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VOL. 2 NO. 36

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09.26.05

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The Big Picture



MicroOptical CEO Mark Spitzer tries on the company's video eyewear glasses, which create a big-screen effect out of tiny images.

***Star Trek*-style sunglasses can turn your cell phone into a full-screen image—if they don't make you sick.**

In a leather bag the size of a laptop, Mark Spitzer carries the tools of his trade: a Dell Axim PDA, a portable Pioneer DVD player, a Samsung phone with a Korean interface, a Bluetooth receiver, and batteries and cables to string them all together.

Not your routine fix-it guy, Mr. Spitzer is a physicist with a doctorate from Brown University—and CEO of MicroOptical, a privately held company that makes video eyewear that can be worn like sunglasses to get a big-screen experience wherever you are. “I like inventing

gadgets, but I am not really a gadgets person," says Mr. Spitzer. "I need all this for work."

For Mr. Spitzer, work entails producing the video goggles that, when hooked up to a DVD player, cell phone, or PDA, allow you to see movies, play games, or watch news clips on the run. "It needs no pupil-related adjustments, has no moving parts, and is sturdy," says Mr. Spitzer, cradling a 2.5-ounce pair. "You can drop it on the ground and it won't break."

Shaped like designer wraparound sunglasses, the eyewear differs in one important respect: A microdisplay fills the space that lenses would normally occupy. Slipped on like an ordinary pair of glasses and plugged into any composite video output, the device creates the effect of a 12-inch screen as seen from 3 feet away.

Mr. Spitzer hopes his glasses are the answer to the tiny-screen problem that's holding back consumers from viewing video on cell phones and other small, portable devices. But the technology itself still has problems—for example, some users experience nausea and may become disoriented. And most agree that the market for consumer electronics eyewear is too young to predict whether it will take off.

Most products developed thus far have been for military or industrial applications, and fewer than a dozen companies currently work in the segment. To date, the biggest customer for video eyewear has been the U.S. military, which has fueled the research on it. The U.S. government established a \$3-million fund for enhanced microdisplays with the 2006 Defense Appropriations Bill.

Now, though, companies are hoping to entice consumers with a must-have accessory for gadget freaks and gaming enthusiasts. "It has been an industry waiting to blossom for a long time," says Chris Chinnock, president of Insight Media, which publishes *Microdisplay Report*. "Now there's a convergence of all the right things with the technology in place, the improved design, ergonomics, and the price. It is all coming together."

This year, Westwood, Massachusetts-based MicroOptical inked a partnership with Orange, France Telecom's wireless unit. With 52 million customers in 16 countries, Orange plans to bundle the eyewear with Samsung phones for its European customers, allowing subscribers to view television, movies, photos, and

broadband Internet content.

"People want to watch music videos and TV, browse the web, and check their email on their cell phones on the go," says John C. Fan, founder and CEO of Kopin, which manufactures the microdisplays at the heart of the eyewear. "The cell phone's small screen is what has inhibited widespread consumer adoption."

Linking the glasses with a cell phone through a thin cable allows for up to five hours of video. The devices also can be connected to DVD players.

The Problem with Small

Video eyewear, and microdisplays in general, became possible when liquid crystal displays (LCDs) were invented in the early 1970s and became progressively higher quality. The first LCD color TV screen had 57,600 pixels in a 2.13-inch (diagonal) screen; today, a 0.97-inch screen has as many as 1.31 million pixels.

"We have nearly 100 times the number of pixels for the same area compared to the first LCD TV display," says Hang Choi, chief technology officer of Kopin. "Today we have microdisplays that have better resolution than a high-definition TV."

Kopin got into the display business with a \$10-million funding from the Defense Advanced Research Projects Agency (DARPA)—the research arm of the U.S. Department of Defense—to create military applications like helmet-mounted displays for pilots and displays built into night-vision glasses.

From there, Kopin graduated to building microdisplays for camcorders, viewfinders, and digital cameras, until melding them directly into eyewear seemed like the logical next step.

Kopin's technology was synthesized in 1984 at MIT's Lincoln Lab, where Mr. Fan worked as the leader of the Electronic Materials Group. He led research on thin photovoltaic cells and wafer engineering before he branched out on his own. The company's microdisplays, manufactured in South Korean foundries, are created from a slice of silicon one-hundredth the thickness of human hair.

Kopin now ships more than 400,000 displays every month but microdisplays for eyewear account for only 50,000 shipments a year, says Mr. Fan. His Taunton, Massachusetts-based company reported revenue of \$21 million for the second quarter of 2005, compared to total

revenue of \$23.6 million in the second quarter of 2004 and \$18.9 million in the first quarter of 2005.

Although video eyewear has yet to find commercial use, the possibilities seem immense. "If Apple plans to move into video iPods, then who is going to watch full-length movies on a 2-inch screen?" says Mr. Fan. "Video eyewear is the only way to create such an application."

Mobile content is a potential market. MicroOptical estimates that by 2008 there will be 500 million handsets in Asia, many offering the eyewear accessory—much like a Bluetooth hands-free option is bundled in phones today.

"If Apple plans to move into video iPods, then who is going to watch full-length movies on a 2-inch screen? Video eyewear is the only way to create such an application."

JOHN C. FAN, CEO, KOPIN

"Everyone wants a very high-resolution, lightweight, and portable screen," says Kopin's Mr. Fan.

Analysts say it is difficult to judge if MicroOptical's estimates are on the mark, especially since the technology is so nascent and microdisplays for personal eyewear still have to overcome significant marketing and user experience challenges. Insight Media and the McLaughlin Consulting Group estimate the worldwide market for microdisplays was \$73 million in 2004, and project that it will grow to \$1 billion by 2008.



Kopin CEO John C. Fan is betting that video eyewear will catch on.

Hitting the Mass Market

Cracking the video eyewear market could well depend on aggressive pricing—some-where below \$200, says Paul Travers, CEO of Icuiti, a privately held firm based in Rochester, New York. Icuiti introduced a model for industrial use at \$499 earlier this year. “You get the price below \$200 and you can hit the mass market,” says Mr. Travers. “But at \$500 you are just at the beginning of the space.”

Keeping costs low has been tough, as consumers have demanded higher-resolution images in smaller and smaller packages.

Kopin’s entry-level product has a 230,000-dots-per-inch resolution, almost on par with that of a color TV, but even that’s not good enough up close. Its higher-end microdisplays offer HDTV quality, but those are too expensive to turn into consumer products.

And there remains a more vexing problem. Many users become nauseous and disoriented after wearing the eyewear for just a few minutes; the eyewear seals out the outside environment completely. Others can feel claustrophobic in such an immersive experience, while some report the device can be stressful on the eyes.

“You have to converge two images in front of the eye and if your convergence angle isn’t correct, the focus isn’t right, or the distance is not proper, it can make it a difficult experience for some users,” says Insight Media’s Mr. Chinnock.

Video eyewear makers are trying to correct these faults by creating eyeglasses that will offer wearers a peek into their normal environment. MicroOptical promises its latest model will allow users to “see around” the screen, and contends it has run tests to ensure that the product is safe.

Kimberley Allen, director of display technology and strategy for iSuppli, an electronics market research firm, says that companies are doing a better job with ergonomics and optics, but there is no quick or single solution.

“It will be another three years at least before we can really have a product that can give users a fantastic experience.”

MARK SPITZER, CEO,
MICROOPTICAL

“There’s no way to capture the whole market with one product,” says Ms. Allen. “For movies, the all-dark glasses will work but for other applications they will have to build a product that lets them be more comfortable with their outside environment. It all depends on the applications, but I still haven’t seen a solution that completely works.”

The queasiness won’t be easy to quell, agrees Insight Media. But sometimes all it takes is a little getting used to, like in-flight turbulence during air travel, say analysts. MicroOptical says it is working on the problem, especially by improving the ergonomics of its product.

For example, the eyewear can be customized to an extent by adjusting the bridge that perches the glasses on the nose. Another potential solution is to make the product even lighter, or integrate microdisplays into regular eyewear to create a product similar to bifocal eyeglasses (this plan is still under development).

“It will be another three years at least before we can really have a product that can give users a fantastic experience,” says Mr. Spitzer. While MicroOptical’s research department tries to figure out how to prevent users from feeling queasy while sporting the glasses, there’s a more immediate marketing problem to solve.

Small firms like MicroOptical and Icuiti lack the distribution channels and clout to reach mass consumers, says Mr. Chinnock. They will need partners like Sony, Ericsson, Nokia, or Samsung for that. Small U.S.-based firms also face competition from Asia, including China’s Shenzhen Oriscape Electronic and Japan’s Scalat.

Even with everything done right, winning consumer acceptance for these niche products could be tough. “You have to convince users that it is a mainstream thing and not a lunatic fringe that would want to use it,” says Mr. Chinnock. “And for that, consumers have to see normal-seeming people use it in familiar places like a train or plane before they go out and buy it.”

MicroOptical’s Mr. Spitzer knows he faces a daunting task. “You want to know what keeps me awake at night? I think that the technology is ready today but the sales are still five years away. We really have to work to educate customers about this.”

He isn’t exactly a fast-off-the-blocks consumer himself. His dream right now is to get himself a good digital camera.