■ AMD Loses Second-in-Command Raza

In a stunning blow, Atiq Raza announced his resignation from AMD at the same time that the company disclosed a huge operating loss (see MPR 8/2/99, p. 3). Raza recently added the titles of president and chief operating office to his previous title of chief technical officer, which positioned him as the number-two executive in the company and heir apparent to long-time CEO Jerry Sanders. Raza's departure raises questions about the future success of the Athlon processor.

Although Raza's public statement provided only the oft-cited "personal reasons" for his resignation, other sources indicate it came after repeated clashes with founder Sanders. Raza, an engineer by training, who remains as comfortable with Spice simulations as with strategic plans, was the odd man out in AMD's management team, which otherwise consists of salesmen and nontechnical managers cut from Sanders' cloth. Unlike these executives, Raza had been with AMD only a few years; he joined after the company's 1996 purchase of NexGen, where he had been president and CEO.

Surprising many, Raza was successful at AMD, which has been hesitant to accept outsiders. Well respected in the technical community, Raza was able to retain most of Nex-Gen's CPU design team and augment it with key players such as former Alpha architect Jim Keller. Some of these designers may leave under a new management.

Raza's future is not determined. He seems unlikely to turn up at another processor vendor, as Intel is out of the question and others would be a step down. While at AMD, Raza made sizable private investments in several startups in the communications and Internet areas; it is more likely that he will wind up running one of these companies.

His departure does not bode well for AMD. No successor has been identified, with Sanders currently acting in all of Raza's former roles including, ironically, CTO. Except for Raza, the mercurial Sanders has been unable to attract and retain top technical executives. Sanders is politely known as a hands-on manager, and his handiwork has resulted in weak financial performance. Raza, in contrast, drove the successful development of the K6 and Athlon processors. After he took over AMD's manufacturing operations several months ago, the company shook off its long-time yield problems and produced a record number of chips in the second quarter.

The initial Athlon looks to be a good product, but we have already seen the company deliver good point products, only to fall behind again as Intel rapidly improves its processors. To remain competitive during the next 12 months, AMD must ramp Athlon's volumes, move it to Fab 25's 0.18-micron process, ramp the part in the new Dresden fab's copper process, and add on-chip cache for the value segment—all while maintaining the Slot A infrastructure. Without Raza's steady hand on the helm, this course suddenly appears more challenging.   —*L.G.*

■ IDT to Sell Centaur, WinChip Line

Following in National's footsteps, IDT has chosen to exit the x86 processor business, putting its Centaur Design subsidiary up for sale. Under new president Jerry Taylor, IDT will focus its efforts on the communications market rather than on the low end of the PC market.

Although IDT has had some success with the initial WinChip processor (see MPR 6/2/97, p. 1), that design is now showing its age and, at just 240 MHz, is too slow to compete against Celeron or the K6-2. The company struggled to produce a second-generation device in its 0.25-micron fab before giving up and setting up a foundry strategy instead.

In the meantime, fierce price cutting by Intel drove the WinChip's average selling price down to $30. Even with its low manufacturing cost, the product line was not profitable at this price. The more powerful WinChip 2 (see MPR 12/7/98, p. 18) is ready for deployment and could raise prices slightly, but going to an outside foundry increases manufacturing costs, again making it difficult to generate profits.

IDT's x86 strategy was built around small profits on a small market share, but under current conditions, the product line could not meet even those modest goals. When the company first introduced WinChip, it hoped to be profitable with a market share of just a few percent. IDT's market share reached 1.3% in 4Q98, but as the chip rapidly became uncompetitive in performance, its share dropped to 0.5% in 2Q99, according to our estimates.

Centaur, led by veteran CPU architect Glenn Henry, has developed several efficient x86 designs in record time and would be worth keeping intact. IDT claims to have received "expressions of interest" from multiple parties. With most of the world's major semiconductor vendors deciding to avoid the PC-processor market, possible buyers include a graphics vendor such as S3 or ATI, or a chip-set maker such as Acer Labs (ALI), all of which might be interested in developing integrated PC processors. IDT says it will shut down Centaur if a buyer is not found by the end of September.

Potential buyers must consider that neither Centaur nor IDT has an Intel patent license. Intel has conveniently ignored WinChip, perhaps because of its small market share, but it might not be as generous to a future owner. More important, any buyer must be concerned that Centaur's strategy is to compete in the low end of the market, where Intel's aggressive Celeron pricing has made it difficult for any vendor to be profitable.

Although Centaur has a strong team of designers, the WinChip brand is not well established outside of the Asian market, and its sales are rapidly dwindling. Any attempt to resurrect the product line is likely to be costly and draw Intel's ire. But for a company committed to getting into the x86 processor business, buying Centaur would provide a good starting point.   —*L.G.*

■ Merced Tapes Out

The first IA-64 processor reached a key milestone by achieving tapeout in early July. Last fall, the company committed to producing first silicon in "mid-1999." Even if the first Merced wafers are hand-carried through the fab by Craig Barrett himself, first silicon isn't likely to appear before August. Intel says, by its reckoning, this would still qualify as mid-1999.

Speaking of CEO Barrett, he recently promised the first Merced samples will be available "in a couple of months or so," presumably meaning around September. These will likely come from the first silicon, which in most processors has bugs that require serious workarounds. High-quality samples probably won't be out until next year. Intel continues to project "mid-2000" shipments for the first Merced systems, but apparently Intel's calendar is flexible enough to include much of 3Q00 under this definition.

In fact, we wouldn't be surprised if first system shipments slip into 4Q00. Twelve months from tapeout to system shipments is optimistic for any modern high-end processor, particularly the first implementation of a radically new instruction-set architecture.

In any case, the Merced tapeout is a major achievement that refutes rampant rumors about the chip's falling further and further behind schedule. Unless some huge problems appear, system shipments in 2H00 are highly likely. That date will mark the beginning of the IA-64 age. *—L.G.*

■ Pentium III Hits 600 MHz

Using unexpected headroom on its 0.25-micron process, Intel today rolled out a 600-MHz Pentium III based on its Katmai processor. This clock speed was originally planned for the 0.18-micron Coppermine processor, but that chip has now been delayed until November for desktop PCs (see MPR 7/12/99, p. 4). The new 600-MHz part matches the clock speed of AMD's forthcoming Athlon (see MPR 7/12/99, p. 1), expected to ship in systems later this month. PCs using the Pentium III-600 are already available.

To prepare for the debut of the 600-MHz Pentium III, Intel cut the prices of its other Pentium III and Pentium II processors last month, as the table below shows. These price cuts, averaging 12%, appear mild. Because Intel cut prices twice this quarter, however, the total drop from the previous quarter is actually quite steep, more than 40% in some cases. The biggest drop is for the Pentium III-450, which now carries a list price of just $230. With Celeron serving most of the demand below this price, Pentium II shipments are rapidly approaching zero.

	1,000-piece list price as of			Change from	
	4/11/99	5/16/99	7/18/99	5/16	4/11
Pentium III-600	—	—	$824	—	—
Pentium III-550	—	$744	$658	–12%	—
Pentium III-500	$637	$482	$423	–12%	–34%
Pentium III-450	$411	$268	$230	–14%	–44%
Pentium II-450	$396	$268	$230	–14%	–42%
Pentium II-400	$234	$193	$173	–10%	–26%

Intel has priced the new 600-MHz part at a towering $824 in 1,000-piece lots, a level not seen since early 1998. This may indicate that the company is pushing the yield curve a little harder than usual to make up for the Coppermine delay, resulting in a relatively small number of parts. This price is 17% higher than that of the Athlon-600.

Like earlier Pentium III processors, the 600-MHz part uses a 100-MHz bus. Intel's 820 (Camino) chip set, which supports a 133-MHz system bus, is due in September. When the 820 ships, Intel plans to deploy a 600/133-MHz processor to take advantage of it. This plan will provide another performance boost to the Pentium III line next month. *—L.G.*

■ Intel Deploys Celeron-500, Cuts Prices

With new headroom in the Pentium III line (see previous item), Intel also raised the top speed of its Celeron line to 500 MHz. The new Celeron-500 is based on the same Mendocino die as previous versions, carrying 128K of on-chip cache. The chip lists for $177. The new speed grade again pushes Celeron ahead of AMD's K6-2 in clock speed. The fastest K6-2 tops out at 475 MHz and carries a $152 list price.

To make room for the Celeron-500, Intel cut the prices of its other speed grades, as the table below shows. These price cuts come just two months after the previous round but are relatively modest, averaging just 10%.

	1,000-piece list price as of			Change from	
	4/11/99	6/6/99	8/1/99	6/6	4/11
Celeron-500	—	—	$177	—	—
Celeron-466	$169	$147	$137	–7%	–19%
Celeron-433	$143	$113	$103	–9%	–28%
Celeron-400	$103	$93	$79	–15%	–23%
Celeron-366	$73	$69	$69	0%	–5%
Celeron-333	$67	$67	—	—	—

We do not expect faster versions of Celeron this year, as the Mendocino die is reaching its speed limit and Intel wants to keep the platform stable for the back-to-school and holiday selling seasons. Celeron is most popular in the consumer market, which is driven by these seasonal issues. Price cuts for the rest of the year are likely to be small, as Intel can't undercut itself without new speed grades at the top of the Celeron line.

This strategy leaves the performance segment focused on Pentium III, with SSE and clock speeds up to 600 MHz. The Celeron segment will be distinguished by its lack of SSE and by speeds up to 500 MHz. After a lull for the next few months, the Celeron line is likely to again see rapid changes in 1H00 as Intel introduces a 100-MHz bus and SSE into the low end of its lineup. *—L.G.*

■ AMD Drops Low-Power Line

Without fanfare, less than a year after announcing the low-power K6 processor line, AMD has removed it from its price list in favor of the "P" versions of its mobile processors. Since AMD began offering the K6-2P (see MPR 3/29/99, p. 4),

most of its customers have followed Compaq's lead and adopted that part rather than the low-power version. The K6-2P dissipates up to 16 W, well above the 10-W limit perpetuated by Intel for its mobile processors and adopted by AMD for the original mobile K6-2.

By taking advantage of this extra power headroom, AMD can offer fast processors at low prices. For example, the K6-2P is available at 400 MHz for only $124, well below Intel's $187 price for the Mobile Celeron-400. AMD claims many notebook makers can accommodate the extra heat and don't mind a modest (typically less than 10%) decrease in battery life, making the K6-2P attractive.

Intel could easily deliver parts to the same "P" specification and achieve even higher frequencies, but it has chosen not to. Intel says its customers prefer the lower heat and longer battery life associated with its low-power parts.

We believe both companies are right. Although AMD has made some impressive gains in the U.S. retail notebook market, its worldwide share of the mobile market is only 7%, according to our estimates. Intel's customers clearly make up the vast majority of the market, and they are the ones seeking traditional low-power designs. There appears to be a small fraction of the mobile market that is willing to accept higher power, however, and these customers are gravitating toward AMD's solution, which reduces CPU cost. By serving this niche, AMD has found an innovative way to differentiate its products from Intel's.

Given AMD's current cash crunch, simplifying its product line by eliminating a low-volume part makes sense. But unless the "P" concept becomes more widely accepted, this cutback will make it more difficult for AMD to expand its share of the mobile market. And if more customers do adopt the "P" parts, Intel is likely to respond with a similar product. Intel is usually willing to let other vendors service niches in the PC-processor market, but only as long as the niche doesn't get too big.   —*L.G.*

■ National to Build Chip Sets for Via
On the heels of the announcement of Via Technologies' intent to acquire Cyrix from National (see MPR 7/12/99, p. 5), the two companies have announced that National will manufacture Via's 133-MHz P6-bus chip set. Intel had granted Via a license to manufacture P6-bus chip sets, but that license was limited to slower bus speeds. Intel sued Via after it introduced the 133-MHz chip set. By building the chip set in National's fab, Via gains the protection of National's broad Intel patent license, which does not have any product-specific limitations.

Cyrix officials have said that, as part of Via, Cyrix will have Intel patent protection for its processors. Whether this is done simply by having National build the chips remains to be seen; this action would not be an entirely satisfactory solution, since Cyrix is likely to want to use Asian foundries.

Furthermore, National has put its South Portland, Maine fab up for sale, putting in doubt the length of time it will have a leading-edge fab at which to build the chips. National hopes to retain a minority interest in the facility, which raises the interesting legal issue of whether a chip built in a foundry that is 40% owned by National is 100% licensed or only 40% licensed. Given this uncertainty, Via's use of National as a foundry may be only the first step in a broader plan for Intel patent protection.   —*M.S.*

■ S3 Introduces New Mobile Savage Chips
S3 has announced mobile graphics chips based on its Savage core technology (see MPR 2/15/99, p. 14). The new Savage/MX and Savage/IX are said to be the first graphics chips in the industry built on a 0.18-micron process. The Savage/IX is also notable for its use of an organic-substrate multichip-module (MCM), which allows it to include up to 16M of DRAM in the same package with the graphics chip.

The MCM approach supports enough memory for serious 3D while preserving the small form factor of pure embedded DRAM graphics chips, such as those from Neo-Magic. To date, only S3 and ATI (see MPR 12/7/98, p. 4) have announced MCM graphics products, though we expect to see more of these in the future.

S3 has priced the Savage/MX, which uses external discrete DRAMs, at $42 in quantity. The Savage/IX is priced at $49, $56, and $68 with 4M, 8M, and 16M of MCM DRAM, respectively. This works out to just less than $2 per megabyte for the MCM DRAM, which is a sizable price premium over discrete memory but reasonable given the space and power savings from the integrated approach.   —*P.N.G.*

■ Mitsubishi Updates 3D-RAM
The new 3D-RAM5 graphics memory chip from Mitsubishi (*www.mitsubishichips.com*) combines four complete copies of its predecessor, the 3D-RAM4, with additional logic to assist in 3D-rendering operations. With a higher clock speed as well, the new chip achieves six times the internal bandwidth of the previous chip. Implemented in a 0.25-micron process, the 3D-RAM5 offers 40 Mbits of storage and the 32-bit ALU that is the hallmark of the 3D-RAM family.

The new chip has four 71.5-MHz 256-bit data buses between the four-bank DRAM array and an 8-Kbit cache associated with the ALU. These internal buses provide more than 9 GBytes/s of peak bandwidth. External accesses are handled via two random-access 32-bit data buses that operate at 143 MHz, plus a 40-bit video output port at 80 MHz.

Mitsubishi has not announced pricing for the new chips. Although the 3D-RAM generally has a much higher cost per bit compared with commodity SDRAM or SGRAM, it is often used in high-performance 3D-CAD accelerators, such as NEC's TE4E (see MPR 8/2/99, p. 20), that can benefit from the 3D-RAM's sophisticated architecture.   —*P.N.G.*   Ⓜ