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SEPTEMBER 23 • 2013 EDITION

Forbes

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HAS CREATED
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BILLION-DOLLAR
FORTUNE.

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REINVENTING AMERICA

CORNING



A glassblower wearing a dark, protective suit and a hood with a yellow stripe is working in a glass furnace. The scene is illuminated by the intense orange and yellow light of the molten glass. The blower is using a long metal rod to shape a piece of glass. The background shows the interior of the furnace with metal mesh screens.

WHERE THE GLASS IS ALWAYS HALF FULL

Corning has lasted a century and a half through boom and bust yet always comes up with the glass inventors like Thomas Edison or Steve Jobs need to conquer new markets. CEO Wendell Weeks says the company's best days lie ahead.

BY CONNIE GUGLIELMO

PHOTOGRAPHS BY EVAN KAFKA

SEPTEMBER 23, 2013 FORBES



Corning CEO Wendell Weeks

“PEOPLE ARE VERY MUCH DISCOVERING ONE OF THE WORLD’S OLDEST MATERIALS ... AND GIVING US WAY MORE OPPORTUNITIES FOR PROBLEMS TO WORK ON.”

There’s glass everywhere. Dozens of brown paper lunch bags containing chunks of glass are stacked haphazardly on a long countertop in Matt Dejneka’s lab. Some bits have a dark hue, some cloudy, some speckled with the trapped air bubbles known in the trade as “seeds.” Most of them are clear and, despite the variations, look pretty much the same.

Except to Dejneka, a materials researcher at Corning Inc.’s high-security Sullivan Park Research Center. Each piece tells a story about the quest for formulations that are stronger, thinner, more flexible, more scratch resistant. Dejneka takes the lid off the same chemical bath he used to help cook up recipes for Gorilla Glass, the ultrathin layer that Steve Jobs picked to shield the iPhone in 2007. I’m handed a sharp glass scribe with a tungsten carbide cutting wheel and invited to scratch different prototypes. There’s one piece I just can’t mark. Dejneka nods, saying he had the same experience with that sample, and eagerly points to the exact spot on the counter where he did his scratch test last year. Corning introduced the new, tougher formulation this year as Gorilla Glass 3, the latest innovation in a product line that has gone from zero to \$1 billion in the five years after the iPhone debuted.

Was Gorilla Glass 3, then, discovered by accident? Gesturing at the bags behind him, Dejneka shakes his head. “There are no accidents.”

Those four words could sum up Corning’s 162-year history of continuous reinvention. No concoction is ever deemed an accident or a true failure since Corning believes in “patient capital,” the idea of investing in unproven technologies even if there’s no quick profit. The firm is rife with stories of inventions that sat on the shelves for decades until the right opportunity came along. The weather-resistant borosilicate glass designed for railroad signal lanterns gave rise to Pyrex cookware. The glass-ceramics technology

the company invented called Pyroceram was used to make CorningWare casserole dishes and missile nose cones. It's certainly the story of Gorilla Glass, invented in the 1960s and intended for car windshields and prison windows. Now it's the surface of 1.5 billion smartphones and tablets—and Corning gets \$3 for each one of those rectangles.

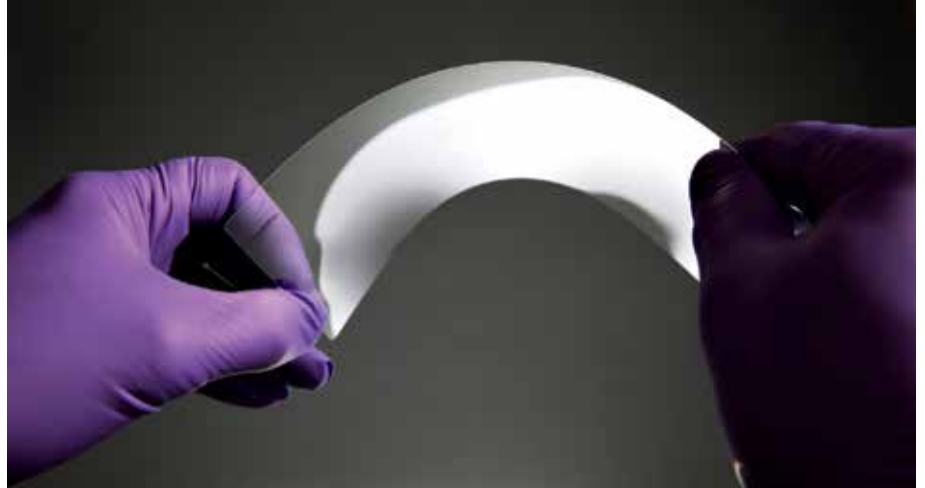
“We invent all sorts of stuff for weird reasons that then becomes something else,” says Adam Ellison, a Corning corporate research fellow and scientist who helped lead the Gorilla Glass project. Corning is all about “unique materials going through a unique process. That’s our future. That’s how we’re going to be around for another 162 years.”

Unlike so many once-mighty American manufacturers, Corning has survived several near-death experiences and bounced back in spectacular fashion with breakthrough inventions. In so doing it has single-handedly kept its eponymous town in New York, already hit by one of the highest unemployment rates in the state, on reasonably stable economic footing. The latest and worst moment was the dot-com crash of 2001, which wiped out the optical-fiber telecom industry, one of Corning’s biggest markets at the time. Its share price dropped from \$113 to \$1.10 as revenue fell from \$6.9 billion in 2000 to \$3.2 billion in 2002. It took a whopping \$5.5 billion loss in 2001. Weighed down by \$4 billion in debt, Corning cut jobs, started diversifying out of optic fiber and slashed research costs in half by moving most of its scientists back to headquarters to share equipment and ideas. From the array of ongoing projects they fast-tracked those with the greatest potential. Repeating history, they found a savior: a thin, strong glass that was ideal for LCD screens. That business came from nowhere and now accounts for nearly a third of its \$7.6 billion in 2012 sales and 78% of its \$1.6 billion in profit.

Yet here Corning is again with its savior turning south. An LCD glass glut

PLAYING WITH SAND

Corning’s glass blends good old silica with other minerals and clever manufacturing techniques to yield tough but flexible smartphone covers and flawless optic fibers. Its production prowess in LCD glass gives it a 20% edge over rivals in profitability.



Willow glass will protect wearable computers and solar-power-producing roof tiles.



The new BMW i8 is the first production car with Gorilla Glass, used in the rear windshield.



New versions of Gorilla Glass will be antireflective, shown in the circle in the sheet above.



Corning, N.Y. depends on the company named after it, and the company gives back plenty.

in 2011 knocked 50% off Corning's share price, and the next year demand for LCD TVs fell for the first time ever. While it is still the leader in the display glass market, Corning's market share has slipped from 54% in 2008 to 49% in 2012, according to Sanford C. Bernstein. Its LCD profit fell 32% in 2012 to \$1.6 billion.

Once again, Corning is on the hunt for its next big idea.

Corning CEO Wendell Weeks is a great seller of glass. He ticks off all the advantages: It's strong, light, thin, flexible and free of harmful chemicals like arsenic and mercury. He sees boundless possibilities for it everywhere. Its ability to disappear as a computing surface perfectly suits our age of ubiquitous touchscreens. Drawn into thin strands of ultraclear fused silica, it can ferry tens of thousands of times more bits of electronic data than traditional copper wires. "It's hard to predict what's going to happen tomorrow, but

it's pretty easy to see what direction it's going," says Weeks, who joined Corning's finance team in 1983 and ran the optical communications business during its boom and bust before being named CEO in 2005. "People are very much rediscovering one of the world's oldest materials, and, as a result, a lot of people are giving us way more opportunities for problems to work on."

The story of the time Steve Jobs called up Weeks and told him he was looking for a glass surface for his new device called the iPhone takes up just a page and a half in Walter Isaacson's biography of Apple's late cofounder. It's now tech folklore, especially the part about how Jobs sent Weeks a note on the day the iPhone shipped, saying simply, "We couldn't have done it without you." The note remains one of the few framed mementos in Weeks' office.

Weeks admits that Jobs was a big catalyst for Corning. Before the iPhone the pace at Corning was akin to a "slow steady heartbeat." But ensuring that Go-

rilla Glass met Jobs' exacting standards on time, says Weeks, was a "reminder to us of when we commit to something, how exactly and precisely and quickly we can move with very little bureaucracy. Everybody that was involved with that just ended up working round the clock to be able to hit that timeline. ... There wasn't a lot new. It just had to happen a lot faster."

The science behind Gorilla Glass had been in place for decades before the iPhone came along. To simplify a bit, glass is placed in a hot bath of molten salt. Some smaller sodium ions leave, and larger potassium ions from the salt bath replace them (think baseballs being replaced by softballs in a frame). As the glass cools, the ions get compressed, producing stress and a tough surface layer. To make flat sheets the glass is poured over a trough to slide down the sides. The two streams come together to form a thin and pristine surface on both sides. Corning has also been using this so-called fusion draw process since the 1980s to make LCD glass.

It used to take an average of ten years to develop a new glass. Corning's teams can now produce one in six months to a year, with a year being a luxury, the company says. (There have been seven formulations of Gorilla Glass since the first generation rolled off the production line.) In July Corning announced that Dell is bringing the first touch-enabled notebooks using new Gorilla Glass NTB to market this year. It's basically the same material as the surface of an iPhone, but Corning gets paid more for a bigger piece of glass and will see its gross margins rise a bit as its bigger capital investments are behind. Even bigger sheets of glass are next, as carmakers beginning next year with BMW will begin using Gorilla Glass on rear windows and sunroofs. It's a vindication of sorts: Gorilla Glass is based on Chemcor, a glass invented in the 1960s for use in windshields. Demand never materialized because automakers thought cheaper laminated

glass worked just fine. But Gorilla Glass weighs less and lowers the car's center of gravity, which increases fuel efficiency, something that matters more today. Corning has also announced efforts to make Gorilla Glass antireflective so the screen can be more easily read in sunlight. And because the surface of a smartphone may host more bacteria than a public toilet (little-known fact), Corning will soon add a version with an antimicrobial coating.

"It's not a new story—it's the same story updated for modern times," Weeks says. "It's not different than Edison coming to us and saying, 'How do I make [lightbulbs] economical?' and Steve Jobs coming to us and saying, 'I want to turn the whole face of the screen into a display, and I need it strong, and I need it to be transparent.'"

After Gorilla comes a new wonder material called Willow, a superflexible glass that's thinner than a dollar bill and can be manufactured inexpensively in a process where the glass is rolled up into a giant spool. It's being talked up for uses including ultrathin displays that wrap around skyscrapers, e-books, solar cells and wearable computers. Market research firm IHS expects the flexible display market to soar to \$41.3 billion in 2020 from \$100,000 this year. "We're going to have wearable computing that will measure the way our body works and to capture the world around us. ... That is certainly going to happen," Weeks says, noting that Corning is already working with unnamed customers on products. "Getting the right product-service combination that gets at that exactly and sets off that special feeling is a harder product to predict."

Corning's telecom division, 27% of its revenue, has benefited from a resurgence in fiber-optic installation to levels not seen since the dot-com days. Corning's latest innovation in optical fiber is a formula—and just as important, a coating—that allows the cable to bend and fit around curves without breaking. That makes laying fiber in the home easier



Operations chief of staff
Jeffrey Evenson

"THERE ARE A LOT OF SMART KIDS IN SILICON VALLEY. I THINK THEY HAVE ZERO PERCENT CHANCE TO DO WHAT WE DO."

and more affordable, says Claudio Maz-zali, business technology director for Corning's telecommunications business. "Three years ago you couldn't bend optical fibers. Now you can tie it in knots."

Signs are emerging of a return to solid growth. Second-quarter sales and profit topped analysts' estimates, thanks to better than expected sales in LCD glass (a business in which Corning has a 20% advantage over rivals in profitability) and an uptick in telecom demand in North America, Australia and China for residential fiber. Shares are up 11% percent this year.

The company with nine lives is finding another way to survive.

It's hard to separate the town of Corning from the firm named after it. Some 5,000 of the city's 11,000 residents work there, and it's by far the town's biggest employer. The announcement in April of a planned \$250 million expansion to the factory where Corning makes ceramic substrates and filters for heavy-duty diesel engines was cheered in the *Corning Leader* as a balance to the devastating news in 2012 of the closure of Sikorsky Helicopter's nearby factory with its 575 jobs. Corning Inc.'s beneficence is everywhere, helping to fund public parks, a businesses lobbying effort and the city's visitor center, housed in an old building next to the clock tower and outdoor square where on Thursday evenings in July free concerts draws residents and visitors sipping root beer floats given out by the community bank. Its Museum of Glass, founded in 1951 as a gift to commemorate the company's centennial, attracts more than 400,000 visitors each year and has grown so popular that a 100,000-square-foot expansion is in the works. "Their touch can be felt everywhere," says Denise Ackley, president of the chamber of commerce. "It's about more than just philanthropy." Weeks and his wife are frequent diners at local restaurants and are often spotted shopping at the local Wegmans grocery store, Ackley adds. "This just seems to ring of the focus of this company—to be a true part of the community in which they do business."

After a devastating flood hit the area in 1972, the company helped rebuild the downtown. Corning also helps promote and underwrite the Wineglass Marathon, which draws 5,000 to 8,000 runners, spectators and wine enthusiasts during the first weekend of October. The town is a short drive from the Finger Lakes region, home to a booming wine industry (pinot noir and Riesling are among the specialties).

The company's origins date back to the day Amory Houghton Sr. bought a stake in a small glass company called Cate & Phillips in 1851 in Somerville,

REINVENTING AMERICA CORNING

Mass. He expanded by buying stakes in other glassmakers, but his renamed Union Glass was nearly wiped out in the Panic of 1857. But things picked up, and his son, who was a good chemist, came up with some recipes for colored glass that got a lot of attention. They sold Union Glass and moved to New York to buy the struggling Brooklyn Flint Glass Works. But Brooklyn Glass got into trouble: Fire closed the factory for a few months in 1866, and rivals were producing cheaper glasses. Houghton's wife, an heiress, saved the company with a cash infusion. Then a banker from Corning, looking to transform the town into a glassmaking center, convinced the Houghtons to move their business upstate in return for \$50,000 in investments.

Corning Inc. contradicts the notion that much of tech innovation today is being done by young engineers at West Coast startups fueled by free sushi and flavored water. "Young people are just smarter," Facebook CEO Mark Zuckerberg famously noted at a startup event in 2007. But, at Corning, experience is a prized asset. Its people stick around for decades. While the average manufacturer loses 2% of its workforce each year, Corning loses only 1% of its technical talent. "We've had this notion we want to invent things that change people's lives. I don't say that as a glib thing," says Adam Ellison, who's been at Corning for 17 years.

"There are a lot of smart kids in Silicon Valley. I think they have zero percent chance to do what we do," says Jeffrey Evenson, who joined the company two years ago as operations chief of staff. "The reason for that is it's so interdisciplinary. For years it was all art: You had to have tried these things and built up a huge experience base to know what ingredient to mix where. With advances in modeling, semiconductors and detection techniques, we've improved our ability to measure things and control processes and are now able to bring multiple disciplines together."

BY THE NUMBERS

Gorilla Glass, chosen by Steve Jobs to cover the iPhone, is one of Corning's biggest hits.

MONEY CORNING MAKES PER PHONE WITH GORILLA GLASS

\$3

ESTIMATED NUMBER OF TOTAL SMARTPHONES SOLD IN 2013

1 BILLION

NUMBER OF CUSTOMERS THAT MAKE UP 42% OF GORILLA GLASS SALES.¹

2

¹LIKELY APPLE AND SAMSUNG. SOURCES: BERNSTEIN RESEARCH; GARTNER.

Corning builds teams of chemists, physicists and engineers of all stripes (ceramic, optical, mechanical, materials). Also on hand are plenty of master glassblowers, called gaffers, to mix and form the glass substrates.

Visitors to Sullivan Park, Corning's R&D center nicknamed "the Ponderosa," have to hand over their phones and cameras before entering. (A security guard allows in my smartphone but only after he tapes over the camera.) In between the offices and cubicles are labs—lots and lots of labs. Researchers clad in closed-toe shoes, safety goggles and heavy gloves oversee the mixing of chemicals and watch as glowing orbs of molten glass are pulled from box-shaped ovens. They're pondering the chemical makeup of new glass substrates and also how that material can be manufactured at low cost. Corning employs dozens of machinists to build and maintain new manufacturing and testing equipment. They have to, since glass production can be as tricky as the materials science. "They build their own machines so they can build stuff that no one else can make at that quality. That's what has enabled them to ride these cycles of growth," says Alberto Moel, an engineer and former IT strategist who now covers the display market for Sanford

C. Bernstein & Co. Example: the ribbon machine, conceived in 1921 by a Corning gaffer to produce millions of Edison's lightbulbs a day, is so perfect at its task that it's still state-of-the-art today.

In the advanced materials lab, a melting and forming facility that's bigger than a football field, new glass recipes are cooked up in ovens heated to almost 3,000 degrees and poured into platinum crucibles to cool. The glass can be pulled and stretched like taffy in the minute or so before it hardens, at about 1000 degrees. Researchers poke, prod and break the glass to study its strength, stability and resistance to scratching. Matt Dejneka cracks a piece of stressed-out glass, and it implodes before my eyes, leaving a sandy grit in the bottom of my shoe. "We're always looking for the edge of the cliff."

Armed with all of their new ideas, Corning's scientists, researchers and salespeople are making calls higher up the consumer electronics food chain than they ever had in the past. A few years ago, Dell says, Corning was just one of a number of indirect suppliers to the Asian manufacturers that made its computers and displays. That changed a few years ago after the iPhone launch, when Weeks himself approached Dell executives about collaborating on new products, says Alan Luecke, executive director of Dell's advanced innovation team. Suddenly, Corning engineers who rarely got outside their office, let alone outside Steuben County, were visiting Dell in Texas to brainstorm on R&D projects. The outreach is working. Dell is looking at uses of Willow and Corning's optical fiber in new products. "They've adopted a much more entrepreneurial innovative culture," Luecke says.

Weeks, like others, was surprised at the iPhone's success and what it meant for Gorilla Glass. Executives from just about every major consumer electronics company in the world have visited within the last 18 months. "It has made little old Corning, N.Y. a pretty popular destination for tech leaders around the world." **F**