GILDER
TECHNOLOGY
REPORT

August 2006 / Vol. XI No. 8

# The World's Best Process Company

**Ascending** into life-after-television with its superior liquid crystal displays (LCDs), exotic green lasers, last-mile fiber webs and cable triplays is **Corning** (GLW). With virtually 100 percent of the world still trapped in a copper cage, with growing demand for movie-and-game-ready mobile displays, and with high-definition video and flat-panel televisions just beginning long, global market runs, Corning's future glitters like Steuben glass.

Driven by displays that range from cell phones to notebook computers and desktop monitors to televisions, global demand for LCD glass is expected to swell from 800 million square feet last year to 1,400 million square feet in 2007, with Corning hoping to outgrow the total market. Most notable is the anticipated ascent of LCD television from 5 percent in 2004 and 11 percent in 2005 to 20 percent this year and 30 percent next with average screen size reaching 27 inches.

At which point we'll have only just begun.

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For Corning, LCD glass could well repeat the 30-plus year run of cathode ray tubes. If you don't own Corning, now is the time to board the great glass boat.

## Inside:



## FEATURED COMPANY: Broadwing (BWNG)

### Broad Wings

If you watched Tiger Woods's emotional win at the British Open on ABC, you were watching content transported on **Broadwing**'s (BWNG) media network. Ditto for the World Cup in high definition on ESPN or ABC. The carrier is also capturing major league baseball in most venues, transporting game content from stadiums without compression so that the production facility sees it as it came out of the camera. That's important if you want to know how the play really turned out—you may well see the action better than the umpire.

This is one example of how Broadwing is able to leverage its all-optical network. Competing optoelectronic kludges typically suffer a little bit of packet loss. Since a video packet contains some 1,400 bytes of information, a lost packet or two can give you the jitters or even freeze your screen. If the loss happens to be right where the glove is, you have butter-fingered pixels. Building on its recent successes, Broadwing has expanded its media network to 41 cities and is adding more services, such as personalized television and interactive programming.

### Let the good times roll

Broadwing had more good news on last week's quarterly conference call. For one thing, the **AOL** (TWX) phone deal just got better. As AOL transitions from fee-based to free, Broadwing's financial relationship with the nation's largest instant messenger provider will remain unchanged while uptake of the new instant messenger phone service, launched in July, likely accelerates among AOL's 47m customers. AOL chose Broadwing to be the primary provider of the entire phone network infrastructure—one of the largest soft-phone implementations in the world—because of its soup-to-nuts automated solution, from prequalification to provisioning to billing to 911 capability. Instant messenger users can sign up online for a free local phone number for each screen name, and the service includes caller ID and voice mail.

Beginning what could well become a protracted boom is converged services, which boasted 30 new customers last quarter alone. Broadwing's converged network allows enterprises to merge all their local network applications such as voice and data onto a single platform using their current network technology, including Ethernet, frame relay, asynchronous transfer mode (ATM), and digital subscriber line (DSL). Enhancing Broadwing's attraction among these typically large enterprises is that its virtual private network services are now available throughout most of the world thanks to agreements made this year with international carriers **Global Crossing** (GLBC) and **Hutchison Global Communications**. Using layer 2 or layer 3 protocols, multinational conglomerates can now connect offices worldwide with their "own" secure networks, avoiding the attacks that plague the public Internet.

Broadwing could not have picked a better time for its new offerings, as price erosion continues to abate across most of Broadwing's products. The carrier has even been able to raise prices on select services, such as wholesale voice and high-speed optical circuits, where demand is running at a record pace for both enterprise and carrier customers.

Helped by a steadily rising gross margin due to improvements in access technology and voice network upgrades, Broadwing managed to slash its net operating loss (ex options expense) to $10.1m during the second quarter, from $14.9m last quarter and $34.5m in the year ago quarter. Even better, the carrier is now running positive cash flows from operations at the rate of $13.2m for the first half of this year, up from a loss of $3.5m during the same period last year. Ignoring balance sheet adjustments, cash flow is an even stronger $20.7m.

And the balance sheet continues to shine, with cash and receivables exceeding all debt and liabilities by $95m. On the strength of the recent convertible offering, working capital increased sequentially from $148m to $317m. With a low interest rate of 3.125% to be paid in cash only, a conversion price of $16.60 or two thirds above today's price, and a long 20-year term, the converts are attractive, and the cash lets Broadwing shop around for strategic network assets.

## Top-line troubles

With all this good news, why is the stock trading at a paltry enterprise value (market cap minus net cash) of less than 1x sales? Probably because Broadwing is teetering on the top line. After eliminating last year's bonus receipts from favorable resolutions of disputed Focal sales, communications revenue is on track to trickle up 3% this year. Partly to blame are long-term contracts, which continue to be renewed at lower prices—remember, market prices have only *recently* begun to stabilize. A slowing economy, much on Wall Street's mind, might also stagnate sales going forward.

Also bothering investors may be Broadwing's rising capital expenditures, now forecast to approach 10% of sales this year. That's double the original outlook. **Infinera** is partly to blame. In July, Broadwing said it will begin deploying the equipment startup's optoelectronic platform in its regional and aggregation networks. Also to blame are increasing optical installs, most recently up 30% sequentially.

But much of this is good news in disguise. Optical installs are good because they portend fresh business. These circuits are being turned up for new customers who are replacing their legacy networks with Broadwing's cutting-edge offerings such as converged services, where sales increased 82% sequentially during the second quarter off a small base. Converged services customers usually run complex multisite networks and demand comprehensive, customized solutions. Thus, it typically takes a long time to sell to these enterprises and a relatively longer time to turn-up their services, which means it'll take time for converged services to significantly impact revenue. It also means these folks are apt to stick around for awhile. A little patience should pay off nicely.

Due to the timing of last quarter's installs, Broadwing wasn't able to bill much revenue, another nice lag for patient investors. Also pointing to some upside sales surprises ahead is voice-over-IP (VoIP). Yes, you can make money in voice, at least if you're Broadwing. Local voice sales have increased 3.7% this year on the strength of VoIP volume, and revenue from AOL's instant messenger users hasn't shown up yet, the service having begun in July.

Furthermore, management believes the Infinera deployments will bump spending up temporarily and thereafter *reduce* capex by eliminating equipment now needed for some services, by enabling capacity to be deployed more cost effectively, and by allowing new services to be introduced faster. Broadwing expects to replace legacy Corvis cards in some of its regional networks and redeploy them in the core all-optical network where their capabilities can be optimized. Finally, the carrier will be able to offer wavelength services in smaller markets where demand is increasing.

As part of the equipment deal, Infinera will license Corvis optical technology, including Raman amplification, and will assume manufacturing and support for Broadwing's all-optical core. Beginning around the middle of next year, the arrangement will shave about $10m annually off of Broadwing's overhead and will permit the carrier to focus exclusively on delivering services.

## Nearing the home stretch

Clearly, Broadwing's new CEO, Stephen Courter, former head of NEON Communications until it merged with **Globix** (GEX) last year, is taking the helm during a rising tide. If he can leverage his capacious, high margin all-optical core network and new access efficiencies which together are helping to pass half of incremental sales through to the bottom line, he could well increase cash flow enough to cover next year's capital expenses and thus be home free. With the 50% incremental margin, a $20m or 9% increase in quarterly revenue brings Broadwing to operational breakeven on the income statement. And cash flow is already running at a pace of 90% of capex based on an eventual return of capital investments to 5% of sales.

What might "home free" mean for investors? Consider that a reasonable enterprise value of 2x current sales more than doubles the stock to $22 based on today's balance sheet. A 2.5x valuation pumps the price to $27. If Broadwing continues down the path it has relentlessly pursued for the past several years and if regulators don't mount a surprise attack, the market should come around on this gem over the next year or two.

*— Charlie Burger*

(CONTINUED FROM PAGE 1)

Lagging Japan's expected 77 percent penetration of the TV market will be western Europe's 49 percent, North America's 36 percent, and the rest of world's 10 percent. Creating only a small portion of today's demand, the Chinese LCD market alone is expected to equal North America's by 2009. For Corning, LCD glass could well repeat the 30-plus year run of cathode ray tubes (CRTs).

But what's that rumble from Wall Street? It's the sound of investors ignoring emerging paradigms and stampeding away from Corning. Setting off the false alarm were inventory backlogs, which prompted many panel makers to cut production rates in late spring. As a result, Corning's LCD glass sales fell 6 percent by volume sequentially in the second quarter while net earnings in the segment shrank 18 percent primarily due to lower sales and slight price declines.

Don't run with the herd. Manufacturers have merely pared inventory and are rebooting production now as they head into the seasonally strong second half of the year. If you don't own Corning, now is the time to board the great glass boat.

Dwarfing the seasonal shuffles are the awesome long-term prospects for LCD glass. This year alone, global sales of LCD glass by volume is still on track to swell some 40–50 percent. Thus, despite Corning's small sequential second-quarter dip, glass sales by volume grew by a robust 45 percent over the year-ago quarter, and net income rose a respectable 20 percent. Even more telling, during the first half of this year net income leaped a whopping 57 percent over the comparable period last year, from $486 million to $761 million.

By pummeling the stock as much as 30 percent since April, testy traders have created a buying opportunity. Ignoring Corning at these prices could be risky for your telecosm portfolio.

## Flat panels swell sales

Is Corning simply cocky to think it can outpace an exploding market in which it already commands a 60 percent share? We don't believe so, for several reasons.

To make LCD screens, manufacturers such as **AU Optronics** (AUO), **LG Philips LCD** (LPL), and **Samsung** cut two pieces of onionskin glass (each less than a millimeter thick) from large sheets, supplied by a glass company such as Corning, and press them together, with the chemicals that form the images sandwiched between. As these glass sheets or substrates grow larger with each new generation, unit costs to produce a particular display size shrink since more screens can be cut out of each sheet. Alternatively, larger screens can be cut to enable larger TV sizes. Over the years, therefore, panel makers have developed an appetite for larger and larger substrates.

Among the glass suppliers, Corning has been blazing the trail to larger substrate sizes. This has not only increased the company's margins and pricing power, it has also expanded its share of the market as it single-handedly satisfies panel makers' demand for size.

Over the past two years, Samsung, Philips, and others have invested more than $20 billion in new plants that are able to use ever larger sheets of glass. Most of these plants use sixth generation substrates, which yield eight 32-inch panels. Gen 7 substrates, which yield twelve 32-inch panels, entered into production during the past year. Corning still stands as the lone supplier of Gen 7 glass, the market for which should ramp nicely through next year as Corning continues to improve yields.

Gen 5 and larger glass accounted for 84 percent of Corning's total glass volume in the second quarter, with Gen 5.5, 6, and 7 glass contributing to 48 percent of volume, up from 45 percent sequentially. Further extending its formidable lead, the glass maker began shipping Gen 8 glass to **Sharp** during the quarter. Gen 8 sheets are large enough to cover a king-size bed and enable screen sizes up to 65 inches.

Eventually substrate sizes will stop growing for at least two reasons. First, transporting onionskin glass as large as king-size beds is extremely difficult. Transporting glass twice that size (Gen 10) could prove problematic. Second, building a factory that produces 50-inch-plus TV screens (Gen 8) can cost $4 billion for a much smaller potential market. More manufacturers are delaying capacity expansions, a sign that demand for larger substrates may be waning already. Most notably, five LCD makers have said they want to build Gen 8 plants, but so far only Japan's Sharp has done it.

When panel makers lose their appetite for larger substrates, many believe it will be time to throw in the towel on Corning. That attitude may result from a simplistic view of a complex technology and market.

For one thing, Corning's manufacturing capacity and efficiencies will help retain customers concerned about reliable glass supplies. During the first half of this decade, Corning improved by 50 percent the capital efficiency of its manufacturing expansion, as measured in dollars per square foot. Its Shizuoka, Japan, Gen 8 plant went from a cleared site to glass manufacturing in 9 months. Corning builds its factories near or beside its Asian customers, helping to form ties while reducing transportation costs and response time. Preparing for the coming Chinese surge, Corning plans to be manufacturing in Beijing by 2008. In South Korea, Corning's joint venture with Samsung ties the knot yet tighter, infuses expansion capital, and discourages Samsung from overstating demand in order to get better prices and shore-up supply.

Even more critically, Corning will continue to improve the quality of its substrates. The king of glass processors has been rushing down the LCD learning

## TELECOSM TECHNOLOGIES

| | |
|---|---|
| Advanced Micro Devices | (AMD) |
| Altera | (ALTR) |
| Analog Devices | (ADI) |
| Broadcom | (BRCM) |
| Broadwing | (BWNG) |
| Cepheid | (CPHD) |
| Corning | (GLW) |
| Energy Conversion Devices | (ENER) |
| Equinix | (EQIX) |
| Essex | (KEYW) |
| EZchip | (LNOP) |
| Finisar | (FNSR) |
| Flextronics | (FLEX) |
| Ikanos | (IKAN) |
| Intel | (INTC) |
| Microvision | (MVIS) |
| National Semiconductor | (NSM) |
| NetLogic | (NETL) |
| PMC-Sierra | (PMCS) |
| Power-One | (PWER) |
| Qualcomm | (QCOM) |
| Semiconductor Manufacturing International | (SMI) |
| Sigma Designs | (SIGM) |
| Semitool | (SMTL) |
| Sprint Nextel | (S) |
| Synaptics | (SYNA) |
| Taiwan Semiconductor | (TSM) |
| Texas Instruments | (TXN) |
| Xilinx | (XLNX) |
| Zoran | (ZRAN) |

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### Advanced Micro Devices (AMD)

PARADIGM PLAY: INTERNET COMPATIBLE PROCESSORS

AUGUST 15: 20.87; 52-WEEK RANGE: 16.90 – 42.70; MARKET CAP: 10.10B

Torrenza. That's the program under which AMD licenses its high-speed interconnect technology to customers, who can then connect their coprocessors directly to AMD processors via expansion slots. In some cases the coprocessors can be integrated onto the same chip as AMD's cores. Torrenza could create new business for AMD in specialized systems. Perhaps more important, it reveals the innovative environment that CEO Hector Ruiz has nurtured at AMD. It's the fighting spirit that enabled Ruiz to give **Intel** (INTC) the runs and that will keep him in the game for good.

Here are four accomplishments Ruiz can boast about: During the second quarter, AMD's revenue rose 53% over the year ago quarter … it was the twelfth consecutive quarter in which microprocessor sales grew more than 20% year-over-year … Opteron processor sales grew 26% sequentially … AMD likely gained share in the server processor market.

Regardless, the news has been dire about how much pain Intel is inflicting on its nemesis. True, AMD's sales were down sequentially primarily because of cutthroat pricing for high-volume desktop processors. The slashing also took gross margin down a bit. But Intel has wounded itself in this war as well. Its gross margin and sales have suffered more than AMD's, and it's warehousing a glut of aging inventory.

With an aggressive new lineup and its timeline lead on advanced processes, Intel will likely keep the heat on its rival until the second quarter of next year when AMD plans to roll out new architectures. Many are worried that Ruiz won't be able to muster the resources to fight a war with Intel, especially in light of his proposed purchase of **ATI Technologies** (ATYT). Sporting a sale price of $5.4b, the Canadian graphics chip specialist isn't coming cheap. In fact, it could be the biggest chip acquisition ever.

Big mergers are tough to do and frequently fail. Though capital investments are still running about $100m per year higher than cash flow from operations, Ruiz plans to triple fab capacity during the next few years and begin volume production at the 65-nanometer process before the end of 2006, followed by 45 nm in mid-2008, only about half a year behind Intel. To do this, Ruiz expects to spend $1.7b this year and $2.5b next. Hefty for AMD, even without the ATI purchase.

The easy part of the purchase will be the payment of 57m shares of common stock, an 11% dilution. But what about the remaining $4.2b in cash payment? As a result of Ruiz's quick move into the market when his stock soared, he managed to boost cash and receivables (net liabilities) to positive $890m today from negative $1,484m last year. Good work, but paltry for the ATI purchase. To complete the deal, Ruiz plans to borrow $2.5b from Morgan Stanley. But that still leaves him back over a billion in net debt after the closing.

All this so AMD can develop platforms like Intel's acclaimed Centrino line, which combines processors, chipsets, graphics, and Wi-Fi. (In addition to competing with **Nvidia** (NVDA) in graphics chips, ATI also makes chipsets.) Well, it's been a big deal for Intel, so why not for AMD? Particularly in laptops, offering both the microprocessors and chipsets has helped Intel to lower power and pledge to corporate customers that chipsets won't change for extended periods. Now Ruiz wants his turn, but to get it he'll have to execute one massive merger while retaining Nvidia as a trusted supplier and conserving enough energy to continue the microprocessor wars. If it weren't Ruiz, we'd be tempted to sell.

Conversations with supportive customers have given Ruiz assurance that he's not a wastrel. Yeah, customers can promise the world and then drop you on a dime. But in this case, we don't believe they'll break their newfound friendship with AMD and lock themselves back into a single-source Intel. Why end the price war and stifle the innovation unleashed by competition?

Unless ATI becomes a distraction or drain, AMD should surge back next year with a new mobile architecture at 65 nanometers, boasting power-saving advances that allow dual-core chips to turn off one core or both and to control the speed of the bus to save power. Also on tap for mid-2007 will be AMD's new architecture for servers, workstations, and desktops. Anticipating these innovations are Ruiz's reassuring customers, now secretly hoping that ATI doesn't derail him.

Based on his "seasonal" outlook for the second half of this year, Ruiz is on track to earn about a dollar per share, more than double over 2005. Until the mid-2007 upgrades, however, AMD may continue to be blunted by Intel. If you think Ruiz is on the road to ruin, then today's forward-looking PE of 20 won't entice you. But if you believe Ruiz will hold his own and return strong in a year, then you'll slowly accumulate shares with a minimum two- to three-year investment horizon.

### Intel (INTC)

PARADIGM PLAY: MICROPROCESSOR KING MOVES ONTO NETWORK

AUGUST 15: 18.13; 52-WEEK RANGE: 16.75 – 27.49; MARKET CAP: 104.57B

It's show time for Intel. Can Mr. Microprocessor gain back lost ground on its feisty foe? We don't know the answer yet, since second-quarter sales were based almost exclusively on the older architectures that got Intel into

**Online Bonus Material:** For additional analysis on **Advanced Micro Devices (AMD)**, **Intel (INTC)**, and **Power-One (PWER)** logon with your GTR subscriber ID at *www.Gildertech.com*

trouble in the first place. In a hurry to prove itself, the company has introduced some of its new products ahead of schedule. The industry's first 90-nm chipsets for desktops began shipping in early June with "healthy yields," and the Intel Core 2 Duo "Conroe" processor, a dual-core microprocessor for desktops based on Intel's new 65-nm process Core architecture, launched in late-July. The first quad-core processors for servers and desktops will ship later this year, ahead of the planned 2007 launch.

As for the next year, the wafer is cast, and now we must watch for uptake from the new lines of power saving chips and new processes. Technologically, Intel is on the right track. Conroe, for example, offers 40% more performance and 40% lower power than Intel's previous best. Microprocessors based on Core have generated the largest number of design wins at launch in Intel history. While refocusing on power savings, Intel has not dropped the ball on process shrinks, also critical for portable devices. The company now manufactures most of its microprocessors at 65 nm, where it's getting high yields on 300mm wafers. Look for 45-nm production to begin by the end of next year, and tri-gate transistors to follow at 32 nm in 2009.

With its new Core architecture at the high-end, Intel is taking a broad, three-tier market approach that includes Pentium at the mid-range and Celeron at the low end. Based on that groundwork, it's hard to imagine the company not booming back next year and beyond. Dampening our enthusiasm during the Q2 conference call were CEO Paul Otellini and CFO Andy Bryant. Both men appeared as leadership-challenged as during the previous quarterly call. Of concern this time was the sharp sequential rise in inventory of 21.4%. That's a Wow, and eyes on Wall Street bulged. Analysts sparred with Otellini and Bryant on the issue, but the seemingly befuddled brass couldn't calm the fear that the company is building up a mountain of older, less profitable products just to keep the fabs humming and gross margin above catastrophic lows.

It was Intel management's continued focus on performance at the expense of power that let AMD get away in the first place. Now the competitive landscape has likely changed for good; last quarter, pricing was more competitive than Intel had anticipated, and AMD, with its unrelenting presence and more innovative culture, will probably keep pressing Intel harder than Otellini is counting on. Reshuffling senior brass or laying off a thousand mid-managers won't change any of that.

If Bryant's latest financial musings are correct, Intel will earn about $0.94 per share this year, ex-options. But don't count on it—the estimates keep getting worse with each update as prices continue to fall, as the mass crossover to 65 nm in all major product segments puts short-term pressure on margins, and as sales in the new product cycle have barely begun. At the recent price of $18.13, the stock trades at just over 19x our latest earnings estimate. For investors with a 5-year horizon, that's pretty safe on the downside, with the added potential to return to last year's $1.40 and a stock price of $35 at a PE of 25. But don't be surprised if earning fall into the $0.80s or lower before ascending next year.

### Power-One (PWER)

PARADIGM PLAY: DIGITAL POWER MANAGEMENT CHIPS

AUGUST 15: 6.43; 52-WEEK RANGE: 4.28 – 8.23; MARKET CAP: 553.34M

It's inevitable. Just as Moore's law advances made certain the cell phone industry's conversion to digital, so will it precipitate a digital revolution in power management for medium and complex circuit boards, still overwhelmingly analog. As semiconductor geometries shrink, chip currents rise and voltages fall, increasing the challenges of regulating power. Analog solutions typically require one hard wire per function; if you have 30 power-related functions, you often have 30 wires, a lot of interface, a lot of complicated circuitry. Using ever shrinking digital technology, engineers can design power modules in 10% of the time with 90% fewer components compared to analog. And changes can be made on the fly, avoiding costly reengineering and re-layout.

Power-One understood the digital trend early on and remains the only company with a complete digital-power solution, as detailed in last September's GTR. Building on its stellar digital prospects, the company continues to add design wins in its traditional power systems business, including high-volume wins in its dc-to-dc product line and in ac-to-dc front-ends with the likes of large server and storage companies. In its Z-One digital power product lines, Power's 60 wins span applications from wireless, networking, telecom, and test equipment to aerospace, aviation, and computing. Among those jumping on board are Tier-1 customers.

Also jumping on the Power train is competitor **Silicon Labs**, which several weeks ago capitulated in its lawsuit with Power-One by recognizing some of Power's broad patent claims. Joining **Atmel** (ATML) and **C&D Technologies** (CHP), Silicon also signed onto Power's Z-Alliance after disembarking from the competing digital power group, the PM-Bus Alliance. Remaining for Power-One is a suit with Artesyn, a power-supply competitor bought by **Emerson Electric** (EMR).

In addition to the distraction and legal fees of the Artesyn suit, Power is facing other challenges of concern to investors. During the first quarter, earnings took a hit as management scrambled to fill orders during a supply shortage. The shortage resulted from a procurement problem at an unnamed contract manufacturer. It took Power most of the second quarter to identify the problem and to solve it by taking over the procurement function for the supply chain. Still being implemented are plans that, hopefully, will prevent similar problems from recurring.

Partially in reaction to the supply-chain disruption, Power invested heavily in inventory during the second quarter in order to meet growing customer demand. Management seems confident that it will not repeat the inventory write-downs which resulted in operating losses late last year. Not so confident are many investors who rode out the previous write-off that followed similar assurances from the company.

Management is facing yet another challenge. Much of Power's revenue is coming from new programs where the company is "still climbing the learning and efficiency curves." Thus, even though the supply issue has apparently been solved, expect earnings to continue to be pressured as new products begin to ramp.

But overall, Power is making solid progress. The second quarter saw strength across all product lines, and Power finally broke past its mid-60s revenue barrier of the past five quarters as sales leaped almost 22% sequentially to $78.6m, the highest in five years, while bookings remained robust. Particularly strong were wireless, analog-to-digital test equipment, and telecom sales. The company also broke past the break-even barrier, earning two cents per share after eliminating an additional two cents from a favorable tax ruling.

Also encouraging, management expects sales of some $76m during the seasonally slow third quarter, with about a penny of earnings. Offsetting weakness from vacationing Europe will be strength in Power's burgeoning storage and server businesses.

The recent share price of $6.43 yields an enterprise value (market cap minus net cash) of about 1.5x forward sales. (We guesstimated sales at a conservative $310m based on the second-quarter results and the third-quarter projection.) If management resolves its remaining challenges and continues to prove the likelihood of Z-One ascendancy, expect the enterprise-value-to-sales multiple for this debt-free company to return to its historic 2.75x. With no further increases in sales, that would push the price to $10.50.

But that's only the beginning. Because it's digital, Z-One can apply to any industry, and the company is reporting wins across the board in all types of markets. The sales cycle saunters—it typically takes 12 to 18 months before programs ramp on Z-One design wins. So have patience. As we've been saying for several years, Power-One is a long-term play on a fundamental innovation that will not pay off for fully half a decade.

— *Charlie Burger*

curve for 25 years, ahead of aggressive rivals such as **Asahi Glass** of Japan, **Nippon Electric Glass**, and NH Techno Glass, a division of **Hoya Corporation**. Not a task for tyros, the onionskin glass sheets must emerge ultraflat and superclean. Corning will continue to rely on its patented fusion process to develop advanced glass compositions and new manufacturing methods, resulting in thinner/lighter displays and reducing costs in both Corning's and its customers' processes.

For example, Corning can now make its near-perfect panels without arsenic and other heavy metals that may soon face stiffer regulations. And panel makers are currently testing a new proprietary process that significantly upgrades Corning's already industry-leading glass. The new glass will lower manufacturing costs markedly for panel makers, who will need to spend less time and effort conditioning the substrates. Corning is also working with manufacturers to develop better bonding methods, which currently rely on epoxy to hold the substrates together. Advanced bonding will in turn require Corning's new glass and will noticeably improve picture quality.

Prices for LCD glass are falling steadily, good news for Corning because it's helping to drive down the price and spur demand of LCD televisions. Last Christmas, 32-inch TVs sold out. Yet by March 2006, the average price for a 32-inch LCD model had fallen still further—down 47 percent compared to March 2005. Based on shipments from manufacturers to retailers, sales of LCD sets increased to 19 percent of the color TV market in the second quarter, up from 13 percent during the holiday quarter. Rounding out the market, sales of notebook computers increased slightly to 37 percent of all computers sold during the quarter and LCD monitors rose to 80 percent of total monitor sales, up from 74 percent sequentially.

Despite the 5 percent per year drop in average selling price of LCD substrates, Corning managed to more than triple its gross margin in this business from 20 percent in 1996 to 65 percent last year. The company has cut its manufacturing costs 14 percent annually by increasing plant sizes (resulting in dramatic decreases in overhead cost per unit), increasing substrate sizes, improving yields, automating, extending equipment life, advancing glass composition, improving packaging, and locating factories closer to customers to reduce shipping and labor costs.

## Corning cultivates the telecosm

Thanks in no small part to Corning, **Verizon**'s (VZ) decision to string fiber all the way to homes and businesses is looking smarter every day. After passing 1 million homes in 2004 and 2 million in 2005, the national carrier is poised to pass fiber past another 3 million homes this year and a total of 16 million by the end of the decade. Both **BellSouth** (BLS) and **AT&T** (T) claim that the cost to build an all-fiber plant far outweighs any savings on maintenance. But Verizon is already reporting operational savings as it reduces the cost to deploy fiber, and the carrier expects to save billions in maintenance costs with robust fiber and passive optics versus aging copper and electronics.

Helping to speed Verizon down the broadband-fiber learning curve far ahead of its copper-centric rivals, Corning is leveraging its own learning of this emerging application. Last year, Corning reduced the revenue it can expect per home passed to a range of between $90 and $210 from a range of between $130 and $220 the previous year. These figures cover aerial and buried deployments of all sizes and include the cost of connecting to a home, meaning Verizon is not only paying less per pass and connect, it is also doing it faster and better.

Here's one way. Over the past two years, Corning has shrunk, by three-quarters, the size of the cabinets that house Verizon's optical splitters. Integral to any passive optical network, splitters divide the signal coming from the central office among 32 end users. Corning's cabinets each serve 432 users, meaning Verizon must install about one per neighborhood. That was a pain when the cabinets were a refrigerator-sized eyesores that required a small crane to place them. Using its new bend tolerant fiber and associated fiber coating which can be bowed and twisted with negligible loss of power in the optical transmission, Corning figured out how to manufacture the cabinets at a quarter of their original size without tangling the capellini and clamshells of wires and connectors. Reduced are shipping costs and increased are options for locating the cabinets. Now one person can place them and still check your connection without tearing his angel-hair out.

In a standard deployment, multi-fiber cables are strung from the cabinets across the local landscape of telephone poles. Originally, to connect to its customers, Verizon had to open the cable at periodic poles, pull out fibers, and splice them to a terminal—meaning more labor challenges, this time from a bucket truck. Here's how Corning solves this one. Based on information from the customer, Corning does the cable entry and splicing in its factory, leaving to the field technician only the task of plugging the customers' fibers into a connector. As a result, Verizon can now install its distribution network in a third the time at a third the original cost.

Corning may even help a sagging **Microvision** (MVIS), whose head-up displays for fighter planes and luxury cars and automotive repair schematics currently display 32 shades of a monotonous monochrome red. Where's the color? Waiting for practical and affordable green lasers. To project color images, a light engine containing red, blue, and green lasers is required. Blue lasers come from **Sanyo**, **Nichia**, and some others, and red are a commodity. But green has not been commercially

available from compact, efficient sources and hence full-color displays are still fictional in small portable devices.

Now Corning has invented a high-power, directly modulated green semiconductor laser that produces a pure light in a low-cost package. Management claims the product, now being tested with major consumer electronics firms, is being well received. With mobile display applications increasing, as ordained by the teleputer paradigm, this could mean several hundred million dollars of business per year for Corning. In addition to cell phones are head-up displays and integrated camera and laptop projectors. Imagine being able to view a video from a projector the size of your cell phone or having navigation and safety information projected in living color on the windshield of your car as you drive.

## Promoting health through palm reading

With international pharmaceutical firms, Corning has been beta-testing a drug-screening system that performs 384 simultaneous cell-level experiments on a disposable microplate smaller than your palm. That's a big deal for drug companies.

In their relentless search for those rare blockbuster medicines, pharma researchers routinely isolate molecules associated with a disease and observe their reaction to a potential drug compound. A fluorescent molecule, called a "label," is added to the mix as an indicator of the reaction. Fluorescence can cause both false positive and false negative results, lengthening the already long drug discovery process.

With Corning's new microplate technology, researchers can screen hundreds of drug compounds simultaneously—up to 40 thousand per day—without labels. For drug companies, that's screening at a screeching pace. Each of the 384 wells on the microplate is coupled to an optical waveguide sensor which detects extremely small changes in mass by measuring very slight changes in refractive index, enabling fluorescent-free detection of biomolecular binding and cell function. Not only can they work much faster, researchers can now screen targets that have been intractable because of labeling. Since the microplate is a platform technology, Corning can eventually add new features, such as the ability to measure reaction kinetics.

Corning is also helping pharmaceutical firms manufacture drugs. For commercial-scale processing, microreactors are used to mix and heat chemicals. Microreactors are large and costly and contain complex glass components to control the mixing and heating of chemicals during manufacturing. Glass and processing are Corning's fortes, and its new microreactor, now in prototype testing with big pharma and soon with large chemical firms, precisely controls mixing, mass, and heat transfer, significantly reducing the size and expense of manufacturing equipment while improving yield and producing purer chemicals using less energy.

Management expects pharma revenues to gradually rise into the hundreds of millions per year and become profitable.

## Ceramic clears air for investors

In the early 1970s, Corning invented the cellular ceramic substrate that has become the standard technology used to make automobile catalytic converters, now a $500 million annual business for Corning. Though not a telecosm technology, if you're invested in Corning, you still need to know about it because governments are in the process of doubling this business for Corning. Regulators worldwide have begun tightening the noose around diesel manufacturers, requiring a new generation of catalytic converters.

To control gas emissions, Corning is building on its basic substrate technology—a ceramic honeycomb coated with a precious metal catalyst. As hot exhaust gases flow through the converter, they react with the catalyst to coat the interior surfaces of the substrate and clean exhaust comes out. To block particulates, Corning is developing another filter with a honeycomb structure but with each channel plugged on either the inlet side or outlet side in a checkerboard pattern. Exhaust enters the channels open on the inlet side and soot is trapped on the walls of the filters that separate the channels. Since the exhaust cannot pass through the plugged outlets, it is forced to flow through the filters to the outlet channels, where it passes to the air sans soot.

To prevent the particulate filter from clogging, when soot builds up on the walls of the inlet channels, the engine is programmed to burn it with high levels of heat. Most of these filters are catalyzed, and great care must be taken to prevent the catalyst from plugging the filter walls. Thus, key to the filter's functionality are its porosity and thermal properties, which must be honed to each manufacturer's engine specs. That makes these filters a headache to design and manufacture, even for a process pro like Corning.

Corning has won the lion's share of heavy-duty diesel platforms and has been working closely with leading engine manufacturers as they begin to ramp production to meet U.S. diesel regs set to tighten next year. The company has also entered the light-duty market (pickups and cars) with its unique aluminum titanate, single-piece filter that works as well as competing products based on silicon carbide. Because of concerns about durability and cost, Corning in 2001 eschewed silicon carbide. Validating these concerns is **Volkswagen**, the world's largest diesel car manufacture, now using Corning filters. European rivals are reportedly ready to sign on as well.

Still losing money, the budding diesel business reached $100 million last year. With about 2.7 million heavy-duty and 13 million light-duty vehicles produced

annually, Corning expects those sales to accelerate beyond breakeven later this year and to reach $600 million by 2010, more than today's auto business. To meet demand, management plans to invest some $300 million in plant expansions and automation over the next 5 years.

## Fitting financials

Thus we can expect diesel to develop into a nice business for Corning, in addition to last-mile fiber networks, green lasers, and drug discovery and manufacturing. But display glass is clearly driving the company today, giving Corning the "feel" of a riskier one-product company. During the first half of this year, revenue from all businesses except display and telecom dropped to 26 percent of total sales from 28 percent during the comparable period last year. Operationally, these units broke even. Telecom, which includes fiber, cable, and equipment, contributed to a more respectable third of total sales. However, that was down from 38 percent last year. Worse, the unit contributed only 5 percent to operational income. The remaining 95 percent came from display glass, which surpassed telecom in percentage of total sales, ascending from a third to 40 percent.

As of June, total cash and investments plus receivables of $5,772 million fell just $257 million short of total book liabilities of $5,515 million, a remarkable improvement over last year's shortfall of $1,348 million. Short-term cash, investments, and receivables of $3,108 million surpassed current liabilities of $2,372 million for a liquid current ratio of 1.3, up from 1.2 the previous June. During 2005, Corning completed three years of $500 million-plus earnings improvement. Cash flow from operations increased 90 percent over 2004 to $1.9 billion, with free cash flow (cash flow minus capex) of $400 million. Expect free cash flow to continue positive this year along with further improvements in the balance sheet.

Including management's outlook, Corning is on a trajectory to earn about $1.03 per share this year, 21 percent more than in 2005. But a seasonally strong fourth quarter for LCD glass should enable Corning to beat that. At the recent price of $19, the stock is trading at just 18.4 times our conservative $1.03 estimate. If the LCD market is as young as it looks and if Corning succeeds with some of its other technologies, that's cheap.

## GLW never stops short

The longer-term challenge for Corning is to ramp some of its other businesses and research projects with the same gusto as the current LCD surge. Since most of the world's carriers are still nursing their aging copper connections, last-mile fiber, cable, and equipment could well see become next big riser, extending perhaps for over a decade. Technologies now being incubated in Corning's labs include fuel cells, ultracapacitors for hybrids, photovoltaics, and inorganic membranes.

You can count on Corning to commercialize many of these technologies. Beginning in 1879 with the invention of the glass envelope for Edison's light bulb, Corning has propelled products to market by first inventing new materials and then devising the manufacturing processes and building the factories that put the products into the hands of consumers and businesses. It was Corning that learned how to mass produce the television bulb and it's Corning that is now the world's leading supplier of glass substrates for LCDs.

Religiously tithing its sales to research, development, and engineering, the company invests two-thirds of that on development and engineering and a third on research, which in turn is split between incubating new businesses and advancing current ones. Historically, Corning has created one to two major businesses per decade, and the company aims to double that rate over the next five to fifteen years. If it can do that, then near-term inventory undulations in the LCD supply chain will hold no lasting significance for buy-and-hold investors.

*– Charlie Burger, with George Gilder*
*August 16, 2006*

## Got Questions?

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

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