

We Pick the Best Imaging Display

It's the time of year when we test high-end imaging monitors. This year we tested 12. The good news is they're better than ever. The bad news is that not everybody won. We awarded four prestigious Editors' Choice Awards. The differences are subtle and surprising.

An imaging display is more than just a monitor. A good display increases efficiency, reduces eye strain and displays great images. Each of the 12 monitors we tested had its good points. **Cornerstone Imaging's** (San Jose, CA 408-435-8900) 50/115sf monitor impressed all the reviewers in every test category.

All monitors are not created equal. They may have the same specs, but they're different. Really look at the monitor you're going to buy. Don't buy a monitor solely on price or someone else's recommendation. What pleases them may not please you. The right monitor is an asset. The wrong one is a liability.

Princeton Graphic Systems' (Santa Ana, CA 714-751-8405) C2001 21" monitor costs \$2,200. It's the first display in their new Caliente Series. It's one of the most expensive monitors we tested.

BY JONI BLECHER

The Test

All the monitors were tested on a **Micron** (Nampa, ID 208-893-3434) Millennia Mxe 166 MHz Pentium running Windows 95 with a 2.5 GB hard drive with 32 megs of RAM. We used **Number Nine's** (Lexington, MA 617-674-0009) 128 Series 2 eight meg board. This card won our imaging display test last month. The monitors were set to 1280 x 1024 @ 75 Hz running 16-bit color.

A monitor's appearance is a subjective decision. We got nine people from all areas of the company to test them. They were:

- Dan Baliotti, contributing editor, Imaging Magazine.
- Joni Blecher, writer, Imaging Magazine.
- Liz Chilton, researcher, Telecom Library.
- Lyle Deixler, technical editor, Telecom

nect Magazine.

- Liz Levy, writer, Imaging Magazine.
- Alison Ousey, associate editor, Call Center Magazine.
- Melissa Rothberg, reprints and permissions manager, Telecom Library.
- Arthur Shorter, accounts receivables clerk, Telecom Library.
- Andrew Torio, artist, Telecom Library.

Everyone on the panel uses computers extensively. They all come from different backgrounds. All have different needs.

This was not a comparison test. Each monitor was rated on its individual visual performance and the testers' preferences. We had three categories: controls, overall

MAG InnoVision's (Santa Ana, CA 714-751-2008) DJ920 monitor (\$2,000) comes with a three-year warranty. It includes parts, CRT and labor. Their JAG dial control is an innovative idea.



design and display. Marks ranged from one (worst) to ten (best).

We judged the monitor controls. This is a new test. Adjusting monitors should be easy. Sometimes controls are hard to read. Sometimes they stick. Sometimes they don't make sense.

Overall design judges the appearance of the monitor. Is it pleasing to look at? Some appear smaller than a 21" display because of their casing.

To judge the display, each monitor went through the video obstacle course in **Sonera's** (Rumson, NJ 908-747-6886) DisplayMate software. It costs \$80. It's good. It's worth having. It helps you get the most out of your display by suggesting adjustments.

The software isn't just for testing monitors. Correct or adjust a display based on what you see. If during the video bandwidth test the pattern is not sharp, DisplayMate suggests an adjustment for sharper images.

This is how we judged the display using the video obstacle course:

Screen Uniformity. This checks for variations in intensity and color. One color is displayed across the entire screen. It uses low intensity colors like gray and yellow. They're more sensitive to variations.

Flicker. Most people don't notice a flicker above 70 Hz. The monitors were set at 75 Hz. Some users are more sensitive to it. This is the standard rate for flicker free.

Geometric Linearity. This checks for geo-

metric distortion. A crosshatch pattern is displayed. All boxes are square, parallel and the same size. If they're not, there's a problem with the display.

Video Bandwidth. This looks for sharpness and fine image detail.

Focus Matrix. It's an aspect of image sharpness. A pattern appears. Distortion is most noticeable in the corners.

Resolution. This judges image sharpness. This is especially important in document imaging applications.

Moire. This maps how well you're hitting the phosphorus dots. It looks at different levels of intensity. Moire appears as vertical ripples or waves across the screen.

Moire is worst at a single resolution. The resolution you're viewing changes the effect. It can get better. You get moire because the dot pitch is too large for the resolution you're displaying.

We found the aperture grille monitors had the most trouble with moire at the resolution chosen. Don't use this as an excuse to avoid buying an aperture grille monitor. High-end displays have moire adjustment in their controls. DisplayMate tells you how to adjust it.

Color Scales. This determines color intensity. The test shows 25 intensity levels of 10 main colors. The scale is from black to brightest. We looked for how well the colors blended into each other and the brightness of each hue.

Reverse Video Contrast. This examines black and white and color contrast. It identifies image sharpness and contrast. It shows different color text on a white, gray and dark gray background. We judged how each color appeared on each background.

12 Test Monitors

The NetVision P815 Shadow Mask monitor from **Artist Graphics** (St. Paul, MN 612-631-7800) achieves a resolution of 1856 x 1484 @ 70 Hz. It costs \$1,800. The P815 is one of the few monitors tested that meets TCO 95 standards. The P815 performed well in the geometric linearity and flicker tests. It had the least amount of screen curving. You see a flatter image in the corners. You get a more uniform image. The on-screen picture menu was easy to see and use.

This monitor is sold as a subsystem. It comes with in its own display board. If you use them both together, you'll get images displayed faster and maximum performance from the display.

Cornerstone's (San Jose, CA 408-435-8900) 50/115sf 21" monitor swept all the categories. That's why it's in the Winner Circle. See how it did it.

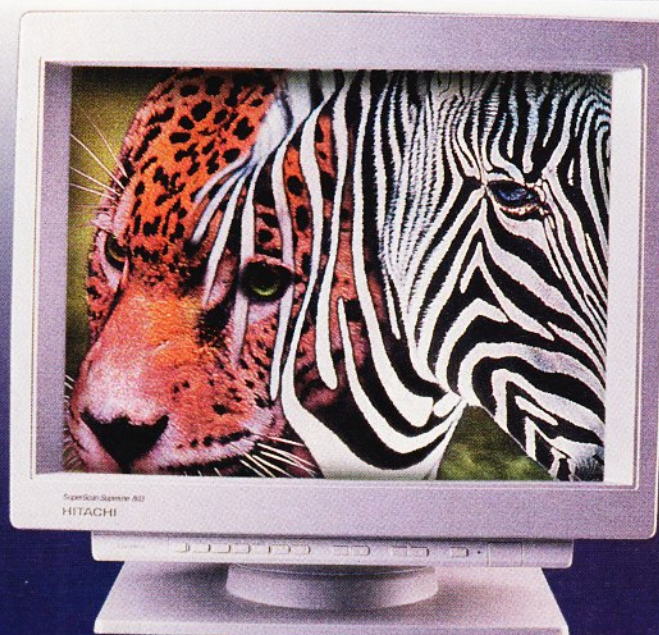
We saw **Hitachi-NSA's** (Westwood, MA 617-461-8300) new SuperScan Supreme 803 (\$1,800) monitor. This is the next generation of the SuperScan 803. It has Hitachi-NSA's new electron gun. It enhances the corners and brightness of the monitor. It has a resolution of 1800 x 1440 @ 77 Hz and a dot pitch of .22mm for the Shadow Mask monitor.

In our tests it scored consistently well

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Hitachi-NSA's (Westwood, MA 617-461-8300) new SuperScan Supreme 803 monitor costs \$1,800. The corners are enhanced and the overall picture is brighter.

Artist Graphics' (St. Paul, MN 612-631-7800) NetVision P815 Shadow Mask monitor costs \$1,800. It achieves a resolution of 1856 x 1484 @ 70 Hz. It comes with its own display board.



HOW EACH MONITOR RATED

Cornerstone	80
Mitsubishi	79.3
Sony	78.6
Nokia	77
Panasonic	74.6
Panasonic	74.6
iiyama	73
Hitachi NSA	72.6
Netvision	72
Goldstar	71.6
Princeton	71
Mag InnoVision	65.3
Samsung	64.3

CONTROLS

This is subjective. Testers either liked or hated the monitor's controls. Each monitor has a manual explaining how to adjust it. The testers were not given it. They used the trial and error method. Most users don't consult the manual when they adjust the display.

Cornerstone	75.1
Sony	75
Panasonic	74.7
Nokia	73.1
Hitachi NSA	72.5
Mitsubishi	72.3
Netvision	71.8
Goldstar	70.6
Mag InnoVision	69
iiyama	65.6
Princeton	63.6
Samsung	63.6

DISPLAY

These are the totals of how each display performed. These are the results from the DisplayMate tests. Each monitor went through the Video Obstacle Course and the Reverse Video Contrast test. Testers were asked to rate the display for each test on a scale of one (worst) to ten (best).

Cornerstone	79
Nokia	77
Sony	76.5
Netvision	75
Goldstar	75
Mag InnoVision	75
Panasonic	74.5
Samsung	74
Mitsubishi	73.5
Hitachi NSA	73
Princeton	72
iiyama	71.5

OVERALL DESIGN

Testers stood back and looked at the monitor. Some displays are visually appealing. Some look bigger because of the way they are encased. These issues were considered when the design was rated.

Cornerstone	76.4
Sony	76.1
Panasonic	74.6
Nokia	74.2
Mitsubishi	74
Hitachi NSA	72.6
Netvision	72.1
Goldstar	71.2
Samsung	70.3
Mag InnoVision	68.7
iiyama	67.8
Princeton	66

OVERALL TOTALS

This is the total of all the tests. Some monitors had great controls but didn't do so well on the display tests and vice versa.

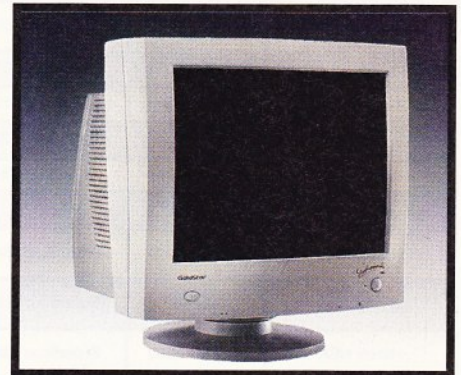
MONITORS

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across the board. The SuperScan Supreme 803 did extremely well on the flicker and resolution tests. The controls were also favored. The one downfall is that its controls are hard to read.

The VisionMaster Pro 500 from **iiyama** (Costa Mesa, CA 714-437-5111) (\$1,900) had the slimmest back. You get more desktop real estate. It reaches a resolution of 1800 x 1400 @ 74 Hz. It's completely flicker free at 1600 x 1200 @ 85Hz. iiyama's line of monitors come with an aperture grille or Shadow Mask CRT (\$1,800). The Shadow Mask is \$100 less.

We tested their aperture grille monitor. It had good controls. They were easy to use and identify. We weren't squinting to read



The Studioworks 28i Shadow Mask monitor from LG Electronics (Englewood Cliffs, NJ 201-816-2200) costs \$1,600. We liked the overall design of this monitor.

the buttons. I would have liked it to make adjustments quicker.

One of **LG Electronics'** (Englewood Cliffs, NJ 201-816-2200) newest monitors is the Studioworks 28i (\$1,600). It performed well in all the tests. It's a good monitor. The Studioworks 28i Shadow Mask monitor has a .28mm dot pitch. This monitor had great clarity and displayed a focused image. We liked the overall design of it.

MAG InnoVision's (Santa Ana, CA 714-751-2008) DJ920 monitor (\$2,000) achieves a resolution of 1600 x 1200 @ 85 Hz. Its dot pitch is .28mm. It comes with a three year warranty that includes parts, CRT and labor. Their JAG control is an innovative idea. JAG control is a dial on the front of the monitor that lets you adjust the display on-screen. It's simple to use. Even so, some people couldn't figure out how to find the monitor's controls. Others embraced the JAG's controls with open arms.

Adjustment controls are a personal

MONITORS

Company	Phone	Product	Street Price	Screen Size	Optimal Resolution	Dot (Pitch) (mm)	Horiz. Scan (kHz)	Vert. Scan (Hz)	On-Screen Cont's	TCO 92	TCO 95	VESA	Tube Warranty	Monitor Warranty
ADI Systems	408-944-0100	MicroScan 5G	\$750	17"	1024 x 768 @ 85Hz	.26	30 to 95	50 to 160	•	•	•	•	3+	3+
ADI Systems	408-944-0100	MicroScan 6G	\$1,450	21"	1024 x 768 @ 85Hz	.28	30 to 95	50 to 160	•	•	•	•	3+	3+
ADI Systems	408-944-0100	MicroScan 6P	\$1,000	19"	1280 x 1024 @ 85Hz	.22	30 to 95	48 to 160	•	•	•	•	3+	3+
ALT	408-764-0590	ALT-995	\$1,200	19"	1600 x 1280 @ 70Hz	.22	30 to 95	50 to 160	•	•		•	3	3
ALT	408-764-0590	ALT-217	\$1,000	21"	1600 x 1200 @ 85Hz	.28	30 to 117	50 to 120	•	•		•	3	3
Artist Graphics	612-631-7800	NetVision P810	\$1,500	21"	1600 x 1200 @ 76Hz	.25	30 to 95	30 to 160	•		•	•	3	3
Artist Graphics	612-631-7800	NetVision P775	\$800	17"	1600 x 1200 @ 76Hz	.25	30 to 95	50 to 180	•		•	•	3	3
Artist Graphics	612-631-7800	NetVision P815	\$1,700	20"	1600 x 1200 @ 93Hz	.25	30 to 115	50 to 160	•	•	•	•	3	3
Cornerstone Imaging	408-435-8900	Color 17/76	\$720	17"	1280 x 1024 @ 76Hz	.26	30 to 82	50 to 120	•	•		•		3
Cornerstone Imaging	408-435-8900	Color 45/101sf	\$1,300	19"	1600 x 1200 @ 81Hz	.26	31 to 101	50 to 160	•	•		•		3
Cornerstone Imaging	408-435-8900	Color 50/101sf	\$1,570	21"	1600 x 1200 @ 81Hz	.27	31 to 101	50 to 160	•	•	op	•		3
Cornerstone Imaging	408-435-8900	Color 50/115sf	\$1,770	21"	1600 x 1200 @ 92Hz	.27	31 to 115	50 to 160	•	•	op	•		3
Eizo Nanao	562-431-5011	FlexScan TX-C7	\$1,000	17"	1280 x 1024 @ 85Hz	.25	30 to 92	50 to 160	•	•	•	•	3	3
Eizo Nanao	562-431-5011	FlexScan FX-E7	\$2,000	21"	1600 x 1200 @ 75Hz	.28	30 to 95	50 to 160	•	•	•	•	3	3
Eizo Nanao	562-431-5011	FX-E8	\$2,700	21"	1600 x 1200 @ 87Hz	.26	30 to 110	50 to 160	•	•	•	•	3	3
Hitachi NSA	617-461-8300	SuperScan Elite 751	\$1,150 (MSRP)	19"	1600 x 1200 @ 75Hz	.22	31 to 93.75	50 to 60	•			•	3	3
Hitachi NSA	617-461-8300	SuperScan Elite 630	\$700 (MSRP)	17"	1024 x 768 @ 105Hz	.22	31 to 86	47 to 130	•	op	op	•	3	3
Hitachi NSA	617-461-8300	SuperScan Elite 701	\$1,550 (MSRP)	20"	1600 x 1200 @ 76Hz	.28	31 to 96	50 to 160	•			•	3	3
Hitachi NSA	617-461-8300	SuperScan Supreme 803	\$1,900 (MSRP)	21"	1600 x 1200 @ 92Hz	.22	31 to 115	50 to 160	•			•	3	3
Iiyama	215-957-6543	VisionMaster Pro 500 (MT-9221)	\$1,675	21"	1600 x 1200 @ 85Hz	.28	27 to 110	50 to 160	•	•	•	•	3	3
Iiyama	215-957-6543	VisionMaster Pro 500 (MF-8721)	\$1,650	21"	1600 x 1200 @ 85Hz	.27	27 to 110	50 to 160	•	•	•	•	3	3
Iiyama	215-957-6543	VisionMaster Pro 21 (MF-8221E)	\$1,500	21"	1600 x 1200 @ 75Hz	.27	25 to 94	50 to 160	•			•	3	3
Iiyama	215-957-6543	VisionMaster Pro 17 (MT-9017E)	\$700	17"	1280 x 1024 @ 85Hz	.25	27 to 92	50 to 160	•			•	3	3
KDS USA	714-379-5599	VS-9	\$650	17"	1600 x 1200 @ 78Hz	.26	28 to 95	50 to 120	•	•		•	1	3
KDS USA	714-379-5599	VS-19	\$850	19"	1600 x 1200 @ 78Hz	.28	28 to 95	50 to 120	•			•	2	3
LG Electronics	201-816-2200	Goldstar Studioworks 28i	\$1,700	21"	1280 x 1024 @ 76Hz	.28	30 to 85	50 to 120	•			•	3	3
MAG InnoVision	714-751-2008	DJ920	\$1,850	21"	1600 x 1200 @ 85Hz	.28	30 to 110	50 to 160	•			•	3	3
MAG InnoVision	714-751-2008	DJ800	\$1,100	19"	1280 x 1024 @ 80Hz	.26	30 to 89	50 to 160	•	•		•	3	3
Mitsubishi	714-220-2500	Diamond Pro 91TXM	\$1,600	21"	1600 x 1200 @ 75Hz	.28	30 to 95	50 to 152	•	•	•	•	3	3
Mitsubishi	714-220-2500	Diamond Pro 1000	\$1,800	21"	1600 x 1200 @ 85Hz	.28	30 to 115	50 to 152	•	•	•	•	3	3
Mitsubishi	714-220-2500	Diamond Pro 700	\$850	17"	1280 x 1024 @ 85Hz	.25	30 to 95	50 to 152	•	•	•	•	3	3
Mitsubishi	714-220-2500	Diamond Pro 87TXM	\$800	17"	1280 x 1024 @ 75Hz	.25	30 to 86	50 to 130	•	•	•	•	3	3
Nokia Display	415-331-4244	Multigraph 445Xav	\$2,100	21"	1280 x 1024 @ 95Hz	.22	30 to 102	50 to 150	•		•	•	2	3
Nokia Display	415-331-4244	Multigraph 445Xavc	\$2,400	21"	1280 x 1024 @ 95Hz	.22	30 to 102	50 to 150	•		•	•	2	3
Nokia Display	415-331-4244	Multigraph 445Xi	\$1,900	21"	1280 x 1024 @ 95Hz	.22	30 to 102	50 to 150	•		•	•	2	3
Panasonic	201-348-7000	PanaSync Pro P17	\$800	17"	1280 x 1024 @ 81Hz	.25	30 to 86	50 to 160	•	•		•	3	3



The Winner Circle

We gave an Editors' Choice to **Cornerstone's** (San Jose, CA 408-435-8900) 50/115sf (\$1,600) 21" color display. It outperformed every monitor in every category.

This Shadow Mask monitor has a dot pitch of .27 mm and a resolution of 1800 x 1440 @ 71 Hz. Though the controls were easy to use, one reviewer suggested coloring the button icons black to make them easier to read. It had great display quality. You could see a lot of detail looking at the desktop.

Mitsubishi's (Cypress, CA 714-220-2500) Diamond Pro 91TXM (\$1,650) 21" monitor received the second highest score for their controls. This test was subjective. All the testers found them easiest to use. They're hidden in a pop-down panel. For some, this was visually appealing. Controls are a vital part of the monitor.

We also liked this monitor because it has a .28 mm aperture grille pitch. Resolution is 1600 x 1200 @ 75Hz. It comes with color calibration software. Setup your monitor to display the color you've scanned in or the color you'll print out. The monitor needs one of your com

ports to work correctly. This is strange. Most monitors don't. Unfortunately you don't have many com ports.

The 445Xi (\$1,900) 21" color monitor from **Nokia** (Sausalito, CA 415-331-4244) has a great overall design. We liked the monitor's appearance. Its shape. Its design. Where the control buttons were located. People asked us: "Where did that beautiful monitor come from?" Followed by: "And where can I get one?"

It's TCO 95 compliant and has a .22 mm dot pitch. The 445Xi is another Shadow Mask monitor to receive an Editors' Choice. It achieves a refresh rate of 1600 x 1200 @ 80 Hz. It's TCO 95 compliant.

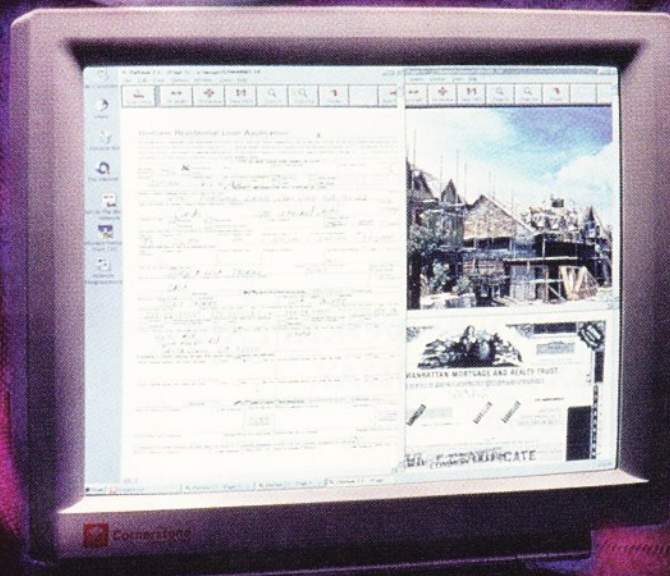
Sony's (San Jose, CA 408-432-1600) 20" Multiscan 20sell Trinitron monitor impressed us. It costs \$2,000. Its top resolution is 1600 x 1200 @ 75 Hz. We gave this monitor an Editors' Choice because it outperformed most of the monitors in the test. It scored 75. Impressive.

Most aperture grille monitors didn't perform well in moire tests. Sony's did well. No fuzzy vertical lines. It showed great detail and uniformity. The 20sell had an almost flat screen. The natural curve was barely noticeable on this monitor.

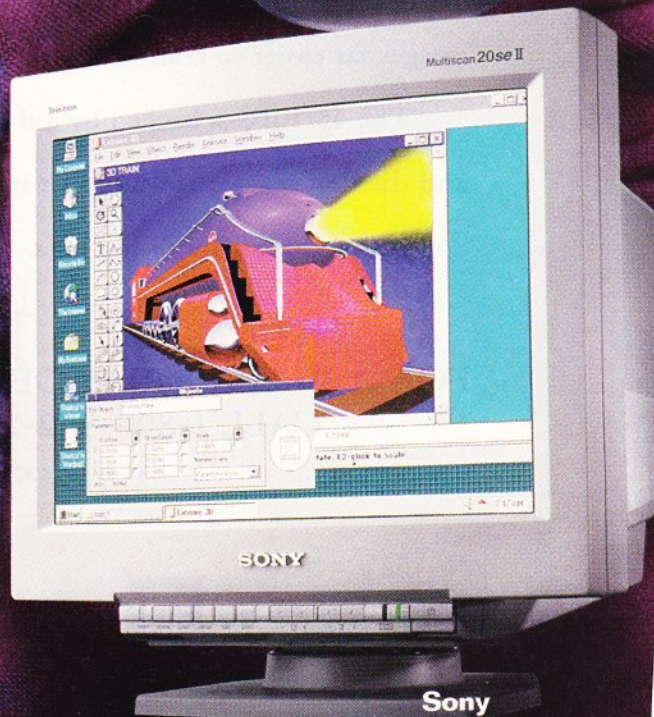


Mitsubishi

Nokia



Cornerstone



Sony