Building the Perfect Laptop

The superslim ThinkPad X300 is Lenovo's bid for leadership in the high-stakes world of laptops

by Steve Hamm and Kenji Hall

"Phyllis! Get me one of those interoffice mail envelopes!"

It was just after lunchtime on Jan. 15, and Peter Hortensius was storming through the cubicles at Lenovo Group's offices in Morrisville, N.C., shouting for his secretary. Hortensius, senior vice-president in charge of laptops, had just heard that Apple (AAPL) CEO Steve Jobs had unveiled the supersvelte, aluminum-clad MacBook Air by declaring it the "world's thinnest notebook" and dramatically pulling it out of an interoffice envelope. Lenovo's ThinkPad X300 notebook was due out in February, after a year and a half in development, and Hortensius was alarmed that it could be upstaged before it even made its debut.

His secretary, Phyllis Arrington-McGee, ransacked filing cabinets until she found one of the envelopes. She handed it to Hortensius, who gingerly slipped the X300 inside. "It fits! It fits!" he shouted.

Perhaps no one was more relieved than David Hill, Lenovo's chief designer, who stopped by Hortensius' office right after the envelope experiment. It had been his idea to create the superthin X300, which was originally code-named Kodachi. Hill shared a laugh about the test with Hortensius and later couldn't resist a poke at Jobs' latest creation. "I'm a bit tired of looking at silver computers," said Hill. "I'd never wear a silver business suit."

Such is life in one of the most competitive markets on earth: the portable computer business. The best engineers and designers at the most powerful technology companies slug it out with top-secret plans and ulcer-inducing deadlines. From Hewlett-Packard (HPQ) and Dell (DELL) to Acer, Lenovo (LNVGY), and Toshiba, design and production teams race to carve out their share of the fast-growing market. They fight over ounces and millimeters, but their victories are measured in billions of dollars.
For David Hill, Steve Jobs, and others in the fraternity, the questions are: What is the perfect combination of weight, price, and features? And what new technologies should be included? It's a sign of the intense competition that the revered Jobs received decidedly mixed reviews for Apple's Air, despite its eye-catching looks.

At Lenovo, Hill and his colleagues have a lot riding on the X300, part of its ThinkPad line of computers. The Chinese company bought IBM's (IBM) money-losing, $10 billion PC business in 2005 with hopes of using it to build a prominent global brand. IBM's ThinkPad had long been a favorite of executives and business travelers, but it lost cachet over the years. The goal now with the X300 is to deliver a machine that will burnish Lenovo's reputation worldwide. "We want to send the message that if there's a company in the industry that can continuously develop the most inventive and best-quality products with efficiency, it will be Lenovo," says Chairman Yang Yuanqing.

The X300 isn't perfect. Perhaps no computer can be. But its development over the past 20 months shows the journey of one team striving for perfection, while at the same time being forced to make hard compromises. Lenovo doesn't expect the X300, with prices ranging from $2,700 to $3,000, to be a huge seller. They believe it will be a "halo" product, leading to positive reinforcement for the corporate brand and for the more affordable ThinkPads. The X300 will be prominently featured at the Beijing Olympics, where Lenovo is to be one of the major sponsors.

Lenovo needs a hit, perhaps more than one, to win recognition as one of technology's premier brands. It trails behind leaders HP and Dell in the notebook market, and some competitors are dismissive of its prospects. "We have bigger rivals to worry about, except in China," says Michael S. Dell, chief executive of Dell in an interview.

**SMALL IS COSTLY**

The X300 arrives as portable computing is breaking out, after decades in which desktop PCs dominated. For the first time ever, more laptops are expected to sell in the U.S. this year than desktops, industry analysts say. At the same time, the miniaturization of electronics has allowed tech outfits to pack so much into high-end mobile phones that they have become, essentially, small computers.

These trends are the culmination of a 40-year quest to fulfill the potential of mobile computing. Back in the late 1960s, scientists envisioned portables even before it was possible to build a desktop PC. In the early 1980s, computing pioneers produced suitcase-size "luggables," and later in the decade they delivered full-powered laptops slim enough to slip into an attaché case. The 1990s brought personal digital assistants such as the Palm Pilot (PALM). And this decade ushered in smartphones like the BlackBerry (RIMM) for businesspeople and the iPhone for consumers. The vision that Microsoft (MSFT) founder Bill Gates articulated nearly two decades ago, of having information at your fingertips, is at last being realized. "Portable computing has been a mind-blowing success," says Gates in an interview.
It's still difficult to design and build an excellent portable computer, however. Making things small adds cost. So when engineers and designers set out to create new portables, they have to stretch to produce something that's compact, powerful, and affordable. That's the challenge that Lenovo's ThinkPad team faced when they set out to create the X300 all those months ago.

The effort started with Hill, a bespectacled 50-year-old Oklahoman who rebuilds motorcycles in his spare time. At Lenovo, where he is director of corporate identity and design, he's known as the keeper of the ThinkPad tradition.

The original design concept, created by consultant Richard Sapper, was that ThinkPads would be simple, elegant, matte-black machines with precise, 90-degree corners. Introduced in 1992, the ThinkPad went on to become the longest-lasting design franchise in computing history. By 2007, on its 15th anniversary, more than 30 million had been sold. After Lenovo bought IBM's PC company and Chairman Yang signaled that he wanted innovative design and engineering, Hill took that as a personal challenge to design the thinnest, lightest, and most elegant ThinkPad ever.

He started out, in June, 2006, with two radical thoughts. One was to push the idea of simplicity further than any computer company ever had before. Like other laptops, ThinkPads have plugs and switches on the sides and back, and labels on the bottom. What if they made a machine that showed nothing on the outside but a logo on the top and a latch on the front? He even toyed with the idea of eliminating the electrical cord. The machine could be powered by setting it in a special cradle. Hill and colleagues built a prototype of such a machine—with a plain outer shell on the bottom. Only when you opened it were the plugs exposed.

Hill's other idea was to make the PC very small, less than 10 inches across and less than one inch thick. Yet he wanted it to have a full-size keyboard, so he dusted off a design from the mid-1990s: a keyboard that folded up when the laptop was closed and opened out to full size when the machine was opened. The "butterfly" keyboard had caused a sensation when it was first introduced on a ThinkPad in 1995.

This was the beginning of the X300, the "concept phase" of development. Like most ThinkPads, this one got its start in the U.S. The planners, project leaders, and some of the designers are in North Carolina. The more detailed design and engineering work is done by a team in Yamato, Japan. Manufacturing and purchasing take place in Shenzhen, China.

Hill refined his design concepts through discussions with Sapper and design colleagues in Japan and China. During a meeting at Sapper's modernistic, V-shaped home on Italy's Lake Como, the 75-year-old design legend urged Hill to make the fold-out keyboard deploy automatically, rather than requiring the owner to snap it into place. By midsummer, Hill handed his ideas over to the Yamato engineers to see what would really work.
FORGET THE SUPERREALITY

The man in charge of product development in Yamato was Arimasa Naitoh, known in his home country as the "father of the ThinkPad." His team in the early 1990s established the ThinkPad's reputation for quality and advanced technology. Naitoh believes there should be creative tension between designers and engineers. "We encourage [the creatives] to design something that's not too real," he says. "If they stick to superreality, nothing will be fun, nothing will be new."

Once Hill's early design concepts were in the hands of the Yamato engineers, they put them to the test. Every day or so, Hill would receive drawings from Yamato showing how the components and electrical parts might fit together. By late September the engineers began to question some of Hill's most radical ideas. Thirteen-inch screens were becoming popular because they're good for watching movies, so the engineers didn't want to use Hill's 10-inch version. Hill gave in. That meant there was no need for the fold-out keyboard. They also concluded that the metal shell in which he wanted to hide the plugs would add too much weight. Hill didn't protest. "You start with wide nets. You gather a bunch of ideas. And you finally settle on the elements that are most promising," he says.

Lenovo's product development managers were focusing on a new high-end laptop that would include three important emerging technologies. The first was solid-state storage, which doesn't break when people drop their laptops the way the mechanical disk drives in most computers sometimes do. The second technology was LED backlighting on computer displays, which would improve movie viewing. The third was a DVD drive just seven millimeters thick. In October, 2006, the managers decided to combine these technologies with Hill's design concepts. The machine was given the code name Kodachi, after a small samurai sword.

The project was approved to enter the "plan phase" in January, 2007. The Kodachi team went to work in earnest on all the mechanical and design elements. They opened discussions with suppliers about their newest technologies. Hill was in near-daily touch with the Japanese team by phone and e-mail.

At the same time, the marketers began exploring Kodachi's sales potential. The original estimate was that Lenovo would be able to sell 130,000 units of Kodachi and a follow-on version, due out in August, over 12 months. But the sales force came back with a stunningly low estimate: just 60,000.

Hortensius swallowed hard and approved the project anyway. The 17-year IBM veteran has a gruff, no-nonsense style, but he often backs designers and engineers in their wilder ideas. With Kodachi, he figured the salespeople were being conservative about a high-end product the likes of which they had not sold before.

Kodachi moved into the "development phase" in April, 2007, and from that time on, Lenovo's designers and engineers lived in a state of dread that a competitor would beat them to market with a laptop just as thin and light. Laptops range in price from $500 to
$3,000, and they weigh anywhere between three and eight pounds. Since Kodachi would be loaded with cutting-edge features, it was going to be priced at the high end—perhaps as much as $3,000.

Over the coming months, the bulk of the work would be done in Yamato. A product development team there, headed by Hiroyuki M. Kinoshita, would take the requirements laid out in the plan and try to fulfill them. It was also in charge of formulating a kind of rubberized paint for the exterior of the machine that would look like leather and have a satiny feel. For years, Kinoshita had been a serious sailor in his free time. But as the Kodachi project ramped up, he had less and less time for sailing. He typically worked from 9 a.m. till 10 or 11 p.m.

He and his colleagues faced a tight schedule, with a steady drumbeat of deadlines and reviews. Early September: mechanical prototype. September through October: testing of complete prototype and components. November: final prototype. Early December: pre-production testing. In December a review board comprising a half-dozen quality managers was scheduled to meet in Yamato to decide if Kodachi was ready to go into test production. That would be the final hurdle.

GO ON, DROP IT

Throughout the development process, Kinoshita's team subjected the prototypes to a series of stress tests. The most extreme was the "free-drop, torture-drop test." The laptop, which was wide open and turned on, was held in a contraption that looked like a guillotine about five feet up from a stone slab. A beep sounded. The laptop was released and hit the stone floor with a loud smack. Engineers rushed over to see the results: Kodachi had survived intact.

On Oct. 1, however, a problem emerged that threatened to knock the team off schedule. Andy Kozak, a graduate of the U.S. Naval Academy who was coordinating Kodachi development from Morrisville, opened a cardboard box containing a prototype that had been hand-built in Yamato. Inside was a crude hinged aluminum box containing Kodachi's electronics that had little resemblance to a finished notebook computer. When Kozak lifted the machine out of the package, he noticed that an important piece was missing: "I explored with my fingers, and I realized there was no solid-state drive. I said: Oh, s---!" The problem, he discovered, was that the solid-state drives they had ordered from two Asian suppliers had not passed quality-control tests. As a result, they had been left out of that machine altogether.

Usually, such setbacks would be dealt with in a few weeks. But the suppliers couldn't resolve their problems before Kozak faced the Lenovo quality review board in Yamato in early December. The session felt like a trial. Kozak sat at a conference table opposite five stone-faced Japanese reviewers and made his case for Kodachi proceeding to the next development stage in spite of the problems. The verdict came down the next day: "Not ready."
Kozak was beside himself. Back in his hotel room in Tokyo, he sent an instant message with the bad news to Mark Cohen, head of ThinkPad operations. Cohen, the powerful right-hand man to laptop chief Hortensius, decided on a risky course: Test manufacturing would go ahead without the solid-state drives, despite the panel's verdict. The drives would be added later, after they passed the tests. Kodachi would keep moving forward.

The ThinkPad factory in Shenzhen occupies a six-story concrete building in a free-trade zone. On Dec. 10, a Monday, a crew of young people—mostly women in blue Lenovo smocks with lighter-blue caps—began assembling the first 25 Kodachi test units. There was no haste. Working under banners exhorting them to "Eliminate Idle Time" and "Meet Customer Requirements," their job was to spot any problems and to develop step-by-step instruction sheets for the assembly line crews that would begin to handle high-volume production, starting on Jan. 25.

"WOW, THAT'S LIGHT"

One day in early January, Kozak was sitting at his desk in Morrisville eating his customary egg salad sandwich for lunch when Cohen walked over and told him Hortensius wanted to see one of the new Kodachi models that were coming off the line in China. Kozak called around until he found one of the precious samples, which had just been shipped to product testers in Morrisville. The machine was everything he had hoped for: extremely thin and light with an elegant matte-black surface. It was also the first ThinkPad with Lenovo's logo on the top. The IBM logo had been removed a few months earlier. He took it to Hortensius' conference room and laid it before his bosses.

It was the first time Hortensius and Cohen had seen the final prototype. Hortensius lifted the machine. "I love this," he said. Early on, he had told the engineers in Yamato he wanted it made lighter, and they had found ways. Kodachi was originally specified at 3.4 pounds. It came in at 3.1. The version without a DVD drive weighed just 2.9 pounds. "This tells people we can do better," Hortensius said later. "It tells me we haven't reached the end of innovation in notebooks."

The Apple Air scare came a few days later. The Lenovo people had heard rumors that Apple had an ultraslim notebook in the works, but they weren't sure whether the speculation was true. By then, Kodachi was in "launch phase," on a relentless march to completion. The main supplier of the solid-state drive had not been able to fix its problems in time, so Lenovo had switched at the last minute to the backup supplier, which came through in the pinch. On Jan. 25, manufacturing started in Shenzhen. Lenovo plans on officially unveiling the X300 on Feb. 26.

One evening in late January, Hill put an X300 in his bag at the office and drove to his home in nearby Cary, N.C. He had been talking for months about the project to his wife, Jena, and now he wanted her to see the finished product. She was in the kitchen when he arrived. "I want to show you Kodachi," he told her. He slipped the machine out of his bag and handed it to her. "Wow, that's light," she said, passing it back to him. She asked how
much it would cost. When Hill told her, she said: "Oh, my." It seemed a bit pricey. Then she asked to hold it again.

Hill has strong emotions about the product he still calls Kodachi. The designers and engineers had accomplished a lot of what he had dreamed of back in June, 2006. His only real disappointment is that the bottom is still more cluttered with labels than he would like. But that gives him challenges for a new generation of ThinkPads that will come out next year. "It's a continuous search for perfection," he says. It has to be for Hill and his team. Rivals around the globe are racing for the same goal.

With David Rocks in Shenzhen, China

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