GILDER TECHNOLOGY REPORT

June 2003 / Vol. IX No. 6

Where Are We?

Seek performance and you do not get volume. Seek volume and you get performance.

Inside:

"Can you hear me now?" It's my brother Walter Palmer on the line.

"Sure I can. Why not? You sound great."

"It's not just great, it's **Vonage**. An Internet phone on my cable modem."

"Vantage? What? How do you spell it?"

"You must of heard of Vonage?" His voice croaked with disdain for his out-of-it older brother.

"Well, maybe…"

"Vonage. Get used to it. V-O-N-A-G-E. It's the future of telephony. Voice over IP. They have 30 thousand subs, increasing a thousand a week. Unlimited service for forty bucks a month."

"Hey, I've been writing books. I'm out of touch."

"They got a national network, 173 area codes, 911 service that gives the operator the address. They got number portability, fax, web-based phone mail, links to your computer, Wi-Fi, what do you want? Just 'cause you become a bear and hide off in some cave, the industry doesn't stop."

No question, Walter is the family's expert on the details of the telecom business and his voice was clearer and more resonant than usual, with no noticeable delay. I was convinced. Vonage represents an enabling breakthrough in IP telephony for all customers with a reasonably broadband line such as a cable modem or digital subscriber line (DSL). By reducing the phone bills of heavy users by an average of some $40 per month, Vonage also offers an easy way for many customers to pay for a broadband connection.

OK, let's catch up. For the last four months, while others have been relishing successes in the amazing three-week war to overthrow the oppressive regimes of Shaq, *The New York Times*, deflation, Kobe, Bill Bennett, and Iraq, all at once, I have been writing a book on an imager company. Called **Foveon Corporation**, it aspires to extend the agenda of regime change to **Kodak** (EK), **Nikon** (NINOF.PK), **Canon** (CAJ) and **Sony** (SNE). My writing soon bifurcated portentously into two books. One is *The Cat and the Camera*, on Foveon Corporation itself and its coming transformation of the $30 billion imaging business; and the other is called *Analogy*, on Carver Mead and Richard Feynman and the relationship between "science" (these days mostly devoted to religious and political speculation) and engineering (the cumulative real science of our era). The true scientists, who make enduring contributions to human knowledge, are the people who invent and build things.

CONTINUED ON PAGE 3

Coming Optical Tipping Point

According to Leichtman Research, the first quarter of 2003 detonated a record 1.9 million increase in the number of high-speed Internet subscribers in the U.S., reaching a total of over 19 million. This trend will soon project the industry well past Peter Huber's 20 million subscriber "tipping-point," predicted to ignite a cascade of new users and push U.S. broadband subscriptions toward 100 million by 2010.

U.S. "broadband" still falls more than tenfold short of the video-ready 8 megabits per second provided to an average customer in Korea for $39 per month. But even the U.S. rates of over 500 kilobits on cable modems and 200 kilobits on digital subscriber lines (DSL) are a huge leap beyond prevailing dialups.

Providing a "wall of worry" for broadband to climb are predictions of a renewed Internet slowdown based on an October 2002 poll by the Pew Internet project. Surveying "experienced" dial-up users (deemed most likely to move up), the Pew team showed a nearly 20 percent rise (from 47 percent to 57 percent) since the previous year in the number of respondents with "no interest" in faster home connections. Must be some mistake, since six months later the pace of adoption is accelerating.

In any case, what would a Pew survey have shown in October 1994, when most folks thought the Internet was a global police force and a browser was a nocturnal prowler of bookstores? Virtually no one predicted that during the two years 1995 and 1996—when browsers were netscaped and email went beyond postal—Internet traffic would abruptly surge more than a hundredfold.

Not until late 1996 and 1997, when John Sidgmore of UUNet began crying in the wilderness, did the market floodgates begin to open. At the very moment that botched regulation choked off broadband and ratcheted back the rate of traffic growth to the previous annual doubling, equity values began assuming a doubling every 3.5 to 4 months. By the end of 2000, traffic growth was being overestimated by 125-fold. At that point, Telecosm markets began a massive two-order of magnitude correction. Around here we remember it well.

Slow to visualize exponential synergies, the human mind is intuitively linear. Who in 1994 foresaw a 12,800-fold rise in traffic over the next nine years? Who in 2003 is considering the current Korean example of abrupt hundredfold rises in Internet usage. Who contemplates online college lectures, streaming videophone calls with the grandkids, three-dimensional sports and other games, or billions of cell phone and surveillance cameras requiring orders of magnitude more bandwidth?

Could the next paradigm shift propel network traffic a hundredfold in two years? Sure. It happened before with far less bandwidth hungry technology. We estimate the June 2003 U.S. backbone traffic at 175 petabytes (10 to the 15th) per month. Projecting this forward to December 2005, our mid-'90s–style discontinuity rockets us to 25 exabytes (10 to the 18th) per month. That's 25,000 petabytes every 30 days, folks—a rate every five hours equivalent to the current monthly traffic.

To handle a 6:1 ratio of peak-to-average traffic, December 2005 capacity must equal 188 exabytes per month. Measured in terms of today's all-optical technology, that's 363 **Corvis** (CORV) systems with 160 OC-192 lambdas, or a 360-system increase over this month's requirement.

But based on telco guesstimates, aggregate U.S. metropolitan area traffic exceeds backbone traffic by four times. Returning to our sample paradigm shift, by December 2005 total metro network traffic would equal 100 exabytes per month, or 2 exabytes per month per metro area over 50 U.S. metro areas. Thus, each metro network would carry an order of magnitude more traffic than today's entire backbone network.

But all this is just fantasy. Right? There will be no new paradigm, just a continued regime of SONET uber alles, $600 T-1 lines at 1.5 megabits per second, and DSL dribblecasts. Asia is irrelevant. From Washington to Wall Street, the wiseguys tell us that there is no demand for more bandwidth. The technical talent in optics flocks back to China, India and Korea while attorneys flow into the regulated sectors in the U.S.

But as chronic innovators and entrepreneurs, we Americans still want our own way, despite an annoying habit of setting up roadblocks and obstacle courses to make the trip more challenging. A handful of regulators, in the long run, are not going to stop 30 million, 60 million, 90 million broadband subscribers from using the Internet or one billion camera phone owners from reaching out and videophoning someone. That means the moment is fast approaching for a return to investments in the all-optical paradigm epitomized by Corvis and **Essex** (EYW).

— Charlie Burger and George Gilder

CONTINUED FROM PAGE 1

In my business, what you look for are companies with categorically superior technologies—home runs rather than incremental singles. On our current list, there are at least three such technologies—**Corvis**'s (CORV) Wavelength Division Multiplexing (WDM) system, **EZchip**'s (LNOP) network processor, and Foveon's imager. However, while Corvis supplies the definitive system, dozens of companies command various features of WDM and others could contrive similar systems if they ever woke up to the opportunity. Don't knock it—Corvis is a fervent pick, but it is not a shovel-the-money sure thing. EZchip is unique, but it offers less a new invention than an industry leading synthesis combining many technologies and insights. In three years it has risen up to technological dominance from a crowd of players entering the network processor business on an innovative substrate of field programmable and adaptable PowerPoint slides; now EZchip supplies real industry-champion silicon devices.

As a discrete worldbeating invention, though, Foveon is in a class by itself. There are no guarantees in the innovation business—every Edison does not become **General Electric** (GE) or General McArthur—but Foveon is as good as it gets. In the current U.S. environment, I expect the lawyers and beadles to be circling at any moment.

JDSU, TERN, AVNX and EQIX

Meanwhile, behind my back the world has continued to turn and twist, and it has other things in mind for me beyond scouring it for innovations. The IRS wants millions of dollars out of my fast dwindling stash. Why not?

Hey, Uncle, we gave it all to my partners in exchange for control of this now worthless company. Perhaps, you'd like the company. It was once estimated by the dot.com gurus of **Merrill Lynch** (MER) to be worth upward of $150 million. It's called the Gilder Publishing, LLC and for you government guys, it's a real deal—a cruise missile with a neutron payload fully tested for destructive power against friendly investments and communications systems. Leaves the personnel alive and mostly in the thrall of the U.S. government. A perfect weapon to drop on Iraq, Iran, Martha Stewart, Wall Street, Redmond. Although it has already wreaked more rubble than all the bombs on Baghdad—trillions of bubbleworth and bubblepop—it is guaranteed to inflict no biological damage. For example, at two recent parties in my home town, I ran into Fred Leonberger, CTO of **JDS Uniphase** (JDSU) and leading inventor of WDM components. At the epicenter of the Telecosm crash, he has survived splendidly. Though for some reason he drew a blank on WDM, he is hale and insightful as always, and hip to opportunities in new hydrogen fuel cell technologies.

My subscribers want to know how I feel about JDSU, **Terayon** (TERN), **Equinix** (EQIX), **Avanex** (AVNX) and Tredennick, among others. Equinix has been on our list for more than a year. I constantly pointed to Equinix when it was down. In the old days I would have "pounded the pulpit" and touted the company for its unique technology and strategic position at the heart of the Internet. But now I am supposed to interrogate its financials for waste, fraud and abuse. So I was persuaded by the financial experts not to wave my arms and urge for you all to buy it as I planned at the end of last year. It was on the list and its executives spoke at two of our conferences, but I suppose many of you missed it. (If possible, don't compound the error by missing Telecosm 2003, August 25 and 26 in Tahoe!)

I let Equinix hide discreetly on my list and then I went to write my books for the government. Now Equinix is a five bagger or something, controlled by **Singapore Technologies Telemedia** (ST Telemedia), and boring as an investment (see, "Whitebox Stockwatch" page 5).

In three years EZchip has risen up to technical dominance from a crowd of players entering the network processor business

As for Terayon, Richard Vigilante of our associated publication, previously called the *Technology Market Advisor* (now the *Whitebox Market Observer*) thinks it is a clinker. Schlomo and Zaki Rakib gave away their SCDMA technology to the cable industry under its DOCSIS 2.0 (don't worry) cable modem standard and now are trying to compete as a manufacturer. Richard doesn't like that. On the other hand, Terayon is among the leaders in supplying broadband technology to the home and they have now introduced DOCSIS 2.0 to Korea, to enhance that country's orders of magnitude edge over the U.S. in per capita broadband. Broadband is going to happen here too, some day. So Terayon isn't a disaster. I suppose they will go up and down like anything else in this undulating Fourier world. And differentiating backward toward the fundamental frequency, I still find legal and regulatory schlerosis in the United States telecom markets.

Telco Titanic

Now Justin Doebele of Forbes Global calls from Singapore to have me discourse on ***Global Crossing***. Also to be owned by ST Telemedia (if Carl Icahn can't contrive a better bid from Craig McCaw's **XO**), Global Crossing signifies a massive shift of Internet and telecosmic assets from the U.S. to Asia. Global Crossing had a fabulous business plan, beautifully fulfilled, that crashed on the shoals of deflation and regulation. Now with Equinix already in its pocket, ST Telemedia is apparently buying Global's $20 billion of assets for $250 million, in the hopes—I kid you not!—of resurfacing the company on NASDAQ, as soon as they can. They were a bit disgruntled, I hear tell from

TELECOSM TECHNOLOGIES

Ciena (CIEN)
Corvis (CORV)
JDS Uniphase (JDSU)
Avanex (AVNX)
Essex (EYW)
Equinix (EQIX)
Sprint PCS (PCS)
Qualcomm (QCOM)
Broadcom (BRCM)
Altera (ALTR)
EZchip (LNOP)
Terayon (TERN)
National Semiconductor (NSM)
Intel (INTC)
Flextronics (FLEX)
Taiwan Semiconductor (TSM)
Transmeta (TMTA)
Analog Devices (ADI)
ARM Limited (ARMHY)
Cepheid (CPHD)
Cypress (CY)
Energy Conversion Devices (ENER)
Legend Group Limited (LGHLY.PK)
Microvision (MVIS)
United Microelectronics (UMC)
VIA Technologies (2388.TW)
Wind River Systems (WIND)
Xilinx (XLNX)
Chartered Semiconductor (CHRT)
Synaptics (SYNA)

Note: The Telecosm Technologies list featured in the *Gilder Technology Report* is not a model portfolio. It is a list of technologies that lead in their respective application. Companies appear on this list based on technical leadership, without consideration of current share price or investment timing. The presence of a company on the list is not a recommendation to buy shares at the current price. George Gilder and *Gilder Technology Report* staff may hold positions in some or all of the stocks listed.

Avanex (AVNX)

ADAPTIVE PHOTONIC PROCESSORS

JUNE 6: 4.48, 52-WEEK RANGE: 0.63 – 4.95, MARKET CAP: 309.1M

Following acquisition of photonic device divisions from Corning (GLW) and Alcatel (ALA), Avanex (AVNX) has become the third largest manufacturer of optical components. Previous design wins at Alcatel and Cisco give the company a possible upside from the early June Bell Operating Company announcement of a contingent plan to procure as much as $1 billion per year of equipment for passive optical networks in the local loop. Cisco has already received a nod from BellSouth (BLS). But Avanex's new component supermarket look is less comely than Simon Cao's super PowerMux was and downplays the all-optical paradigm that will prevail when optical markets return in force.

Essex (EYW)

OPTICAL PROCESSORS

JUNE 6: 4.40, 52-WEEK RANGE: 1.50 – 4.95, MARKET CAP: 39.3M

Now out of the shadows of NASDAQ bulletin boards and on the American Stock Exchange under the symbol EYW, Essex continues its slow but steady ascent from designer of exotic custom devices for the government to producer of WDM passive optical processors. Capable of handling wavelength densities of up to 10 thousand lambdas, the Hyperfine system is orders of magnitude ahead of the competition. Back from a secret assignment, inventor Terry Turpin has an enhanced role in the company. Ringing the opening bell at the American Exchange on June 4, Turpin signaled an Essex now profitable for the first time since it entered telecom at the height of the boom. Under CEO Len Moodispaw, it has roughly tripled its contracts over the last year and absorbed twenty new digital signal processor and software engineers from Synsis Development Labs.

ANTI-CLIMAX: Ninety percent of the company's work is classified. But the contracts with Telcordia and DARPA use Turpin's Hyperfine with CDMA to increase the security of already mostly secure optical transmissions. So far worth only $250K, this venture is the only commercial application so far, but Essex, and Turpin will be ready when the industry abandons its apparent current plans to run the Internet on tin cans and greased string.

Equinix (EQIX)

SECURE INTERNET BUSINESS EXCHANGES

JUNE 6: 8.10, 52-WEEK RANGE: 2.00 – 9.17, MARKET CAP: 69.0M

Now essentially controlled by Singapore Technologies Telemedia, Equinix expanded its presence last month in Fujitsu's (FJTSY.PK) fast growing data center in Singapore. With its superior connectivity in the Asia Pacific region, Equinix is nicely positioned to take advantage of the trend toward outsourcing and expansion in Asia. Closing on a $10 million final funding infusion on June 5, Equinix is financially stable and commands a board of directors including Mike Volpi of Cisco, Scott Kriens of Juniper, and Lee Theng Kiat of ST Telemedia. This company is strategically situated to grow with the Internet where it is growing fastest.

Sprint PCS (PCS)

NATIONWIDE CDMA WIRELESS NETWORK

JUNE 6: 5.12, 52-WEEK RANGE: 1.75 – 7.68, MARKET CAP: 5.240B

Armed with a successful launch of its Vision high speed data system, Sprint PCS (PCS) enters a critical phase of direct competition in CDMA broadband wireless with Verizon (VZ), which has announced plans to invest three times as much as Sprint in new capital gear over the course of 2003.

Qualcomm (QCOM)

CDMA INTEGRATED CIRCUITS, IP, SOFTWARE

JUNE 6: 33.55, 52-WEEK RANGE: 23.21 – 42.89, MARKET CAP: 26.485B

With the SARS epidemic seemingly under control, Chinese firms maintain their goal of signing up at least 13 million subscribers by year's end. Having enlisted only 2.8 million new subscribers as of April 30, the CDMA forces will have to double monthly signups for the remainder of the year to meet the target, which translates into 1.4 million subscribers per month. Announcing another $100 million gout of venture capital to prime the pumps in Asia, Qualcomm founder Irwin Jacobs says "the Chinese know how to meet their numbers."

Altera (ALTR)

PROGRAMMABLE LOGIC DEVICES

JUNE 6: 18.84, 52-WEEK RANGE: 8.321 – 19.80, MARKET CAP: 7.214B

On May 20, shipped the industry's first Field Programmable Gate Array (FPGA) with 20 high-speed, 3.125 Gbps transceiver channels, which allows companies like OmniWorks to package complete OC48 (2.4 gigabit) engines within the PC card form factor. This low powered (450 mW per transmission quad) delivers 45 channels with embedded dynamic phase alignment (DPA). All of which means that Altera has still got its technical act together in communications.

EZchip (LNOP)

10 GIGABIT NETWORK PROCESSORS

JUNE 6: 7.41, 52-WEEK RANGE: 3.79 – 9.6, MARKET CAP: 54.0M

With some 20 customers, including more than 10 large systems vendors, EZchip has eclipsed all its competition and finds itself nearly alone in the ring with (uh oh) Intel (INTC). Fifty down, one to go, but there is room for more than one player in this market.

MEAD'S ANALOG REVOLUTION

NATIONAL SEMICONDUCTOR (NSM)
SYNAPTICS (SYNA)
SONIC INNOVATIONS (SNCI)
FOVEON
IMPINJ
AUDIENCE INC.
DIGITALPERSONA

COMPANIES TO WATCH

ATHEROS
BLUEARC
CALIENT
CELOXICA
COVENTOR
COX (COX)
CYRANO SCIENCES
ENDWAVE (ENWV)
NARAD NETWORKS
POWERWAVE (PWAV)
QUICKSILVER TECHNOLOGY
RF MICRO DEVICES (RFMD)
SAMSUNG
SiRF
SOMA NETWORKS
SYNOPSYS (SNPS)
TENSILICA
TRISCEND

Terayon (TERN)

BROADBAND CABLE MODEMS, HEAD-ENDS

JUNE 6: 2.9, 52-WEEK RANGE: 0.86 – 3.62, MARKET CAP: 213.8M

Time Warner Cable's NYC division, the nations largest cable TV system with 1.2 million customers, recently deployed Terayon's DM 3200 Network Cherry Picker systems as part of Time Warners NYC digital TV service. The DM 3200 is used to maximize bandwidth to the home, allowing specifically tailored programming for individual customers. Using rate shaping to adapt bandwidth use to the needs of different channels, the DM 3200 frees up capacity for additional services, such as voice-on-demand (VOD). But this kind of incremental advance is not going to make Terayon a hot company again.

National Semiconductor (NSM)

ANALOG EXPERTISE, FOVEON IMAGERS

JUNE 6: 22.97, 52-WEEK RANGE: 9.95 – 33.74, MARKET CAP: 4.191B

Recently downgraded by Deutsche Securities and upgraded by Morgan Stanley and by us.

Flextronics (FLEX)

CONTRACT MANUFACTURING

JUNE 6: 10.73, 52-WEEK RANGE: 5.47 – 12.045, MARKET CAP: 5.569B

Consolidation in the circuit-board industry will benefit the larger-tier players such as Flextronics. A maker of Microsoft's Xbox game player, Flextronics commands industry leading market share, and is well positioned to benefit from the current trend toward outsourcing.

Transmeta (TMTA)

MICROPROCESSOR INSTRUCTION SETS

JUNE 6: 1.68, 52-WEEK RANGE: 0.74 – 2.47, MARKET CAP: 232.7M

In a show of support for Transmeta's chip design for devices in need of long battery life, Microsoft announced on May 6 that is has chosen TMTA as a design partner for next-gen wireless Smart Displays (touch screen monitors that allow Windows XP-based PCs to be used wirelessly).

Analog Devices (ADI)

RF ANALOG DEVICES, MEMS, DSPS

JUNE 6: 38.122, 52-WEEK RANGE: 17.88 – 40.33, MARKET CAP: 13.927B

Introduced new 16-bit analog-to-digital converter (ADC) on June 2 that operates at 550 kSPS (kilo samples per second)—the lowest power 16-bit successive approximation ADC to date with only 20 mW power dissipation with a 2.7 V power supply.

Cypress (CY)

BROADBAND SOLUTIONS, VOICE OVER IP

JUNE 6: 12.60, 52-WEEK RANGE: 3.60 – 18.64, MARKET CAP: 1.588B

On May 29, Cypress priced a $500 million offering on the convertible bond market. Its 1.2% notes will be convertible into 55.172 shares and $300 at a price of $18.13. The company plans to use the money to buy a dilution hedge, redeem a different convertible issue and buy back stock.

Xilinx (XLNX)

PROGRAMMABLE LOGIC DEVICES

JUNE 6: 28.58, 52-WEEK RANGE: 13.50 – 31.43, MARKET CAP: 9.643B

Xilinx and Samsung have teamed up to develop adaptable metro edge IP switch/routers using Xilinx FPGAs, showcased by Samsung this week at Supercomm in Atlanta.

Whitebox Stockwatch

Since my own newsletter is slowly migrating toward non-tech stocks, but I still want an excuse to come to Telecosm, we thought I might do an occasional commentary for the GTR on Telecosm stocks.

The rally, however, makes this is a challenging time to start. There is not a single stock on the GTR list I personally want to buy at today's prices.

My message is 'never invest on hope.' Drive risk as close as possible to zero. Place yourself in positions where practically speaking the only side is the upside.

When I disparaged Equinix last summer, its new corporate sponsor had not yet emerged and the company was already effectively broke. Today EQIX is a better investment at $8 than it was then at $2. But it is still an exercise in hope.

All the debt is gone. Since at $8 it trades at about 30 percent of net tangible asset value of roughly $330 million, compared to the current market cap of about $70 million, there is now some asset anchor in the price.

On the other hand, it is not yet clear those assets can produce returns. The cash burn is still significant especially for a company whose assets are not especially liquid (heavy on equipment and leasehold improvements). And the revenue acceleration ($22 million average for the past two quarters as opposed to $19 million per quarter for 2002) does not compensate for the cash drain and the still negative gross margins.

June or September numbers could make the current share price a bargain if they suggest sharp revenue growth. Will you miss your chance, if you stay on the sidelines until then? Probably not. The price is anticipating favorable news. In any event you will have the satisfaction of having made the right decision, a good predictor of your long-term success.

The Avanex acquisitions make that company more interesting. But when somebody pays you to buy a company, which Alcatel did, the mess is usually worse than it looks.

A glance at the P&L suggests Alcatel handed off the photonics business without doing much to clean up costs. (By contrast, the Corning businesses bought by Avanex had been cleaned up quite a bit.) But the real problem is lack of revenues. The new Avanex has a couple or so years to live while waiting for revenues to come back. Will they? I can't imagine how one would make a good guess given the persistent lack of sales visibility. Given the current market cap of over $300 million, which certainly exceeds the (still somewhat cloudy) net tangible asset value of the post-merger company, there is no harm in waiting for more information, a better price, or both.

EZchip is still a development stage company, with essentially zero revenues. It is run by very smart people who do not waste money. (If a few other GTR companies could do as much with such tight R&D budgets, they would be raving buys). But with LNOP products now shipping in trial quantities, we are near the end of the road. The sales will come soon or never.

For LNOP to grow into its current price would require revenues of $25-30 million, on a multiple of 2x sales. But on a bet this speculative (one product category, no sales history, a new market, Intel the leading competitor) why place the bet for a payoff of less than 10 to 1? That implies sales around $200 million (because the multiple would be better.) That is not impossible: this is probably a bi-polar proposition: Revenues will remain effectively zero or easily exceed $200 million. If you think the chances of success are no worse than 1 in 10, you can make the bet, but not with the college fund.

—Richard Vigilante,
Whitebox Market Observer

CONTINUED FROM PAGE 3

Doebele, to learn that in some quarters in the U.S. new GX IPO plans will be received without enthusiasm, except by the Leracketeers, in their increasingly global search for deep pockets.

Global Crossing is a story of the catastrophic regulatory and monetary failure that brought U.S. broadband to a screeching halt and precipitated a thousand bankruptcies among communications companies. But that is not the story people want to hear. Lurid crimes in the suites, sleepytime auditors, depraved CFOs, leaky septic tanks full of emails leading to CEOs believed to be salaciously seeking profits is the vision of the SEC in its can-you-top-this rivalry with Eliot Spitzer, Milberg Weiss and Lerach.

Even people with a clue about business imagine that acute financial analysis would have identified balance sheet flaws in each of those thousand companies. Quickly seen as shams would be GX, G*, WCOM, 360 degrees, XO and all the rest. Such an analytical sieve would catch no gold at all. In previous eras it would have barred investments in McCaw Cellular, **MCI**, TCI, **Fox** (FOX), Turner, **Comcast** (CMCSA), **Sprint** (FON), and you name it. Today Equinix would flunk, though it rose to the top of a technology analysis, and **AT&T** (T) and **AT&T Wireless** (AWE) would look like geese as fat as **Berkshire Hathaway** (BRKb), ready to ovulate aurically most of the time.

There are no guarantees, of course. We hung on hypnotically to the equity of Global Crossing as it sunk financially like some telco Titanic while continuing to cleave multiple lightpaths in infrared oceans across a globe of glass with dashing Gary Winnick at the helm breathing in the media wind like some modern Marco Polonius. Now the Asians take over Global Crossing, along with most of the rest of the Internet and its optical embers and enablers, and the Americans prepare class action suits and ingenious new porny pop-up ads. Karl Rove and his friends do not have a clue.

Flooding the PONs

Hey, but they got a real tax cut through. I was wrong again. Despite making every mistake in the book except giving up, the Bush team achieved a stunning upside surprise. Pushed through with the personal intervention by the President, the tax cut that was enacted was far superior to anything the Administration had proposed before. Short of a flat tax it is as good as it comes. Are these guys smart or lucky? Does anyone know?

As a result, the boats are all rising at last and opportunity beckons. Since its enactment, the tax cut has already hugely paid for itself, generating some $750 billion in appreciation of stocks alone and a proportionate enhancement of real estate and small business values. Revenues will soon be rising at all levels of government. So much for the costs of tax cuts. Even the optical Internet whispers a play, as three surviving RBOCs (regional Bell operating companies) declare a contingent intention to invest billions of dollars in paradigmatically passive optical networks (PONs) to U.S. homes and businesses. Passive optics are our theme. Although a specialized jargon has arisen around certain products, PONs are the essential business that made Simon Cao and Avanex famous and Terry Turpin of **Essex** (EYW) a paladin of the Telecosm. Avanex has purchased the optronic components businesses from **Corning** (GLW) and **Alcatel** (ALA) and is merging them with their own line of proprietary power muxes and exchangers. If the FCC doesn't require all fiber be shared with every homeless tin-cup CLEC (competitive local exchange carrier), broadband optics contracts will be put out for bid by the BOCs on June 19 and Alcatel/Avanex will be one of the prime contenders along with **Cisco** (CSCO), **Nortel** (NT), **Lucent** (LU) with JDSU in tow. All these companies, though, according to Charlie Burger, are attempting to harvest new revenues with old optics. The highest ambition of Avanex seems to be to compete with JDSU as a low margin omnibus component "supermarket." But when the optical world turns around, it will want not SONET upgrades but new paradigm systems that can cheaply handle the new tsunami of data (see "Coming Optical Tipping Point").

Corvis has increased by 11,000-fold in six years the capabilities of fiber optics.

Imaging innovation

For the moment, Foveon optics are more fun than fiber. The Foveon business book, to be titled *The Cat and the Camera*, will be published by Norton some time over the next span of months. That is the way it is in publishing. Unless, like Andy Kessler of Velocity Capital (*Wall Street Meat*, Escape Velocity Press), you take the process into your own hands and publish the book *tartare*, and it proves so juicy and hilarious and timely and insightful that everyone wants to read it even if it lacks any recognizable imprimatur—in other words, unless you can contrive a miracle—you wait around for the publisher to act. It is a lot like a pregnancy. Nine months in the oven is the usual rule.

The Foveon book, however, is not about publishing. It is about what you do when you have invented a hugely superior new product—potentially scores of times better than anything else out there—but with a current mar-

ket of zero billion dollars. Foveon is a company launched by a close friend of the *GTR* and a paragon of all Telecosm conferences named Carver Mead (see him this August in Tahoe). A longtime professor at Caltech and godfather of Silicon Valley innovation, he aimed to transform the camera business on the basis of his discoveries about the nature of the human retina. With crucial help from two other prolific inventors—Dick Merrill imported from **National Semiconductor** (NSM) (who actually made the crucial breakthrough and the chip embodying it) and Dick Lyon formerly of **Apple** (AAPL) (who made Merrill's concept into a product)—Mead drastically overshot the mark. Foveon created an imager that can do still or motion color pictures of nearly unlimited resolution and accuracy on a single silicon chip potentially manufacturable in volume for close to a dollar. This product is both canonical and nikonoclastic. Along with Wavelength Division Multiplexing in optics, the Foveon X3 chip is the most exciting invention I have encountered in my 25 years following the microchip industry. Foveon and WDM turn out to be similar and complementary technologies.

Knocking opportunities

But we are investors around here. Finding the technology is not enough. We must identify ways to profit from it, so we can generate wealth and foster more inventions. Close to three years ago we determined that the best of the some fifty network processor designs being offered by companies large and small—from **IBM** (IBM), **Motorola** (MOT), and **Intel** (INTC) to **Applied Micro Circuits** (AMCC), **Broadcom** (BRCM), and Fastchip—was a device from an unknown firm in Migdal Haemek, Israel, named EZchip. Hatched from the shell of a NASDAQ company called **LanOptics** (LNOP), EZchip would be an Israeli curiosity if it were not 51 percent owned by LanOptics. You can buy LanOptics stock in reasonable hope of sharing in the upside of EZchip.

A year ago, EZchip still faced at least ten serious rivals. Now all its competitors have fled the field except for Intel Corporation. Although currently producing no chip remotely comparable in capability, Intel is fully committed to the network processor arena, already rules the low end, and will be a serious player as time passes. But with some 20 design wins, including more than ten large systems vendors, one in the U.S., EZchip has become the overwhelming technological leader, with impressive commercial prospects.

Foveon is even more dominant in its technology and we have been following it in these pages since 1998. It is 40 percent owned by National Semiconductor, which has licensed the chip and manufactures it. Also owning a significant share of Foveon (around 15 percent) is **Synaptics** (SYNA), a touchpad and haptic processor company that spun out Foveon in 1997. In the last year, National's commitment to Foveon's technology has steadily increased. Foveon chips are "hot lots," in the EZpass fast lane through the National fabs, and National has licensed the technology to adapt for sale as low-end imagers.

Optics success story

Then comes Corvis Corporation, which has created the most elegant and cost effective systems for Wavelength Division Multiplexing (the breakthrough optical technology) and has recently purchased the optical network of **Broadwing**, incorporating the Corvis system. In this still rapidly advancing technology, founder David Huber has chosen vertical integration in a brazen effort to show the huge cost effectiveness lead of Corvis's Raman based systems. It has increased by 11 thousand fold in six years the capabilities of fiber optics (measured in bits per second per wavelength times wavelengths per fiber, times fibers per cable, times kilometers between regenerators). Corvis's system amplifies light with sound (that's the Raman effect) to transmit some 320 different bitstreams, each on a separate wavelength, for five thousand kilometers without opto-electronic regeneration. Broadwing's network should soon be able profitably to underprice the competition and pump-prime the market for Corvis technology.

All these industry-leading companies pose complicated investment issues. Although my chief expertise is technology, investment is indispensable to its success. Some of us may imagine that we are in it for ourselves, but investment is not a zero sum game. The more wealth we generate the more opportunities open for our children and for the children of the world. The more good we do the more goods we earn.

Laying down the law

In the course of writing my book on Foveon, I have had to consider the strategic enigmas of breakthrough innovations. In moments of weakness and enthusiasm, Mead, Merrill, Lyon and others at Foveon speak of transforming the camera business. That is not a promising goal. The reason why it is not a promising goal was identified by my partner Nick Tredennick. As a sometime amateur legislator, I would like to make a law about it.

As a discrete worldbeating invention, Foveon is in a class by itself – as good as it gets.

As a law giver Carver Mead is preeminent, since he named Moore's law ("chip capabilities double roughly every 18 months"), but I rank high for naming Metcalfe's law ("the value of a network rises by the square of the

number and power of the machines attached to it"). If I may resume a legislative toga for a minute and appropriate my partner's insight, I would like to announce Tredennick's law: *"Seek performance and you do not get volume. Seek volume and you get performance."*

Catchy isn't it? The essence of it is the learning curve. Making the argument with authoritative data and detail is Harvard's Clayton Christensen in his forthcoming book, *The Innovator's Solution*. Creating a high performance product is only the first step. If you make one brilliant prototype of a magical Silicon Wonderchip XXX, and then embark on an agenda of costly performance improvements, you will restrict yourself to a sparse population of elite users. In the end, this small market of demanding buyers—whether of high-end cameras or high-end routers or specialized business communications—will not be able to pay for the early rate of improvement. Meanwhile your rival—Intel, perhaps—incorporates an inferior ripoff on some underused corner of a Pentium and makes billions of units. Moving down the learning curve of the semiconductor industry with Moore's law, the Pentium will soon be doing the job more cheaply and better than your Silicon WonderchipXXX.

Seek volume

High performance cameras are a small market. Ubiquitous imagers are a huge market. In a matter of a few years, the ubiquitous imagers will outperform the high performance cameras. In high-end Canon cameras, industry standard CMOS imagers are already outperforming film. Foveon must aim not at usurping cameras but at proliferating one-chip imagers. It should not be hard, since Foveon solutions can do both still and motion and use less than a hundredth of the power of rival chip sets. Foveon's low power edge is vital since the biggest imager markets will be portable. The goal must be to dismantle the camera, hollow it out, and diffuse it through the world. Without challenging the dominant camera companies for any of their existing customers, Foveon can achieve volume by putting the chip in every cellphone, ATM machine, airport security booth, PC monitor, convenience store corner, and digital watch.

Similarly EZchip must move rapidly down the curve from its current niche of routers and switches. It must dismantle the router and put it everywhere. Promising are its some 20 design wins for a variety of metro switches, routers for IPv4 and IPv6, server switches, firewalls and virtual private networks, wireless hubs, load balancers, and the trusted computing association platform. It will not finally prevail, though, until it is in every set-top box, wireless router, and home entertainment hub, seamlessly shuffling, converting, and handing off the variety of Ethernet, NTSC, HDTV, USB, FireWire, DOCSIS, IPv4-v6, MPEG 2-4, Foveon, Flash, 802.11X, DIVX, FM, SCSI, Fibre Channel and DS0 connections, and distributing them among a variety of terabyte storage facilities and on sundry displays, monitors, phones, speakers, and personal digital assistants. As the only single chip network processor that operates at all seven layers of the network, from phy to presentation, EZchip can become dominant by seeking volume in the domicile where all the layers converge.

The coming challenge for all our innovators is to find strategies to build up volume. Foveon took a key first step by licensing its technology to National for low-end imager applications. EZchip is preparing to enter new businesses. Corvis is boldly lowering the price of Broadwing services. Lower prices bring higher revenues and expanded markets. That is the ultimate harvest of Tredennick's law.

"Can you hear me now?" Hey, it's Walter again. With his unlimited Vonage service he can call me any time. Watch for Vonage. Along with ubiquitous imaging, Voice over IP is a critical enabler for American broadband and is giving a crucial push to the Bell Operating Companies to do fiber to the home at last. If they do, the optical economy will come back sooner rather than later. Charlie Burger will be back. Fred Leonberger will recall the virtues of WDM. It is a pivotal moment for the Telecosm.

—George Gilder,
June 9, 2003

Got Questions?

Visit our subscriber-only discussion forum, the Telecosm Lounge, with George Gilder and Nick Tredennick, on www.gildertech.com

GILDER TECHNOLOGY REPORT PUBLISHED BY GILDER PUBLISHING, LLC AND FORBES INC. • Copyright ©2003, by Gilder Publishing, LLC

291A MAIN STREET, GREAT BARRINGTON, MA 01230, TEL: (413) 644-2100, FAX: (413) 644-2123 • EMAIL: INFO@GILDER.COM

EDITOR IN CHIEF	EDITOR	EXECUTIVE EDITOR	TECHNOLOGY ANALYST	MANAGING EDITOR	ART DIRECTOR	SUBSCRIPTION DIRECTOR	CUSTOMER SERVICE
George Gilder	Nick Tredennick	Bret Swanson	Charlie Burger	Mary Collins Gorski	Peter Johnstone	Rosaline Fernandes	Sandy Fleischmann

For subscription information telephone toll free: (800) 292-4380 • WWW.GILDERTECH.COM