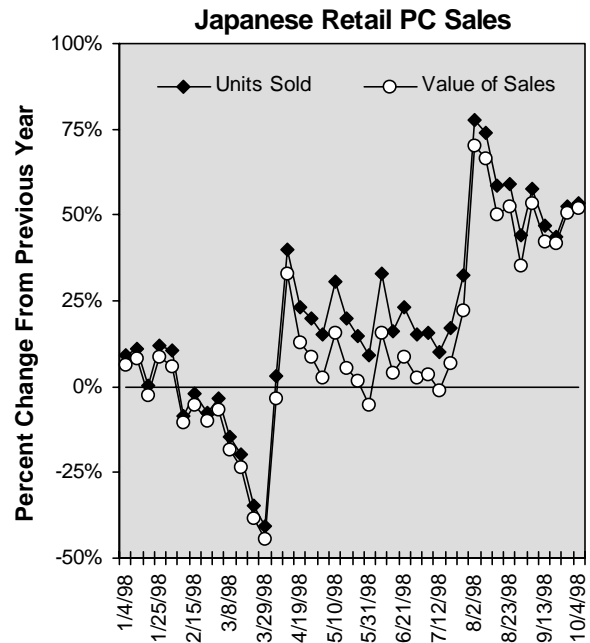
Source: IC Insights

Chart 8



Sources: IDC, Dataquest

Chart 9



Source: GfK Japan

Japan Joins PC Market Revival

Worldwide PC Shipments grew faster during 3Q98 than the first half of 1998 (Chart 8). Strong Western European growth, 22.4% according to British research firm Context, and 18%-19% growth in the US market were cited as the two markets combined account for some 60% of the global market. Retail PC sales in Japan have averaged growth of 56.7% in units and 51.5% in value of sales since the release of Windows 98 this summer, compared to declines of over 40% at the end of the 1st quarter (Chart 9).

Broadcom Booms, Terayon Breaks Out

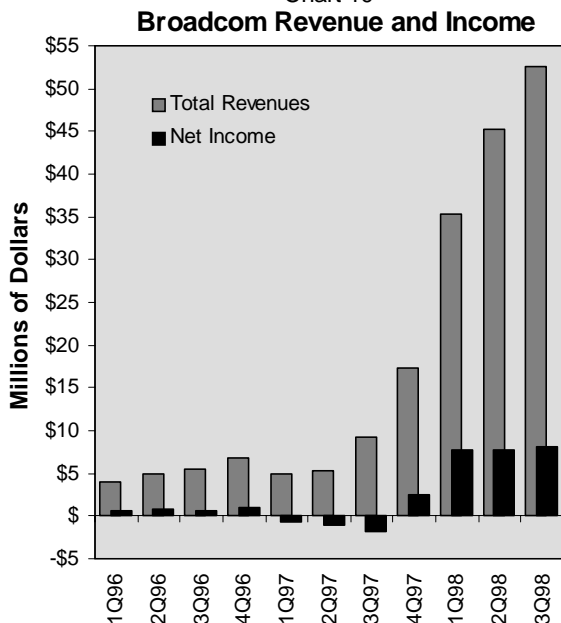
The @Home Network reports its cable partners now pass 10 million homes with two-way upgraded cable systems capable of offering @Home's cable modem service. And @Home reports 3Q98 subscriber totals of 210,000 up 43% in three months (see Chart 2, page 2). Terayon, with its GTG heralded S-CDMA technology, reports total shipments of 34,500 modems and 327 headend systems, with 3Q98 shipments of 17,500 and 170, respectively. Dominant cable modem chip maker, Broadcom, reported 3Q98 revenues increasing 16% from 2Q98 and 467% over 3Q97 (Chart 10). Broadcom's potential sales feed less on stand-alone modems than on integrating cable modem chips onto PCs motherboards, which judging from a similar shift in DVDs represents an 8 times larger market.

DVDs Move from TVs to PCs

DVD player sales in the US (stand-alone units for connection to TVs) have risen dramatically from a monthly average of under 30 thousand in 1997, to 34 thousand in January 1998, 79 thousand in June and 113.5 thousand in September, or a US total of 1 million units since their introduction in March 1997. But the stand-alone numbers are dwarfed by DISK Trends' estimate of 1.2 million DVD drives for PCs shipped in 1997 alone and projected sales of 4.3 million DVD drives for 1998. Indeed, global shipments for DVD-ROM (Chart 11) will rise to 1.2 million per month through the end of the year, according to Royal Information Electronics, of Taiwan. The dominance of PC-based DVD further marks the shift from TVs to PCs for video and audio and favors Telecom companies such as C-Cube (CUBE), LSI Logic (LSI), and National Semiconductor (NSM), as well as the cable modem stocks.

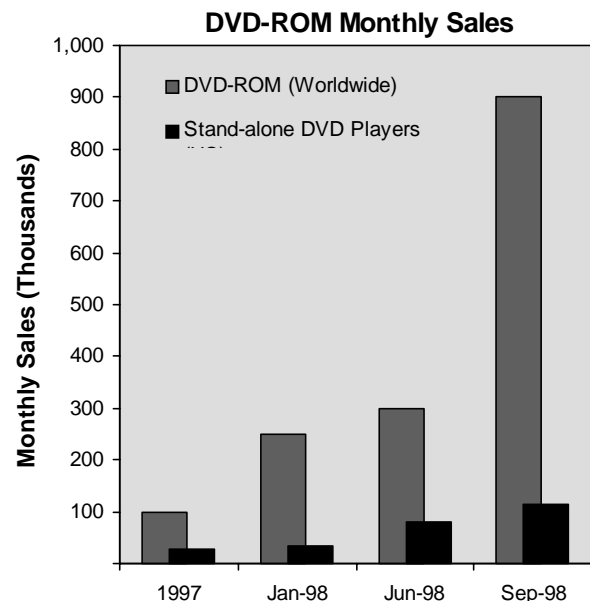
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Chart 10



Source: Company Reports

Chart 11



Source: Royal Info. Electronics, CEMA

Global Crossing's 20 month ascent is unexcelled in the history of enterprise.

(WCOM) and **Cable & Wireless** (CWP) delivering up to 80 Gbps across the Atlantic is a significant player. FLAG's most notable achievement was to evoke a splendid cover story in *Wired* by science fiction author Neal Stephenson of *Snow Crash* fame and fortune. But its top capacity is 5 Gbps, which seemed big at the time. Otherwise, these projects are mostly run by elephant companies copulating nervously with one another. OXYGEN is a suitably ambitious venture, headed by Neil Tagare, but it is having trouble raising funds and is running at least two years behind Global Crossing.

Measured by its opportunity, Global Crossing may be one of the lower priced stocks on the market. At present it is valued at 2.5 times its invested capital, while the company's customers are paying 3.7 times the cost of the facilities for rights to use them. By contrast, Qwest is valued at six times invested capital. Network suppliers with a global reach will tend to prevail. They enjoy what are termed "line economies"; the ability to reach new destinations merely by extending existing lines, rather than starting from scratch. To reach any particular location it will always be cheaper for the companies that already have global bandwidth. Global Crossing adds to the usual line advantages a self-healing loop architecture that allows the multiplication of loops by installing a single bisector; you get two loops by adding one line down the middle. In relation to such a global web, any continental system will incur a serious disadvantage competing in international long distance markets unless it buys capacity from Global Crossing.

So far Global Crossing has laid 5000 kilometers of fiber to Europe. This Atlantic Crossing system is already profitable. In the third quarter, GBLX reported \$15 million earnings on revenues of \$117 million and passed the one billion dollar mark in total cumulative revenues since its founding in 1997. Most of the revenues came from contract sales that cumulatively total close to \$800 million, of which \$115 million was ascribed to circuits activated during the latest quarter. It has already recovered 75 percent of the construction costs of Atlantic Cross-

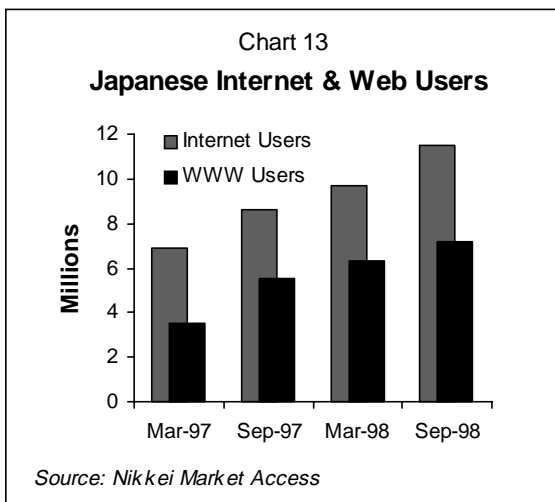
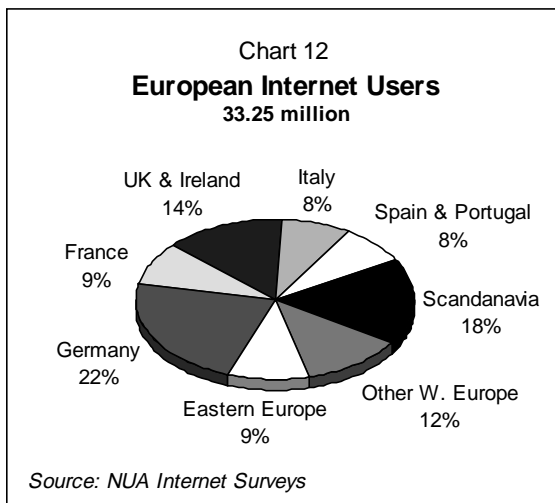
ing by selling 21 percent of the capacity to such companies as **Level 3** (LVLT), **WorldPort** (WRDP), and **Deutsche-Telecom**. In October, the company announced a Pan European Crossing, a \$700 million, 7,200 kilometer network that will mostly operate terrestrially, connecting 18 major European cities. Using state-of-the-art WDM technology, it could become the most capacious independent network on the continent.

I have to tell you that I have a personal interest in this company. For the last ten years, I have been looking for a successful heir to the Milken legacy: projects of a scale and inspiration that could change the shape of an industry, or even an economy. I didn't find any. As I expected, junk bonds surged back from their regulatory doldrums to become once again the nation's

most profitable investment—and Leon Black made a mint trading the Drexel portfolio—but no one used high yield securities with nearly the creativity of the master.

Then last month, I was invited to speak to a Global Crossing investors meeting in Cancun, Mexico. I had been impressed with its able execution of an ambitious business plan, building

Atlantic Crossing in ten months. But at the time, I did not realize that Winnick had been Milken's leading colleague at Drexel's Beverly Hills' office. I did not realize that Global Crossing had issued nearly a billion dollars of junk bonds, gearing up the company's equity into an entrepreneurial juggernaut like the Milken ventures. Discovering who Winnick was lent new glamour to



the company.

The seeds for Global Crossing were sown in 1981, in a small Drexel conference room in Beverly Hills, with an ashtray in the center piled with smouldering butts, where Winnick met Bill McGowan of MCI. On the surface, McGowan was not impressive. He was sweating heavily, pacing back and forth, smoking compulsively. His business plan was to compete head to head with AT&T. Winnick did not understand microwave technology or fiber. But he looked into McGowan's

eyes and he looked “very determined.” He felt a radiance of vision and conviction that echoed Milken’s own. With Milken’s support, Winnick initiated the first loan to McGowan of \$20 million. Over the next five years, Drexel would loan him another \$2 billion to build the nation’s first state-of-the-art fiber optic network at a time when AT&T experts were planning to delay the technology into the next century.

“Like some others I have known,” Winnick says, “McGowan was a guy who had never learned the words ‘no’ or ‘stop.’ They just didn’t fit in his vocabulary.” Winnick admired McGowan, who died of a massive heart attack two years ago, but he hoped he himself was different. He hoped he would know when to stop.

Six years later, in 1985, he was driving on the Maine Turnpike to visit his older boy Adam at camp near Augusta. In the car was his wife Karen, an artist and writer, and their two other sons, Alex and Matt. (The Winnicks celebrated their 25th in 1997). Winnick had just won a major deal, luring the Burroughs Corporation account away from **Goldman-Sachs**, and he was reliving the triumph in his mind. He was a master of the universe. Then he saw a blue police car in the mirror. He suddenly twigged that he was driving 30 miles above the 55 mile a hour limit. “You’re losing it,” he thought to himself. Something was out of balance in his life.

He recalled the days of his father’s bankruptcy in the household supply business. When Winnick was 16 years old, the family had to leave a mansion in Roslyn that had been built by the tycoon who financed the Comstock Lode and was a founding investor in AT&T, and move into a ranch house built by Levitt of Levittown. His father never fully recovered from the humiliation and stress. He died of a heart attack three years later at age 51. Now his son, a large man with a linebacker’s build, was feeling the Drexel pressure cooker.

Financial pressures force most people to continue on. “Balance,” like liberal politics, is chiefly a luxury of the rich. But Winnick was making \$2 million a year and shared in a number of the famous Drexel investment partnerships. He was rich and restless. He resolved to resign from the company on his return.

That was 1985. Despite some \$400 million in funds from Drexel directed to Winnick’s new firm, Pacific Assets, he did not achieve a major breakthrough until Global Crossing. But Global Crossing is the first new company to capture the

Milken magic. Just as MCI pioneered single mode fiber in the US, 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 Milken’s companies—MCI, TCI, and McCaw—it will change its industry, and the world economy as well.

Telecosm Technologies Come Roaring Back

We say every issue that the Telecosm Technologies Table is based on each company’s mastery of an ascendant technology—and not on any judgment of market pricing or timing. That disclaimer has rung all-too-true for months as the technology

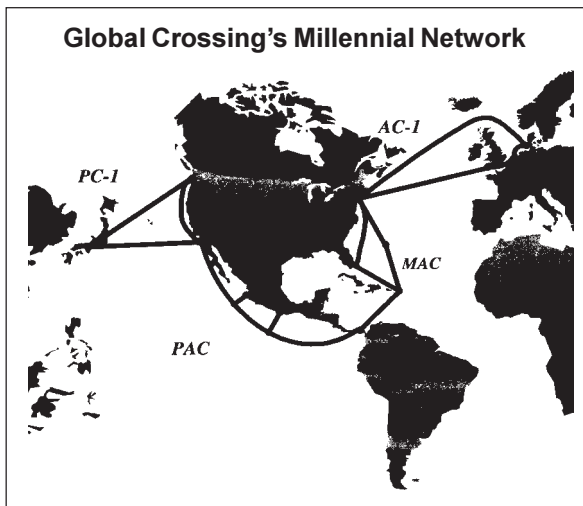
sector led the market in the search for a bottom. Even the best companies’ stock prices tended to sink in the tsunami of selling during the last several months.

But when the seas begin to calm, quality rises to the top. Investors who stuck with the list have been richly rewarded in the past month, as across the board Telecosm companies bounced back

from yet another dip in early October. Many have now recovered most or all the ground lost since the collapse began several months ago and several have hit new highs.

Leading gainers since GTR’s October 9 publication date are **Ciena** (CIEN), up 100 percent, as new hopes arose for a merger with **Tellabs** (TLAB), and a new recognition of Ciena’s ascendant technology spread. **Intenia** (Stockholm Exchange), the Swedish software star, and **National Semiconductor** (NSM) both soared 56 percent, and **Atmel** (ATML) surged 46 percent. Buoyed by runaway cable modem sales, **Broadcom** rose 33 percent, to a level up 160 percent since its IPO. Also surging since the October 9 GTR are **Nortel** (NT), up 44 percent, and **Qualcomm**, up 37 percent, while up more than 20 percent were **Qwest**, **Texas Instruments** (TXN), **Uniphase** (UNPH), **MCI WorldCom**, **Xilinx** (XLNX), and **Corning** (GLW)—Global Crossing’s source of LEAF (large effective area) fiber. **Teligent** (TGNT) announced the opening of its 24 gigahertz wireless service in 15 cities and rose 27 percent.

The Telecosm list is up over 35 percent overall



**A pure
Telecosm play,
GBLX artfully
exploits the
defining abun-
dance of the
era—the band-
width explosion
of WDM over
fiber optic
thread.**

TELECOSM TECHNOLOGIES

ASCENDANT TECHNOLOGY	COMPANY (SYMBOL)	Reference Date	Reference Price	Price as of 10/30/98
Cable Modem Service	@Home (ATHM)	7/31/97	19 1/2	44 1/4
Silicon Germanium (SiGe)	Applied Micro Circuits (AMCC)	7/31/98	22 11/16	24
Analog to Digital Converters (ADC), Digital Signal Processors (DSP)	Analog Devices (ADI)	7/31/97	22 3/8	19 7/8
Dynamically Programmable Logic, SiGe, Single Chip Systems	Atmel (ATML)	4/3/98	17 11/16	11 9/16
Single-Chip Broadband Data Transmission	Broadcom Corporation (BRCM)	4/17/98	24 *	82 15/16
Digital Video Codecs	C-Cube (CUBE)	4/25/97	23	17 7/8
Erbium Doped Fiber Amplifiers, Wave Division Multiplexing (WDM)	Ciena (CIEN)	10/9/98	8 9/16	17 3/16
Fiber Optic Cable, Components, Wave Division Multiplexing (WDM)	Corning (GLW)	5/1/98	40 15/16	36 1/8
Submarine Fiber Optic Networks	Global Crossing (GBLX) +	10/30/98	29 5/8	29 5/8
Low Earth Orbit Satellites (LEOS)	Globalstar (GSTRF)	8/29/96	11 7/8	16 3/4
Business Management Software	Intertia (Stockholm Exchange)	4/3/98	29	26 5/8
Wave Division Multiplexing (WDM), Fiber Optic Equipment	JDS Fitel (Toronto Exchange)	5/1/98	19 1/4	14 7/8
Broadband Fiber Network	Level 3 (LVL3)	4/3/98	31 1/4	32 9/16
Single Chip ASIC Systems, CDMA Chip Sets	LSI Logic (LSI)	7/31/97	31 1/2	15 1/8
Telecommunications Equipment, WDM, CDMA, SiGe	Lucent Technologies (LU)	11/7/96	23 9/16	80 3/16
Telecommunications, Fiber, Internet Access	MCI WorldCom (WCOM)	8/29/97	29 15/16	55 1/4
Single-Chip Systems, Silicon Germanium (SiGe)	National Semiconductor (NSM)	7/31/97	31 1/2	12 11/16
Telecommunications Equipment, WDM, CDMA, SiGe	Nortel Networks (NT)	11/3/97	46	42 13/16
Point to Multipoint (7-50 Ghz), Spread Spectrum Broadband Radios	P-COM (PCMS)	11/3/97	22 3/8	3 3/16
Code Division Multiple Access (CDMA)	Qualcomm (QCOM)	9/24/96	38 3/4	55 5/8
Broadband Fiber Network	Qwest Communications (QWST)	8/29/97	20 3/8	39 1/8
Linear Power Amplifiers	Spectrian (SPCT)	7/31/98	14	10 11/16
Nationwide CDMA (Code Division Multiple Access) Wireless Network	Sprint PCS (Private)		Anticipated IPO	
Java Programming Language, Internet Servers	Sun Microsystems (SUNW)	8/13/96	27 1/2	58 1/4
Broadband Wireless Services	Teligent (TGNT)	11/21/97	21 1/2 *	30 3/4
Digital Signal Processors (DSPs)	Texas Instruments (TXN)	11/7/96	23 3/4	63 15/16
High-Speed Copper Networking	Tut Systems (Private)		Anticipated IPO	
Wave Division Multiplexing (WDM) Modulators	Uniphase (UNPH)	6/27/97	29 3/8	49 1/2
Field Programmable Gate Arrays (FPGAs)	Xilinx (XLNX)	10/25/96	32 7/8	44 21/32

+ New Addition

* Initial Public Offering

Note: This table lists technologies in the Gilder Paradigm, and representative companies that possess the ascendant technologies. But by no means are the technologies exclusive to these companies. In keeping with our objective of providing a technology strategy report, companies appear on this list only for these core competencies, without any judgement of market price or timing.

since the October 9 GTR, compared to 18 percent for NASDAQ and 23 percent for the Morgan Stanley Technology Index.

Meanwhile, in a special issue commemorating the 40th anniversary of the Integrated Circuit, *Electronic Engineering Times*, the bible of semiconductor technology and microchip design, named the forty forces that will shape the future of the semiconductor industry. Number one was silicon germanium (SiGe), featured in GTR from the March 1997 issue on, as a technology that would enable single-chip communications systems. Atmel, National Semiconductor, and **Applied MicroCircuits** (AMCC) will all benefit, along with **IBM**. Also in the top 15 were such GTR favorites as intelligent DRAMs, **ARM** (ARMHY) microprocessors, E-beam lithography by **Lucent** (LU), digital signal processors from TI, the Palm [Pilot] OS, and single-chip systems, with Telecosm company **LSI Logic** (LSI) in the lead. And on and on.

We could hardly have improved on the list if we tried. Our only cavil would have been an inadequate stress on the significance of components for the new optical technologies being launched by Global Crossing and the other undersea ventures. The key producer of components for these systems is Uniphase.

George Gilder, November 2, 1998

After much consideration, we have decided to allow ForbesASAP exclusive rights to publish an occasional adapted text from the reports some six to eight weeks following receipt by GTR subscribers. In practice this will mean there is a possibility of a second wave of impact after initial publication.

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