



cleverdis

SPECIAL REPORT

NEC LCD Solutions:
Thinking Outside
the Box



NEC



001



21.3-inch QXGA Monochrome TFT LCD
NL204153BM21-01



20.1-inch QXGA Color TFT LCD
NL256204AC15-02



12.1-inch XGA Color TFT LCD
NL10276BC24-13



8.4-inch XGA Color TFT LCD
NL10276BC16-01

21.3-inch UXGA Color TFT LCD
NL160120BC27-02



The world is changing ever more rapidly, and those who think times will get easier again had better think twice. Times have changed. Approaches to business are changing, and those who don't evolve will fade to extinction. Now, more than ever, controlling costs and estimating return on investment (ROI) have become essential. In a business world where many products and services are harder and harder to differentiate, the solution to obtaining increased profits lies in increasing efficiency and enhancing one's corporate image. To this end, choices are sometimes difficult in a minefield of conflicting information about new technologies, all of which, if we are to believe the pundits, will lead to greater efficiency and ROI! Often it's hard to really estimate the feasibility of a new project's ability to bring value to a corporation. Frequently value is determined by price. The lowest-priced product is generally perceived to have greater value over the higher-priced product from a competitor. In reality, value is a more complex balance of factors, one of which just happens to be price. This is true in many markets and applications involving the use of flat panel displays. Although there are some large display markets, such as those for PCs, desktop monitors and consumer TVs where LCDs are purchased as commodity products, there are a host of smaller markets where the display needs are more complex and where the actual cost of a display is but one factor in the value proposition. Other factors may include long-term product support, advanced feature sets that optimize viewing angle or enable a product to be viewed in a variety of lighting environments, backward compatibility and consistency of supply (even in periods of constrained product availability). Few display suppliers take these factors into account when they design flat panel displays. NEC is a notable exception. In this Special Report, we examine the way in which NEC addresses the entire value chain in flat panel display markets, and we take a closer look at the technological advances that enable new solutions in new vertical markets where flat displays have never been considered before.

edito editorial

Richard Barnes, Editor-in-Chief



Richard Barnes, has been working as a journalist and presenter since 1980, winning, in 1984, the Pater Award for Radio Journalism in Australia and working as news editor for major networks. He moved to Europe in 1986, where he hosted and produced radio and TV programs for a number of years and has also had feature articles published in prestigious magazines worldwide. His TV reports are still regularly featured on CNN. In 1999, he joined Cleverdis as Editor-in-Chief. Today, his work is extended to running the business unit and broad implication in other communication projects. His expertise in the field means he's now often called upon to counsel leading companies in the field worldwide.



Often overshadowed, the $\geq 10''$ TFT LCD industrial market continues impressive growth

By Ross Young, President, DisplaySearch

The TFT LCD industrial/public display market has enjoyed impressive growth over the past few years, with even more impressive growth expected in the future, but hardly anyone has noticed. As shown in Figure 1, 26% growth was earned in 2002 to 1.9 million units and 26% growth is expected again in 2003 to 2.4 million units. Despite these positive results, this market has received little notice due to higher growth in higher volume markets such as LCD monitors, LCD TVs and this year, notebook PCs. Looking forward, we expect 29% CAGR on a unit basis to 6.5 million units with public displays rising at a 140% CAGR and industrial displays rising at 27% CAGR. For the past year, supply constraints have limited growth, but significant supply growth is expected on record capital spending of \$8.3 billion expected in 2004. As a result, we expect to see significant improvements in availability of not only 10"-15" industrial panels, but also 30"-42"+ panels for digital signage, with prices falling significantly on lower costs from larger substrates.

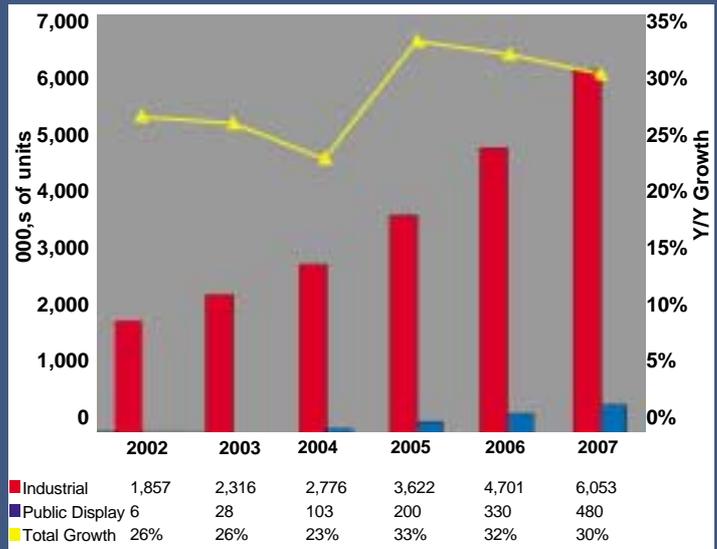


Figure 1: 2002 - 2007 $\geq 10''$ Industrial/Public Display TFT LCD Shipment Forecast

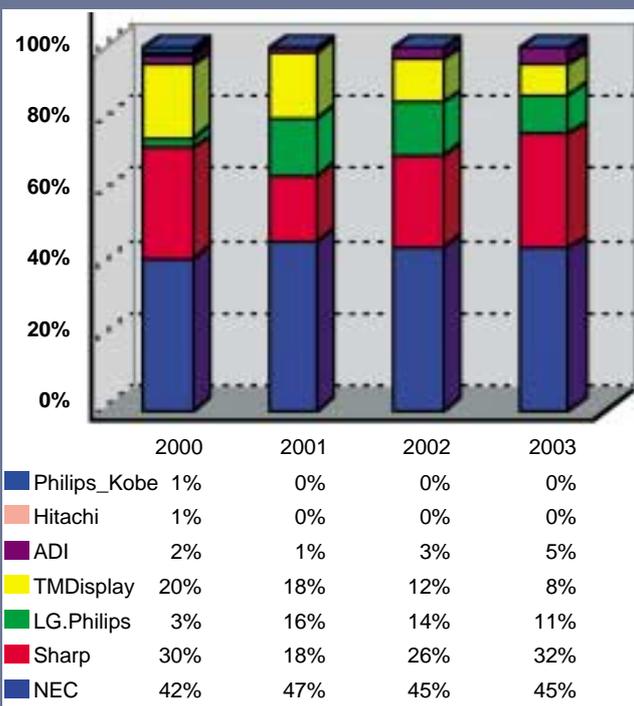


Figure 2: 2000 - 2003 10.4" VGA Shipments by Manufacturer

We define the industrial/public market as a superset of a large number of smaller applications including factory automation, POS, kiosks, medical, digital signage, trade show displays, education, etc. In the case of large-area TFT LCD penetration on a unit basis, most of the market has been at 10.4" and 12.1" with 10.4" VGA and 12.1" SVGA accounting for 96% of the 2000 market and 74% of the 2003 market with 15" making up most of the difference. Looking forward, we expect to see larger TFT LCDs make significant inroads into the digital signage market as replacements for PDPs due to their lack of burn-in, longer lifetimes and better front-of-screen quality in high ambient light environments. In the largest segment, 10.4" VGA, NEC has been the market leader as shown in figure 2, with at least a 45% share from 2000 to 2003. Sharp has led the 12" and 15" markets. For more information on DisplaySearch's industrial shipment results and forecasts, please contact Kendra Smith at Kendra@displaysearch.com.

While the computer, consumer, and communications applications represent the largest markets for flat panel displays, they tend to be subject to commoditization and volatile pricing. There are other markets in which display performance and ability to meet specific customer needs are paramount. In these markets, TFT-LCD manufacturers that have advanced technology capabilities and a well-developed sales and engineering force can find profitable niches. The key factors for success include the ability to discover customer needs, deliver products with the appropriate level of performance, and provide an assured source of replacement parts for long periods of time.

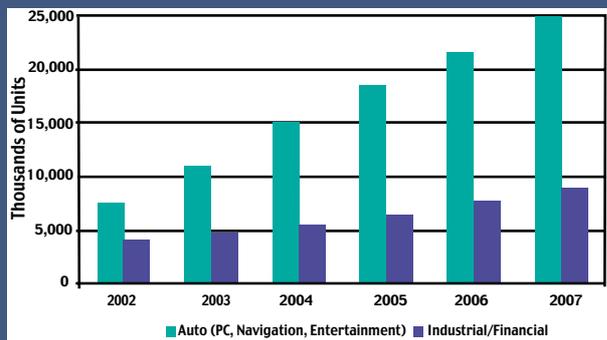


Figure 3: Niche TFT-LCD markets: Industrial/financial, auto

gaming, and other entertainment content is leading car makers to rapidly install in-line displays, following several years of strong growth in the aftermarket business. The market potential for direct-view TFT-LCD panels will reach \$1 billion in 2004 for the industrial/financial applications, and in 2006 for the automotive segment.

The market for TFT-LCDs in medical applications is currently over \$100 million, with significant growth in large, high-resolution displays for radiology, patient monitoring, PACS, and other diagnostic applications, mainly through the replacement of CRTs. The medical market in particular demands the highest quality of display performance, and has unique requirements, such as the need to have high bit depth instead of color in radiology applications.

One of the fastest-growing specialty markets is in commercial passenger entertainment displays. These are most noticeable as seat-back displays in aircraft, but are also being installed in passenger trains, subways, buses, and other vehicles. TFT-LCDs that are compact and have good video performance have

Opportunities for TFT-LCD in niche markets: meeting the customer needs

Paul Semenza, iSuppli/Stanford Resources

There are several market segments that exemplify the above characteristics. A key segment is in the industrial/financial applications, which include analytical, process control, and test and measurement equipment, as well as kiosks, point-of-sale, point-of-purchase, automated teller machines, and gas pumps. In these applications, the increased performance, productivity, and revenue-generation possibilities afforded by TFT-LCD panels are causing a transition from older CRT displays and the creation of new applications.

Automotive applications are growing even faster in unit terms, although the smaller average screen size means the revenues are smaller overall. Here, the ability of high-performance TFT-LCDs to show map, navigation, and operator information, as well as video,

enabled the rollout of customized passenger entertainment services in all aircraft classes, as well as advertising revenues in trains and buses. This market is expected to more than double in size between 2004 and 2006.

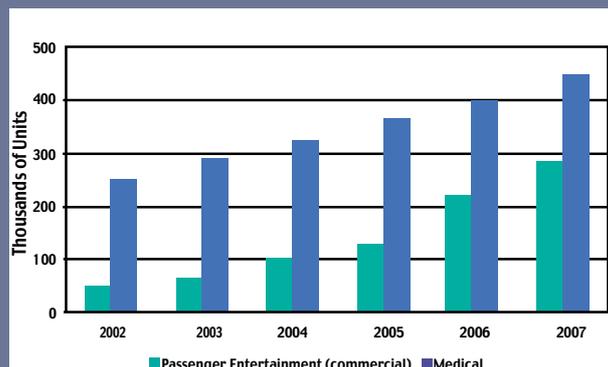


Figure 4: Niche TFT-LCD markets: passenger/entertainment, medical



Shigehiko Satoh

Shigehiko Satoh is the associate vice president and general manager of the displays strategic business unit at NEC Electronics America, Inc. where he oversees sales, marketing and engineering activities for the company's LCD and PDP products for the North American market. Dr. Satoh joined NEC Electronics Japan in 1969. He holds bachelor and doctorate degrees in applied physics from Tohoku University in Japan.

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Omid Milani

Omid Milani is director of the displays strategic business unit at NEC Electronics America, Inc. where he manages and directs its marketing, operations and engineering functions. Under his leadership, the company has become one of the top two TFT-LCD suppliers in the United States. Mr. Milani holds B.S. degrees in engineering and mathematics and an M.S. degree in electrical engineering.



double interview

NEC ELECTRONICS AMERICA, INC., HEADQUARTERED IN SANTA CLARA, CALIFORNIA IS A DEVELOPER, MANUFACTURER AND SUPPLIER OF SEMICONDUCTOR-BASED ADVANCED TECHNOLOGY SOLUTIONS, SYSTEM SOLUTIONS AND PLATFORM SOLUTIONS. A WHOLLY OWNED SUBSIDIARY OF NEC ELECTRONICS CORPORATION, THE COMPANY OFFERS TO THE NORTH AMERICAN MARKET A BROAD RANGE OF DIFFERENTIATED SEMICONDUCTOR SOLUTIONS COMPRISING STANDARD PRODUCTS, ASSPs, ASCPs AND ASICs, ALL BACKED BY OUTSTANDING TECHNICAL SUPPORT AND THE GLOBAL MANUFACTURING CAPABILITIES OF ITS PARENT COMPANY. AN EXTENSIVE NETWORK OF REGIONAL SALES, REPRESENTATIVE AND DISTRIBUTOR OFFICES SERVES CUSTOMERS THROUGH THE U.S., CANADA AND MEXICO. IN ADDITION, NEC ELECTRONICS AMERICA IS THE NORTH AMERICAN SALES AND MARKETING CHANNEL, SPECIALIZING IN INDUSTRIAL APPLICATIONS, FOR ACTIVE-MATRIX LCDs FROM NEC TECHNOLOGIES, LTD.

Cleverdis: What is unique about NEC's LCD business that sets NEC apart from other LCD suppliers? And, what are your target markets?

OM: NEC's LCD focus is on a broad category of applications referred to by display analysts as the industrial LCD market. Within this category there are applications encompassing test and measurement equipment; medical systems; factory automation equipment; POS products; kiosks and ATMs; entertainment and office automation equipment; transportation systems and much more. These applications generally require a more extensive support model and third-party integration not available by suppliers involved in the high-commodity markets such as those for notebook PCs, desktop monitors, or LCD TVs. While the TAM for the industrial market is smaller than the PC, desktop monitor or LCD TV markets, it is an area where we (NEC), as an LCD supplier, can better leverage our core technologies. By targeting the industrial market, we are able to satisfy the niche requirements

of the diverse applications making up the industrial space.

Cleverdis: How do you go to market?

SS: Although we have a sizeable direct account base, we also do a large percentage of our business through our distribution partners and a small network of third-party partners we refer to as value-added partners (VAPs). Within the industrial display market, there are a number of mid- to small-tier accounts that are best serviced through our distributor partners or VAPs. These accounts may require special logistics support, JIT fulfillment programs or value-added integration capabilities that are best serviced through one of our distributors or third-party partners. Our relationships with our distributors and VAPs give us the ability to meet the needs of a wider variety of accounts and applications and give mid- to smaller-tier customers access to tailored display solutions provided by trusted NEC partners.

Cleverdis: Who are your distributors and VAPs?

OM: Our distribution partners are Arrow Electronics, Avnet Applied Computing Solutions, Bell Microproducts, Edge Electronics, Future Electronics, Omni Displays and Symmetry Electronics Corporation. Our VAPs are DuPont Display Solutions and Raintree Systems.

Cleverdis: NEC traditionally is not the price leader for LCDs in the market, and yet your displays sell very well in the industrial and medical sectors. How is this possible and how does "total cost of ownership" (TCO) factor into the equation?

OM: As mentioned earlier, in servicing the industrial market, NEC is better able to leverage its support model and core technologies. How people calculate TCO is still often a mystery. In many cases customers still do not calculate TCO, so we calculate it for them, or guide them through what we consider to be key factors in their calculations. We believe that the



premium people pay for an NEC panel is more than compensated by the value that they receive. In these markets, the cost of the panel and the panel technology itself are not necessarily the only important criteria. Even though NEC has been showing its technology leadership for many years, from our customers' point of view, what they're most concerned about is having a product with excellent technology that they can rely on for many years and for which they can receive outstanding customer service for the life of the product. They can also customize the panels for specific applications. For example, one customer may want to use a panel for indoor/outdoor applications. Outdoors, there are temperature, brightness and reflection issues, so NEC can provide the solutions customers are looking for. We have established an infrastructure in North America where we use third-party partners and our distributors to enhance our panels to match customer's exact requirements. This is very valuable to the customer.

SS: Another factor in TCO is LCD redesigns. If a display supplier makes an LCD obsolete and changes the footprint for the replacement display, then a customer may have to undergo costly design changes in the product. In our case, we retain the same panel footprint, avoiding very costly redesign problems for the customer. For future investments, it's important to understand that when industrial or medical integrators are designing for major facilities, the project may span several years. If an LCD panel changes or is made obsolete during that time, those integrators and product designers will be faced with major headaches. For this reason, NEC has developed a systematic 24-month schedule to prevent this type of scenario. First, we issue a pre-notification of phase-out, and then follow it six months later with

the official phase-out notice, which includes the schedule for last-time-buy forecast submission, last-time-buy purchase order submissions, and final delivery of all last-time-buy products ordered. Deadlines for these milestone are completed at six-month intervals, giving customers a full 24 months from first notification to final phase-out.

Cleverdis: What would you say is the main differentiating factor of NEC in the market sector compared to your main competitors?

SS: Service differentiation is a big advantage for the industrial segments. Backward compatibility plays a big role as well. NEC continues to innovate with new technologies in order to enable growth for new markets. We have recently introduced transfective LCD technology, which is a mixture of reflection-type LCDs and transmission-type devices. If you take the equipment outdoors, you can use sunlight to look at the screen, and when you're in a dark space, it works with the backlight. This also has the same footprint, making it backward compatible.

Cleverdis: Another technical advance has come in the form of your wide viewing angle technology...

OM: Yes, our version of IPS, which is called SFT, is continuing to improve, and now we have Super-Advanced SFT, which allows not only the best viewing angle, but also the best color reproduction at any angle, improved brightness and faster response times, which are essential in many medical and industrial applications. In the PC market, most people can adjust their PC displays so that viewing angle does not matter.

Cleverdis: How does NEC's strategy help customers differentiate themselves?

SS: Our customers want to introduce a unique product to the market faster than their competitors. NEC's display solutions enable our customers to design base products that offer a variety of feature sets. This is possible because we offer a variety of LCDs, with differentiated feature sets, that are all plug and play compatible. This translates into more flexible equipment designs for our customers. What Dell does in the consumer PC market, we do in the display sector, allowing customers to "build to spec." Having this flexibility, especially in these markets where engineering resources are so limited, translates into substantial cost savings for customers. At the end of the day, even if technologies are similar, the business model becomes a really compelling story: "Which supplier is easiest to deal with and has the least amount of risk going forward over an extended period of time."

Cleverdis: There have been some major changes to the structure of NEC. Tell us about them and how they'll affect service to your customers.

SS: As of April 1, 2003, NEC Corporation separated its LCD business into a new global company, NEC LCD Technologies, Ltd. This new company develops, designs and manufactures color LCDs for the industrial market and high-resolution display modules for high-end monitors. This is beneficial for customers because previously, as part of such a large corporation, it was challenging at times to respond as quickly as the market demanded. Under the current structure of NEC LCD Technologies, we are able to "listen" to our customers more effectively and respond with display solutions that meet their fast-changing requirements. NEC Electronics America will continue to serve as the North American sales, marketing and technical support arm of this new company.

analysis

While not a big player in the overall display market, NEC has the lion's share of the prime market for industrial TFT displays, being the leader in the 10.4" VGA market, where, according to DisplaySearch, NEC commanded almost half the market in 2003, and have done so for a number of years. While NEC sells products into other markets, its business model concentrates more specifically on the vertical markets of industrial and medical applications where the company's value-add lies not only in technological advances but also in backward compatibility and reliability.



NEC LCD Core Technologies



NEC's TFT LCD displays are designed to meet the specific needs of industrial and high-end monitor applications. NEC offers a rich line-up of industrial TFT modules. Screen size, picture quality, adaptability to ambient light environments, extended temperature ranges and other specifications meet the specialized requirements of the industrial market. Three core technologies underpin NEC's success in these markets and applications and demonstrate a commitment to providing total display solutions. These technologies are adaptive design technology, SFT technology and NLT technology.

NEC's Adaptive Design Technology

NEC's focus on adaptive design technology has resulted in a broad product offering targeted at the diverse requirements of the various applications comprising the industrial market. NEC offers a long-term support model; broad product offerings with various feature sets within a

product family; backward compatibility in successive generations of products within a product family; industrial grade modules; and application-specific solutions such as wide temperature ranges, portrait mode viewing, and extended TAB drivers.



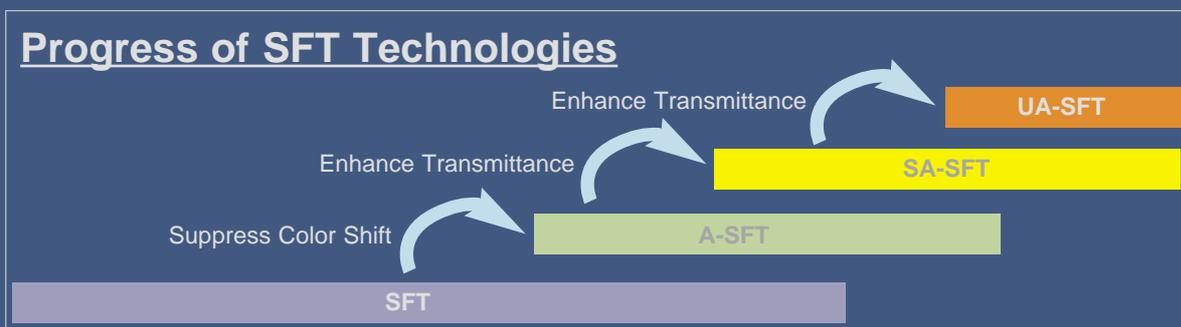


SFT Technology

SFT is NEC's proprietary technology based on IPS (in-plane switching) ultra-wide viewing angle technology. SFT is a term NEC has adopted to describe its high-end LCDs featuring super-wide viewing angle, high transmissivity, wide color gamut and fast response times.

The technology makes it possible to view high-resolution images from any viewing angle. Over the years, NEC has continued to improve this technology, resulting in successive generations of SFT products with further improved feature sets. The table below highlights the evolution of NEC's SFT technology.

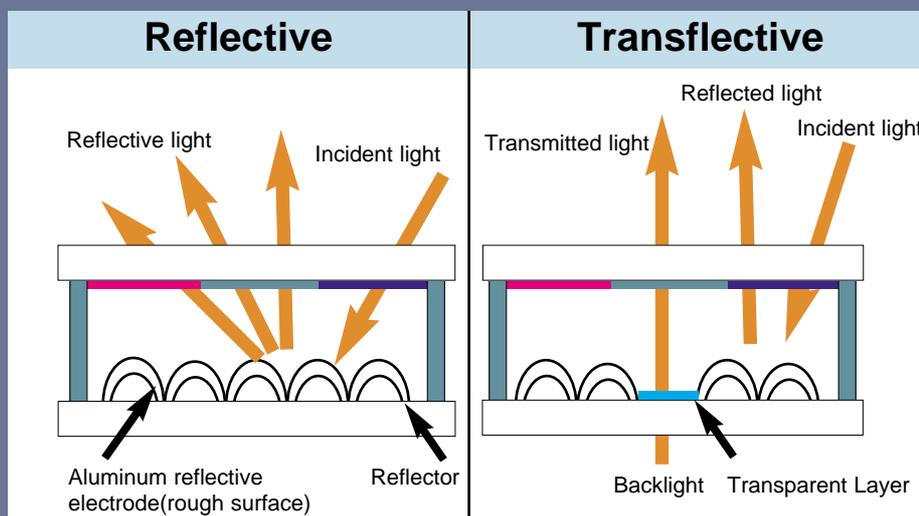
SFT Evolution	Features
1. SFT	Ultra-wide viewing angle technology
2. A-SFT = Advanced SFT	Dual domain in-plane switching; fast response LC cell design, minimized color shift
3. SA-SFT = Super-Advanced SFT	High aperture, improved panel transmissivity
4. UA-SFT = Ultra-Advanced SFT	Further improvements in luminance and response time, higher contrast ratio



NLT Technology

NLT stands for natural-light TFT and refers to the NEC displays designed for use in all possible ambient light environments: displays incorporating transfective technology. NEC has developed a transfective LCD that maximizes the high ambient light visibility features of a reflective-type LCD and the low ambient light

visibility features of a transmissive-type LCD. The result is an LCD capable of delivering high-quality images in indoor and outdoor light environments. NEC transfective displays are ideally suited for indoor/outdoor applications such as industrial PDA, marine, instrumentation and transportation.





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Mr. Smith is currently the Global Supply Base Manager at Tektronix for key strategic commodities including displays. During his tenure at Tektronix, he has held division level roles in human resources, materials, marketing and manufacturing. Mr. Smith also led the team responsible for developing and executing the Tektronix strategy for the use of EMS providers in support of product manufacturing.



case study



TEKTRONIX INC. IS A TEST, MEASUREMENT, AND MONITORING COMPANY PROVIDING MEASUREMENT SOLUTIONS TO THE COMMUNICATIONS, COMPUTER, AND SEMICONDUCTOR INDUSTRIES WORLDWIDE. WITH MORE THAN 55 YEARS OF EXPERIENCE, TEKTRONIX ENABLES ITS CUSTOMERS TO DESIGN, BUILD, DEPLOY, AND MANAGE NEXT-GENERATION GLOBAL COMMUNICATIONS NETWORKS AND ADVANCED TECHNOLOGIES. HEADQUARTERED IN BEAVERTON, OREGON, TEKTRONIX HAS OPERATIONS IN MORE THAN 20 COUNTRIES WORLDWIDE. FOR MORE INFORMATION YOU MAY VISIT OUR WEB SITE AT WWW.TEKTRONIX.COM

Cleverdis: Tell us a bit about Tektronix and the equipment you manufacture.

TS: Tektronix has more than 55 years experience providing high quality test and measurement equipment and service. Tektronix is a world leader in the test, measurement and monitoring markets, manufacturing more than 1000 test, measurement, and monitoring products including solutions for computer, communications, and advanced electronics design; digital video; optical networking; and wireless communications. The vast majority of these products utilize LCD displays.

Cleverdis: How are LCDs used in the equipment you manufacture?

TS: Tektronix's products include a broad range of instruments designed to allow a scientist, engineer or technician to view, measure, analyse and test electrical circuits, optical circuits, mechanical motion, sound or radio waves. In most of our products, displays are the primary visual interface.

Cleverdis: What are your primary requirements when selecting a display supplier?

TS: The factors Tektronix considers when selecting a display supplier are:

- Dependable supply – Is the supplier able to navigate through periods of tightened supply?
- Quality of the product – Is the product well constructed, does it have a low failure rate, does it consistently perform to spec?
- Viability of the supplier – Has the supplier been in the business a long time, will they continue to be in the business a few years down the road?
- Responsiveness – Does the supplier respond quickly and completely to inquiries for pricing, availability, technical questions?
- Competitive – Are the products they supply competitive in terms of technology, support, and pricing?
- Technical expertise – Has the supplier demonstrated technical expertise in the new products they offer and provided knowledgeable responses to technical issues and questions?

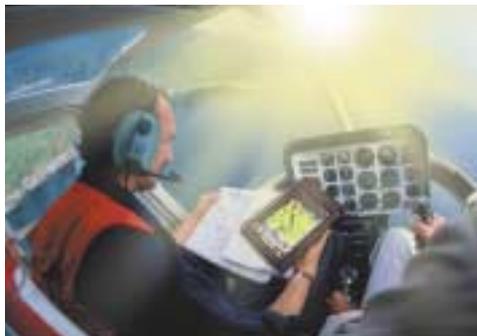
Cleverdis: What is it about NEC that fits your supplier requirements? What differentiates them from other display suppliers?

TS: NEC has been in the LCD business since the 80's. Tektronix has been doing LCD business with NEC for about 10 years. NEC's long

standing commitment to supplying LCDs for applications other than notebook PC or desktop monitors is one way they differentiate themselves from other LCD suppliers. NEC has been a technology leader in developing LCDs for non-mainstream applications (applications other than notebook PC, desktop monitor and television) such as test and measurement equipment. As we have developed new products to better service our customer base, NEC's product quality, low failure rates, long-term support model and technical expertise have repeatedly drawn us to NEC to satisfy our display needs. In times of constrained supply, NEC has worked with us to assure a steady supply of LCDs with consistent on-time delivery, enabling us (Tektronix) to keep our delivery commitments to our customer base. While NEC is not the market leader in terms of LCD unit pricing, the TCO proposition has balanced out the initial pricing variances over their competition. NEC's phaseout policy, their philosophy of designing future generations of products with enhanced feature sets while maintaining compatible footprints has helped us (Tektronix) maintain our performance leadership position and deliver cutting edge products.



DUPONT DISPLAY SOLUTIONS IS ONE OF A STRATEGIC CORE OF DUPONT BUSINESSES WHOSE MISSION IS TO CREATE NEXT-GENERATION MATERIALS AND PROCESS TECHNOLOGIES THAT MAKE DISPLAYS LOOK BETTER, PERFORM BETTER AND COST LESS. IT IS PART OF DUPONT'S \$2.5 BILLION ELECTRONICS AND COMMUNICATIONS PLATFORM, WHICH CONSISTS OF THE BUSINESS UNITS DISPLAY TECHNOLOGIES, ELECTRONIC MATERIALS, IMAGING SYSTEMS, FLUOROPRODUCTS, AND FUEL CELLS.



Peter Compo is President of DuPont Display Solutions, a DuPont Displays Business Unit that designs and markets high-performance enhanced flat-panel displays for challenging OEM applications. In addition to Display Solutions' business responsibility, he has the role of ensuring the connection of the Solutions business to the larger set of DuPont businesses and technological resources that can be directed towards creating next-generation display products. Peter is a 16-year veteran of DuPont and is located in Torrance, California.



Peter Compo

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DuPont Display Solutions

case study

Cleverdis: What does your business contribute to the display market?

PC: We "fill the gap" between the performance needs of tough OEM display applications and the performance provided by even the highest performance off-the-shelf displays.

Cleverdis: What applications have this "gap"?

PC: Can you imagine a soldier using a laptop that can't be read in bright desert sunlight? Or a paramedic using a life support device that can't be read in sunlight, or that doesn't withstand the bumps and grinds during patient transport? In these cases, we enhance the displays, visually- for optimal viewing in bright sunlight and environmentally- for operation in varying temperatures and rugged conditions.

Cleverdis: So these applications tend to be military and medical? Outdoors?

PC: Yes, - today it is military and medical, and also, aviation and marine customers that demand most of these enhancements. But we're now seeing new expanded interest.

Tablet PCs are a very interesting application. Tablet PC displays are very low brightness and need contrast enhancement. In industrial applications we see opportunities for 6-inch to 10-inch displays in hand-held equipment that incorporate cameras and other sensors and which are used by technicians in outdoor environments. In marketing applications we see displays for outside advertising in malls or stadiums, and more.

Cleverdis: How do you "Fill the Gap"?

PC: We use an array of techniques. We are the leader in direct bonded glass enhancements to LCDs for readability and ruggedization. We have passive and active backlight upgrades that typically do not change the display footprint. We use special purpose films and filters to shield and protect displays, and provide privacy.

Cleverdis: What differentiates DuPont from competitors?

PC: We focus on fundamentals, and bring the power of DuPont's global science and engineering resources to bear. In the area of sunlight readability, for example, we

emphasize minimizing power consumption and heat. That is, we reduce the sun's effect, instead of trying to overpower it. This gives OEMs more latitude in design. In a typical sunlight environment an unenhanced display can have a contrast ratio of 1.5:1. By combining our direct bond with the right active backlight enhancement, we can increase the contrast ratio to 10:1 or more. That means the display is over six times more readable with only twice the output, which translates to: "high visibility at low power and heat."

Cleverdis: NEC panels are used in a large number of your products. How strategic is your alliance with NEC Electronics America in this field?

PC: We're a NEC Value Added Partner, which is a very strategic relationship for us. NEC's approach to this market makes a lot of sense for DuPont Display Solutions. They are committed to the high-performance industrial market,- their displays generally have attributes that make them good enhancement candidates. And perhaps most important, NEC works together with us on how we can solve difficult customer problems.



Taking FPDs to new heights – far from the desktop

Avnet Applied Computing Solutions

Flat Panel Displays are at the heart of an extraordinary revolution in Public Display Applications... with displays in many situations no-one ever thought about before.

An example is Captivate Network, Inc., the national news and entertainment network, an Avnet customer over past years. They saw a unique opportunity for the placement of content and advertising in high-rise elevators around the country using flat panel displays.

Captivate Network now has a network of over 4,000 flat-panel displays in the elevators of hundreds of premium office towers in the U.S. and Canada, delivering programming and advertising to business professionals and affluent consumers. Captivate's leading programming partners include The Wall Street Journal, The New York Times, The Los Angeles Times and CNN. This innovative display idea has so far attracted advertising support from

names like Oracle, BP, Staples, Inc., Kinko's, UBS Financial Services Group, Fox - Twentieth Television, Pfizer, Franklin Templeton Investments and GQ Magazine.

"Clients want to make sure they get maximum impact from their ads, and Captivate is an efficient use of advertising dollars to reach this key demographic," said Michael DiFranza, president, CEO and founder of Captivate Network.

The issues and Solutions: Captivate needed a display that was readable from any location within the elevator cab. ACS and Captivate worked with NEC to develop a solution that would enhance the display's range of visibility without significantly impacting the per-unit cost. The end result was a sleek, elegant device deployed in nearly every major market high-rise office tower in North America.



Avnet Applied Computing Solutions is a global company dedicated to helping OEMs get new products to market quickly. AACS works with top suppliers like NEC, Intel, Microsoft, and others to help smooth their customers' design cycles and get them to market first. If you are currently looking at an NEC product for your design, feel free to call Avnet. They offer a broad range of products, and provide the technical expertise, integration capability, and logistics mastery leading companies demand in today's ever more competitive market.

To find out more call 1-877-ASK-AVNET or visit acs.avnet.com.



LCD Enhancement Technology

Bell Microproducts

When it comes to displays, the industrial marketplace is very different from the desktop market. The industrial market has special needs arising from the diversity of applications comprising this market segment.

The most rudimentary of needs are long product life cycles, high MTBFs and superior quality. NEC provides LCDs that meet these requirements. But, with applications ranging from mobile and marine computing, where sunlight readability and low power consumption are required, to medical/military applications, where high contrast and low emissions are requirements, the industrial applications present unique challenges.

Standard, off-the-shelf LCDs frequently do not meet the application requirements. Bell Microproducts, working with NEC Electronics America, provides cutting edge solutions that address these requirements. In addition to LCD enhancements, Bell provides solutions such as plug and play Smart Panel Kits (standard VGA, video, or DVI

input) or fully integrated all-in-one systems including a single board computer, hard drive, memory, power supply and optional enclosure.

Bell also offers premier sunlight-readable LCDs using Eclipse-Xtm technology, a proprietary process whereby a standard transmissive TFT is converted to a transreflective TFT. Traditionally additional bulbs would be added to increase brightness, thereby increasing heat, power consumption and overall size and weight of the display. Eclipse-Xtm does not require added power or generated heat but maintains the mechanical integrity of the LCD by using the light from the sun to increase the display brightness five-fold while maintaining 10:1 contrast ratios in direct sunlight.

In addition to these capabilities, Bell Microproducts' flat panel display lab technicians perform optical testing, prototyping and touch-screen integration in-house. No matter what your FPD needs, Bell Micro has the solution. Contact us at fpdmarketing@bellmicro.com





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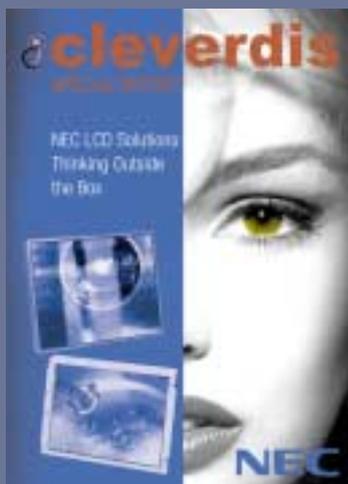
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is President & CEO of Cleverdis, he has held positions of Director and Chairman with a number of companies in the Display and Digital Peripherals Industry. He is recognised world-wide by industry leaders and the management of major end-user organizations for his work in creating true, efficient and sincere communication between consumers and vendors.

The market for flat panels in new vertical markets is one that merits a great deal more attention. Potential end users (corporate and industrial buyers) need to be better educated about the increasing use of attractive and efficient visual interfaces in applications never thought of before, as well as the resulting return on investment. This ROI will be realized through factors as diverse as increased worker efficiency, reduced errors (through improved visual acuity), reduced overall costs and reliability, and in some cases, through less tangible factors such as customer loyalty and corporate image. NEC's policy of investing in the development of panels and solutions to fit the specific needs of these markets is a sign of acute intuition regarding the expanding possibilities in this field. The product design, planning and control of supply each take into account the specific issues encountered by integrators in the sector. All that is left is to educate potential users and integrators of the possibilities. The issuance of this Special Report is certainly a major step in that direction.



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