# Life After Intel in the 3D Market

## *Imminent Debut of i740 Graphics Processor Increases Pressure to Innovate*

Intel's forthcoming i740 3D accelerator, due as early as next month, is likely to outperform most current 3D controllers, taking significant market share away from S3 (today's market leader), ATI, and other players in the hot desktop-3D market.

The 740 can't replace every other graphics chip on the market, though. If it's a good desktop chip, it won't be a good fit for notebook designs. If it's priced for the mass market, it won't be a good deal for low-end or high-end machines. Apart from just providing faster, better 3D engines, how can other vendors compete with Intel?

There are many graphics chips already on the market, or announced for 1998, that Intel probably won't try to compete with. S3, Cirrus, and a few other chip suppliers sell older 3D chips at very low prices; we've heard of chips being sold for less than $10. These sales don't generate much publicity, in part because they don't generate much (if any) profit.

I believe there is room for profit even in the sub-$10 price range, however. Last year saw sub-$1,000 PCs; today, major system vendors are competing to offer sub-$800 machines, and prices are likely to keep dropping. If manufacturers can find enough customers who don't expect leading-edge performance, prices could conceivably drop below $400 for a fully functional system (less monitor). If $5 super-I/O chips can be a good business, then comparably priced graphics controllers can be too.

At that price, however, integrating the graphics accelerator with other necessary subsystems is a better plan. This is the theory behind Cyrix's successful MediaGX and forthcoming MXi processors. This combination leads to good graphics performance for moderately priced PCs.

PCs used as set-top boxes may spend much of their time displaying TV listings, e-mail, and phone numbers—all text-oriented tasks. Videoconferencing, the next most likely use of such systems, needs a decent CPU but benefits little from 2D or 3D acceleration. Perhaps the right combination here is to use a CPU with memory and PCI controllers, plus a separate PCI-bus chip to handle graphics, USB/1394, and analog I/O for video and audio. This organization would allow the vendor to provide a differentiated product line from two CPU choices and two graphics choices without having to develop up to four different CPU+graphics chips.

Once Intel has been through one or two generations of graphics chips, it's likely to begin exploring integration options. Core logic is a logical place to start, given the company's dominant position in that market. Adding a 3D engine to the north bridge would have several benefits. The graphics chip would have direct access to the CPU bus and memory controller, which would boost graphics performance. Eliminating the AGP interface and an extra package would reduce pin count, board space, and layout complexity, leading to a significant drop in overall system cost.

The major drawback of this combination would be a loss of OEM flexibility, but Intel would presumably continue to offer discrete core-logic and graphics chips. I expect to see such products from Intel by 2000, leaving a window for more agile vendors to get into this business first (and then out again if necessary). SiS, for example, already has both core-logic and 3D products and might be able to integrate the two functions relatively easily.

High-end 3D chips are safe from Intel for the time being. Customers who use 3D for CAD applications can afford to pay top dollar for multichip sets that provide significantly better performance than mainstream devices. The same goes for PC and arcade games, which have become a larger market than CAD, at least in unit volume. Quake II alone will persuade tens of thousands of gamers to buy cards based on 3Dfx's Voodoo 2 chip set.

Notebook computers are another safe harbor, at least for a while. The 740 is likely to consume too much power for mobile systems, but Intel's acquisition of Chips & Technologies and investment in Real3D (see MPR 1/26/98, p. 5) will allow Intel to market a low-power notebook 2D/3D chip in 2H98.

Embedded DRAM is becoming a critical success factor for notebook graphics, and Intel does not currently make DRAM. It seems likely that Intel has already begun working on this technology, but it could be two years or more before the company can build it into graphics chips. This suggests Intel's first notebook-graphics chip will require discrete DRAMs, leaving a niche for Neomagic, Trident, and others who are further along the embedded-DRAM learning curve.

Given Intel's powerful brand name and enormous resources, we expect the company to quickly become a leading graphics-chip vendor. But given the wide-ranging demands of the graphics market, Intel is unlikely to dominate this market as it does the CPU and core-logic markets. There will always be opportunities for clever 3D-chip makers, but those that fail to innovate will perish beneath the treads of the Intel juggernaut. M