

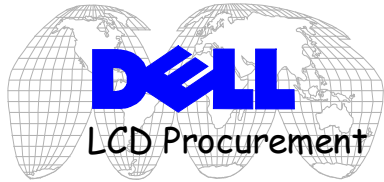
DisplaySearch
International Symposium on
The Economics of the Display Industry

High Resolution LCDs for
Portable Computers:
Optimized Alternatives

Mark Fihn
LCD Strategic Commodity Manager
Dell Computer

March 10, 1999

www.dell.com



LCD Panel Standardization

Supply/Demand Optimization

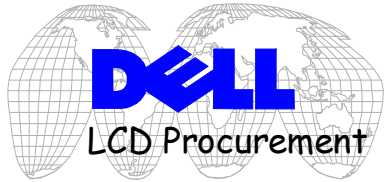
- Mechanical Standardization
- Technology Differentiation

Mechanical Standards:

- Size (X&Y)
- Mountain holes (size & location)
- Screen centerline
- Connector (type, location, pin-out)
- Integrated inverter

Technology Differences:

- Quality
- Price
- Service/Reliability
- Performance
 - Power consumption
 - Brightness
 - Viewing angle
 - Weight
 - Resolution



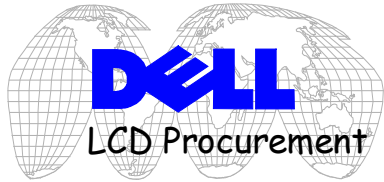
Higher Resolution

Why it's coming:

- Video
 - Small Pixels are better
- Software
 - Font Scaling Technology
- User Expectations
 - Digital Cameras
 - Internet Browsing
 - Etc.

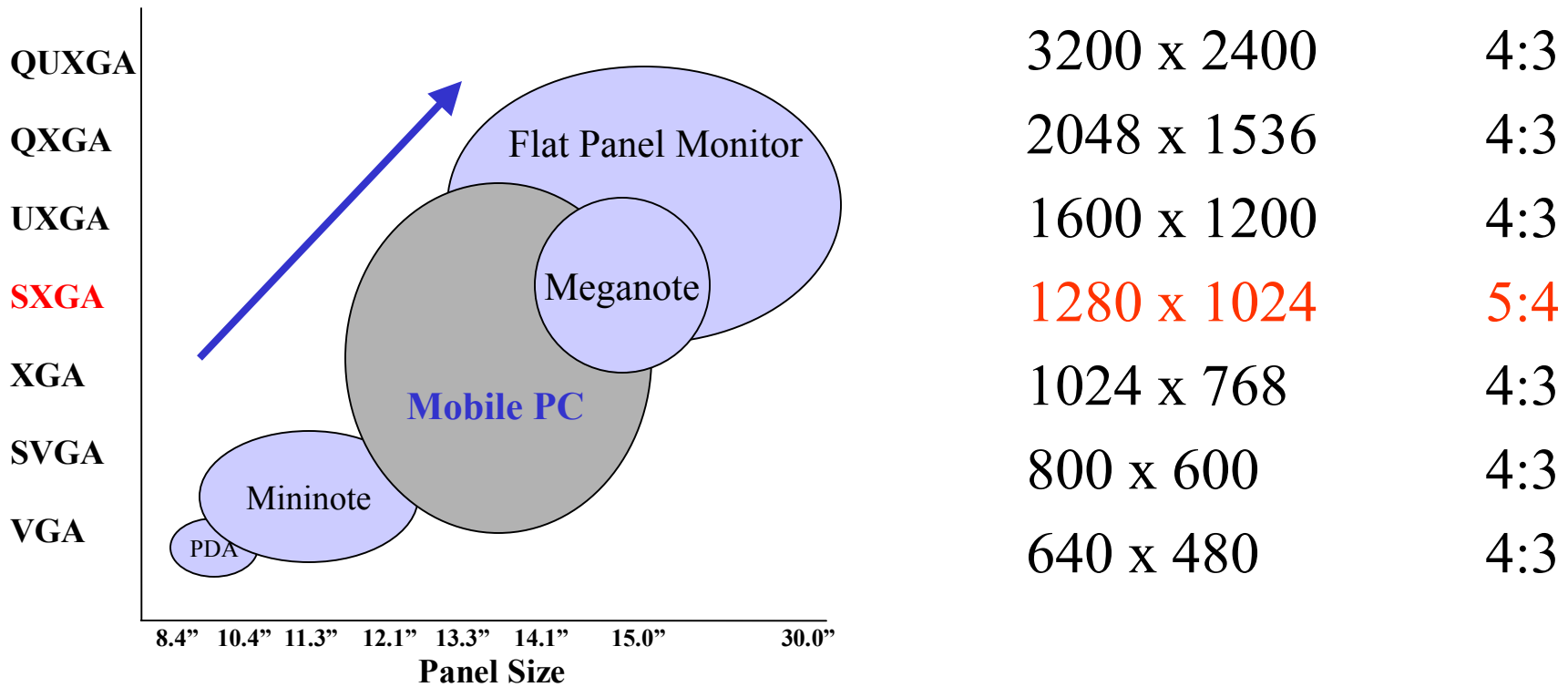
Issues to consider:

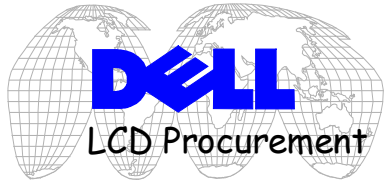
- SXGA Aspect Ratio
- Resolution Vocabulary
- Information Content
- Pixel defects



Panel Standardization

Graphics Resolution





Panel Standardization

SXGA Aspect Ratio Issue

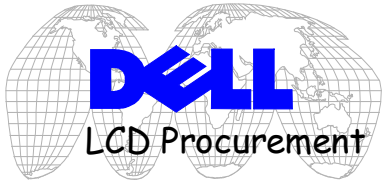
14.1" Platform

		x	y
13.3" XGA	4:3	10.64"	7.9"
13.7" SXGA	5:4	10.70"	8.56"
14.1" XGA	4:3	11.28"	8.46"

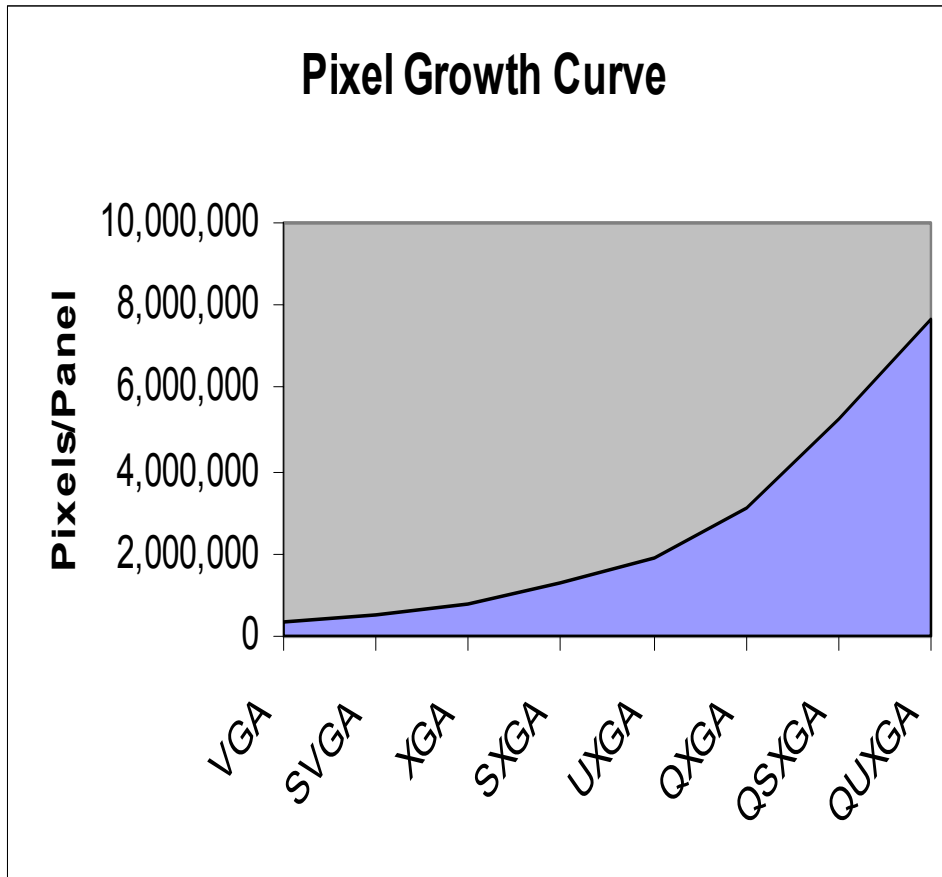
15.0" Platform

14.1" XGA	4:3	11.28"	8.46"
14.4" SXGA	5:4	11.24"	9.00"
15.0" XGA	4:3	12.00"	9.00"

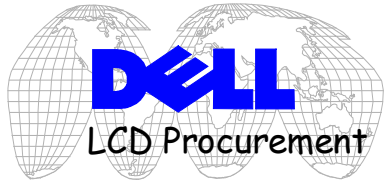
- SXGA creates mechanical design issues for portable systems
- SXGA creates marketing positioning issues



4:3 Aspect Ratio



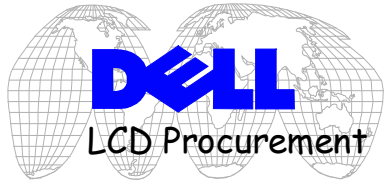
- **Resolution Technology is growing sequentially**
- **XGA 4:3**
1024 x 768 = 786,432
- **UXGA 4:3**
1600 x 1200 = 1,920,000
- **Need Intermediate step with 4:3 Aspect Ratio**
 - Technology exists, (drivers, video controller)
 - Marketing challenge
 - Expected cost savings
- **16:9 is sibling to 4:3**



Resolution Vocabulary QUIZ

- 1). What does the acronym “SVGA” stand for?

- 2). Which is the higher resolution, SXGA or QVGA?



Resolution Vocabulary?

19-Inch Monitors: Flat Is Beautiful

Upcoming article showcases large screens and big improvements to CRT monitors.

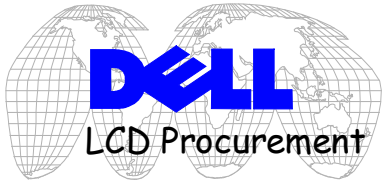
by Susan Silvius, special to PC World

March 4, 1999, 4:18 p.m. PT

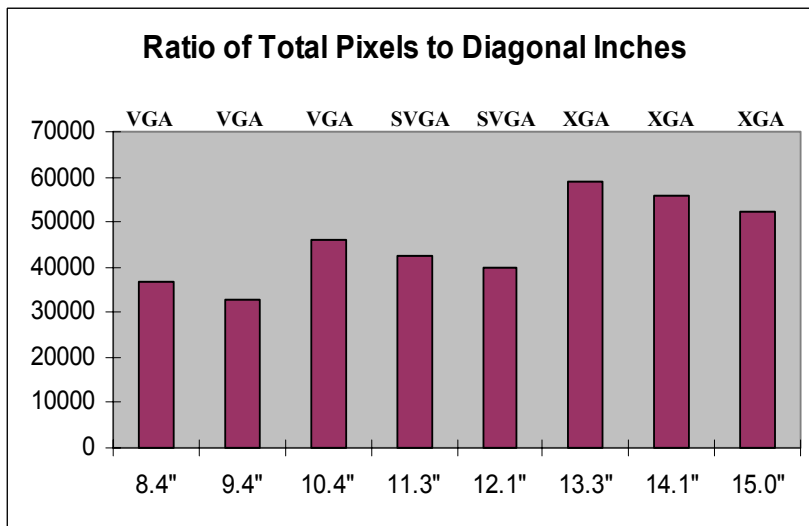
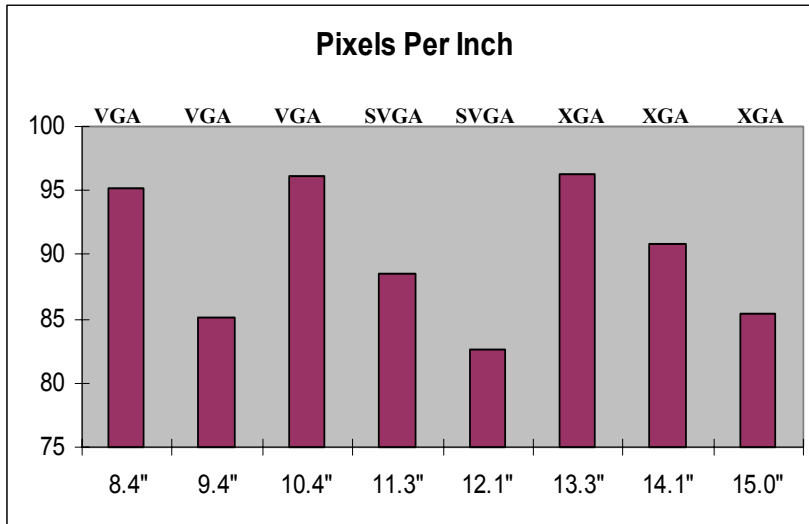
The progression from small to large monitors can't happen too quickly for most of us. Who doesn't want to work at a higher resolution? You see more of your spreadsheets and other documents on screen, and even graphics look smoother. Only high prices and the excessive amount of space they require have kept really big monitors off our desks.

Now the scene has changed dramatically, with big 19-inch CRTs costing what 17-inchers did a year ago, and short-neck tubes allowing these behemoths to fit on normal desks. As a result of these improvements, the time is right to buy a big monitor, according to "Flat-out Fabulous," our review of 24 19-inch monitors in the upcoming May issue of *PC World*.

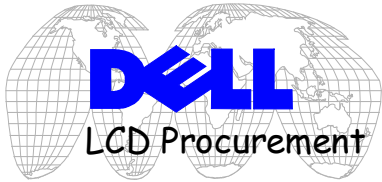
But it's not only price and physical dimensions that have changed. Today's models use less power than ever, and their image quality is noticeably improved--not only in terms of clarity but also in terms of geometry, thanks to the flatter screens among the CRT monitors in our review. For the first time, some mainstream CRTs are competing with LCD flat-panel monitors in providing almost perfectly flat screens. The new flat CRTs, costing from \$799 to \$999, may not match LCDs' sex appeal, but they have an obvious price advantage. Other models cost from \$449 to \$799 and use the more conventional flat-square or vertically flat tubes, both of which have a degree of curvature.



Pixels Per Inch?

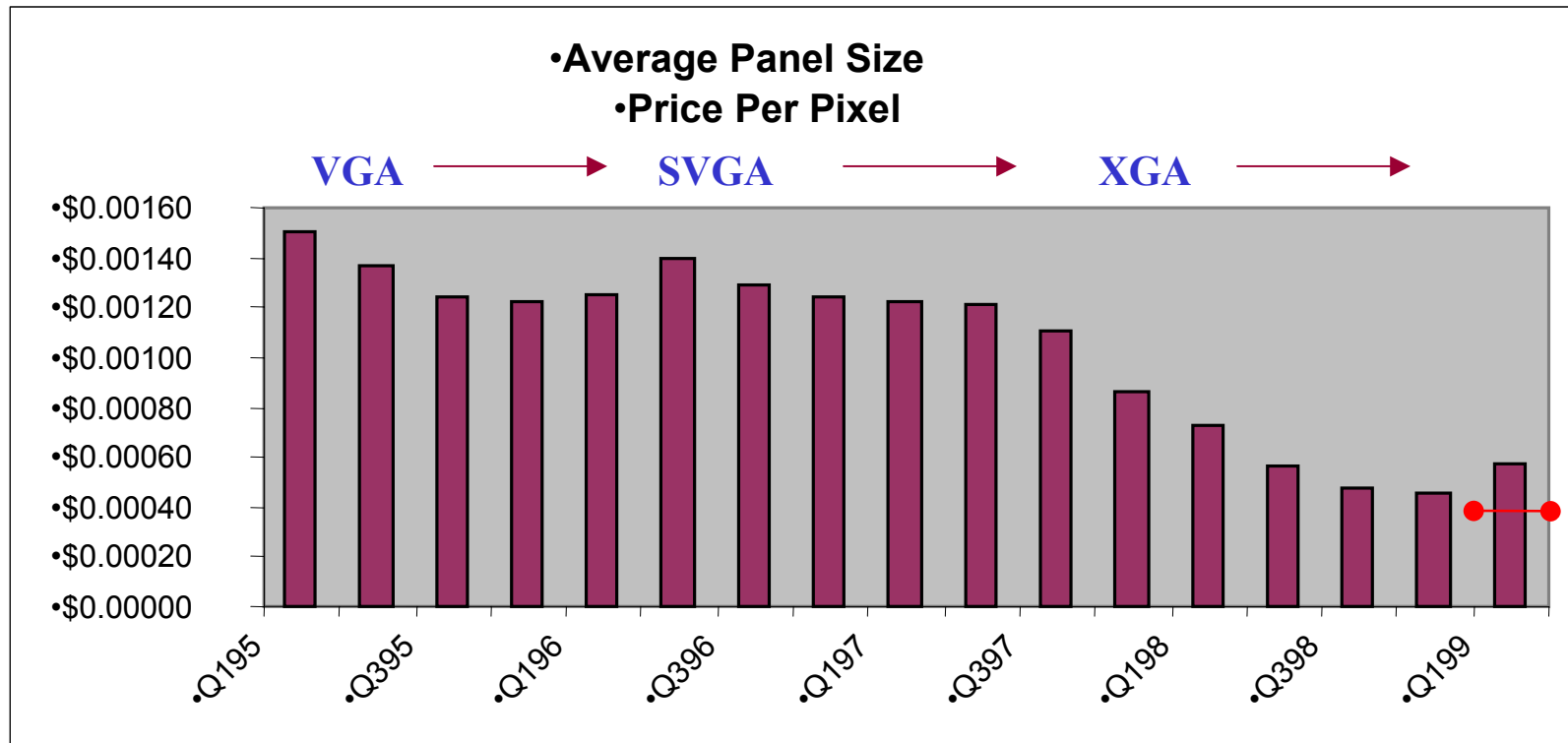


- **Need to move away from acronyms. VGA, SVGA, XGA, etc, have no practical meaning.**
- **PPI may not adequately reflect “information content”. Difficult to explain panel size differences:
e.g. 10.4” VGA has higher PPI than 14.1”/15.0” XGA**
- **Consider a ratio that divides the total number of pixels on a panel by the diagonal dimension**



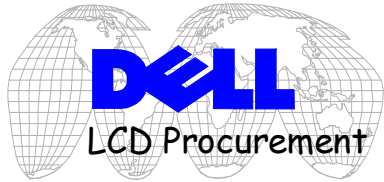
Information Content

Price Per Pixel Analysis



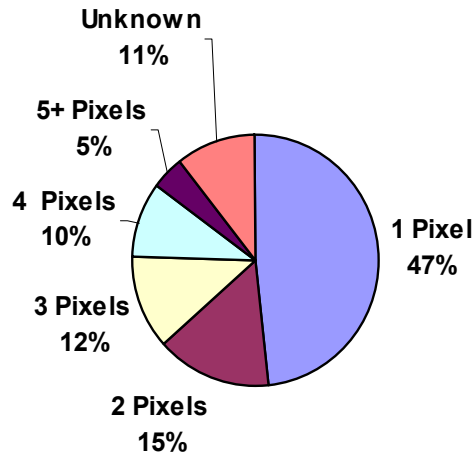
●—● **If 50% of demand in 1Q99 moved to the next higher resolution, Price/pixel would have continued its downward progression...**

- **Moving to higher resolution has a similar effect to shrinking DRAM packaging; resulting in higher fab output in terms of information capacity**
- **May result in pricing dialogues focused on pixel count (or information content capacity), rather than panel size**



Pixel Defects

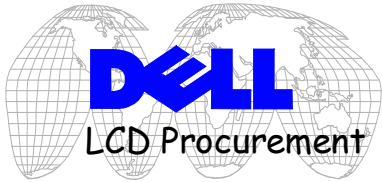
Pixel Defect Distribution



Actual Distribution of pixel defects
from field returned panels for Dell
15.0" Panels

- **Premise:** Increasing customer demand for video performance creates the predictable result for higher customer expectations regarding pixel defect rates.
- **Fact:** DVD attach rates are much higher with larger size panels.
- **Fact:** Larger size panels at existing resolutions have large size pixels
- **Result:** Customer dissatisfaction with pixel defects is a growing concern

Possible Solution: Higher resolution, (smaller pixels size), where defects are less obvious



Summary

- SXGA Aspect Ratio is not a good solution for portable computers
- SXGA-like resolution is highly desirable for portable computers -- increasing information content in ways that CRT monitors cannot
- Resolution vocabulary needs to be improved
- Information content will become more important than panel size
- Higher resolution will help to defer customer dissatisfaction associated with pixel defects
- Bigger is not necessarily better...