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SEGWAY LLC

Background

In January 2001, an informal book proposal consisting of an email dialogue between a writer, Steve Kemper, and his agent was leaked to the media. The proposal outlined a book chronicling the invention and development of a new product, code named "Ginger" or "It," by DEKA Research, a secretive technology development firm run by a well known eccentric inventor, Dean Kamen. Because of a strict confidentiality agreement, the proposal did not reveal any significant details about what "IT" was. Because of the extraordinary nature of the investors, advisors, and forecasted impact of the product, the worldwide media provided extensive coverage of the leaked proposal and fueled rampant speculation about the nature of the invention. In fact, several new web sites devoted to the subject flourished with hundreds of active participants and thousands of readers. (See for example: http://www.theitquestion.com.) Ginger was eventually revealed at the end of 2001 as the Segway Human Transporter, an electric-powered personal mobility device (Appendix A).

Some excerpts of Kemper's proposal follow:

…Kamen didn't invent the wheel, but people far smarter than I who have seen IT believe that people will talk about Kamen the way they once talked about Henry Ford. John Doerr thinks Kamen will do for the 21st century what Ford did for the 20th, and he calls Kamen a combination of Ford and Edison. …Anyone who pays attention to Silicon Valley breaks into a sweat at the mention of Doerr, one of the golden boys of the dot.com world. He's a partner in Kleiner Perkins Caufield & Beyers, the venture firm that launched Netscape, Amazon.com, Excite, @Home, Heatheon and many others. Everybody wants him, so naturally he's almost impossible to reach. Well, since seeing the invention he's been calling Kamen at least once a day to try to convince him to give KP a bigger share of the new company that the invention will generate. At the moment, [Kamen] has limited KP to $38 million, about 7 ½ percent of the company. This is the largest single investment KP has ever made, and they've given the new company the highest valuation in their history--$500 million. …The other major investor, equal to Kleiner Perkins, is the venture arm of Credit Suisse First Boston … Credit Suisse agrees with KP's valuation and expects the new company formed around Kamen's invention to make more money in its first year than any start-up in history…There's a group of minor investors as well, billionaires and multi-millionaires …who are putting up anywhere from half a mil to several million each. They include Paul Allaire, CEO of Xerox and Vern Loucks, recently retired CEO of Baxter. The total comes to nearly $90 million.

Ginger is a separate company from DEKA and the team naturally thinks of itself as independent. But Kamen, an old-fashioned industrial patriarch, doesn't see things that way and continues to vet every important decision and many unimportant ones… Because Ginger will be a world-wide consumer product, and because it's likely to run afoul of existing regulations and/or inspire new ones, Tim Adams, Ginger's CEO, hires experts in the relevant fields. Though Kamen has no experience in any of these fields-- he scorns the whole concept of marketing and has always considered manufacturing the dull aftermath of invention-- he quickly establishes himself as an intuitive force and the final word in all of these unfamiliar areas.

This document is a teaching tool prepared by Professor Karl Ulrich from a collection of publicly available sources, principally internet web sites. A more detailed discussion of the Segway development is contained in the book *Code Name Ginger* by Steve Kemper (Harvard Business School Press, 2003). From 1999-2002 Ulrich was CEO of a company (Nova Cruz Products) that competed indirectly with Segway.

…Doerr involves some of his friends: Steve Jobs, Jeff Bezos, Randy Komisar, and other bigwigs from Oracle and Intuit. Kamen tries to find a way to benefit from their knowledge without surrendering to their egos, fame, and pressure to invest in Ginger. The West Coast contingent tells Kamen that Ginger's top executives lack the vision to launch a revolutionary product and create a worldwide billion-dollar business. Credit Suisse agrees. Kamen, who demands absolute loyalty from his employees and gives it in return, is torn. He leans harder on Ginger's execs, who sometimes argue, sometimes agree, and continue to feel chafed. The deadline for launch badly stresses the engineering team, which finds itself stretched between engineering the product and interviewing job candidates to fill holes.

….[describing meeting with the advisory board consisting of Bezos, Jobs, and others]….

Good morning to everyone," said Adams [then CEO of the company], smiling at the front of the table. "Before we start, we'd like to ask you to hold your questions until after each presentation." "Yeah right!" snorted Bezos, followed by that big honking laugh. "Otherwise we might as well not be here," said Jobs. "How long is your presentation?" asked Doerr. "Each pitch is about ten minutes." "I can't do that," said Jobs. "I'm not built that way. So if you want me to leave, I will, but I can't just sit here." Adams stared at Jobs for a moment, then turned to the screen and put up a spec sheet about Metro and Pro, the two Ginger models expected to launch in January 2002. "As you can see," began Adams, "-" "Let's talk about the bigger question," interrupted Jobs. "Why two machines?" "We've talked about that," said Adams, "and we think-" "Because I see a big problem here," said Jobs. "I was thinking about it all night. I couldn't sleep after Dean came over." He explained his experience with the iMac, how there were four models now but why he had launched with just one color, to give his designers, salespeople and the public an absolute focus. He had waited seven months to introduce the other models. Bezos and Doerr were nodding as he spoke. "If you start with the Metro at less than $2,000 and it's a hit," he continued, "you could come out with the Pro later and charge double for industrial and military uses." Adams's eyebrows shot up and he looked at Kamen, whose face was a mask. "Mike?" said Adams, looking at Ferry for a marketing opinion. "It's a good point," he said, giving his usual soothing, noncommittal, safe response. "What does everyone think about the design?" asked Doerr. "What do you think?" said Jobs to Adams. It was a challenge, not a question. "I think it's coming along," said Adams, "though we expect-" "I think it sucks!" said Jobs. His vehemence made Adams pause. "Why?" he finally asked, a bit stiffly. "It just does." "In what sense?" said Adams, getting his feet back under him. "Give me a clue." "Its shape is not innovative, it's not elegant, it doesn't feel anthropomorphic," said Jobs, ticking off three of his design mantras. "You have this incredibly innovative machine but it looks very traditional." …after a pause Adams began again: "Well, let's keep going because we don't have much time today to-" "We do have time," said Doerr curtly. "We're here to get Steve and Jeff's ideas." "The problem at this point is lead time in our design schedule," said Adams. Jobs snapped his head quickly from Doerr on one side to Kamen on the other, as if he'd been slapped. "That's backwards," he said, his voice rising. "Screw the lead times. You don't have a product yet! I know burn rates are important, but you'll only get one shot at this, and if you blow it, it's over." Agitated, he turned to Bezos. "Jeff, what do you think?" "I think we'd do a disservice to the machine if we didn't give a great design firm a chance," …Jobs grunted. …

Brian Toohey's presentation was next, on the regulatory obstacles Ginger would face and how he intended to overcome them. … Bezos said, "I think this plan is dead on arrival. The USA is too hostile." His idea was to go slow, using one city or country as an experimental station. Once Ginger's benefits were clear, the company would have a wedge to pound into U. S. regulations. …
But Jobs was shaking his head. Because of the internet, he said, slow was no longer possible. People

would learn about Ginger in a flash of bits and bytes, and would want one now. So a small launch in a foreign place was foolish, because if the machine wasn't available in the U. S., the company would blow its chance for $100 million of free publicity in its biggest market. … "I think the emphasis of this conversation is wrong," said Bezos. "You have a product so revolutionary you'll have no problem selling it. The question is are people going to be allowed to use it?"

… Kamen wanted to be sure that Doerr and Schmertzler, his major investors, hadn't lost sight of two things through the smoke of Jobs' bombardment. All the talk about small launches at colleges or in foreign cities or among industries worried him. So he reminded them about the serious problems that Ginger could help solve.."If we really believe that this is a big idea," he said, "then we need to remember that big ideas can make new ways of seeing things. We shouldn't try to put a big idea into a niche." He looked around the table. The first person to speak-surprise!-was Jobs. "I don't worry about the big idea, because if enough people see the machine you won't have to convince them to architect cities around it. It'll just happen. That's the story of the PC. Nobody had any idea how they would be used, and look what happened." "I think we all agree with the big idea, Dean," said Bezos. "That's why we're here, not to make $3 billion in a niche market." All very nice, thought Kamen, but neither Jobs nor Bezos had a dime invested in Ginger and he hadn't heard from anyone who did, so maybe it was time to throw a bone. "If you wanted to make money on the niche markets, you could always do that, too," he said, patting Schmertzler on the shoulder. "Dean, we've all made plenty of money," said Doerr, sounding offended. "We're not here for the money. Please retract your statement." How rich. Here was a $38-million investor acting as if money didn't matter, like a gambler lighting his cigar with a $1,000 bill. Kamen smiled and apologized for suggesting that his investors might prefer to make money instead of change the world. Schmertzler moved his eyes from Doerr to Kamen, wearing a look that mixed disbelief with consternation, and implied that changing the world would be nice, but first let's compound our investments. …

Aileen Lee, Doerr's assistant, a young Harvard MBA, suddenly spoke up for the first time. Could Ferry state Ginger's "value proposition"? A trendy business school term for "gimme the headline." Lee had made a list of significant new products and each had a clear value proposition. Next to "cell phone," for instance, you could put "allows wireless telephone communication." Next to "fax machine" you could put "allows visual transmission of documents over phone lines." And so on for the PC, the PDA, and other products. What would Ferry put next to Ginger? Ferry seemed flummoxed, and began rambling about the different markets for Ginger. "Answer her question," said Doerr sharply. "What would you put next to us?" He paused infinitesimally, then bored in again. "You're the marketing guy. You should know." Another tense pause. "I'll answer if you can't." "I think it's a really good question," said Ferry blandly. "And-" Doerr snorted in disgust and shook his head, then looked at Kamen to see if he understood that he had a dunce for a marketing director. Bezos and Doerr had to go, but Doerr still seemed agitated. He had drawn several conclusions from the meeting. First, they needed a value proposition. Second, the launch was indefinitely on hold until they got the product right. Bezos asked Kamen how he felt about that. "I think the design can be fixed with relatively small impact on the launch date," Kamen said carefully. "We get to do something like this so rarely," said Doerr, sounding righteous again. "We shouldn't launch until Steve Jobs wets his pants." … Not that Kamen doubted Doerr's noble motives, but he knew that if they missed the launch date, Ginger would need more money, because the burn rate at that point would millions of dollars per month.

Money might not matter to Doerr at the moment, but it always mattered to Kamen, especially in this case. If Ginger needed more funding, Kleiner-Perkins and CSFB would offer it eagerly--for a bigger

share of his company. That wasn't going to happen, whether the design sucked or not. He had a lot of things to think through on the long flight home, including damage control among both his staff and his investors. His biggest worry coming out of the meeting wasn't the design or distribution channels or where to launch or regulatory obstacles. He knew that Doerr had considered Adams and Ferry mediocre even before the meeting, and their performance today hadn't done anything to change that opinion. They had seemed out-matched, stodgy, traditional. Only Toohey had done well. His fears were confirmed within a few days by conversations with most of the outsiders from the meeting. Bezos, Jobs, Doerr, Schmertzler, [Harvard Business School professor] Sahlman-all of them wondered the same thing: why was Kamen letting these guys run this company? "They're buttheads," said the silver-tongued Jobs. "That marketing guy should be selling Kleenex at a discount store in Idaho. And that CEO-where did you find an old-line butthead like him?" Damage control, he thought. Gotta do some damage control.

About DEKA Research

From the Deka web site http://www.dekaresearch.com

"DEKA Research & Development Corporation is a dynamic, growing company, focused on the development of radical new technologies that span a diverse set of applications. Our team is comprised of engineering, manufacturing and quality professionals dedicated to creating innovative solutions for advanced technologies. The people at DEKA focus on the complete development process, from proof of concept to low volume manufacturing runs, designing advanced medical products which are easier to use, more accurate, and more functional than the products they are replacing. DEKA's technologies, and the products which incorporate these technologies, are improving lives around the world."

Founded in 1982 by Dean Kamen, DEKA consisted of a relatively small group of individuals and lots of innovative ideas. Today, almost 200 engineers, technicians, and machinists work in our electronics and software engineering labs, machine shop, and on CAD stations. Our facilities have been designed to promote constant interaction between and within the engineering groups. Our on-site machine shop and molding facility are central to the success of our projects; ideas are prototyped and tested in record time.

DEKA's mission, first and foremost, is to foster innovation. It is a company where the questioning of conventional thinking is encouraged and practiced by everyone—engineers and non-engineers alike—because open minds are more likely to arrive at workable solutions. This has been our formula for success since we began, and it will continue to drive our success in the future."

About Dean Kamen

From the Deka web site (http://www.dekaresearch.com)

"Dean Kamen is an inventor, an entrepreneur and a tireless advocate for science and technology. His roles as inventor and advocate are intertwined -- his own passion for technology and its practical uses has driven his personal determination to spread the word about technology's virtues and by so doing to change the culture of the United States. His vast knowledge of the physical sciences, combined with his ability to integrate the fundamental laws of physics with the most modern technologies, has led to the development of breakthrough processes and products.

As an inventor, he holds more than 150 U.S. and foreign patents, many of them for innovative medical devices that have expanded the frontiers of health care worldwide. While still a college undergraduate, he invented the first wearable infusion pump, which rapidly gained acceptance from such diverse medical specialties as chemotherapy, neonatology and endocrinology. In 1976 he founded his first medical device company, AutoSyringe, Inc., to manufacture and market the pumps. At age 30, he sold that company to Baxter International Corporation. By then, he had added a number of other infusion devices, including the first insulin pump for diabetics. Following the sale of AutoSyringe, Inc., he founded DEKA Research & Development Corporation to develop internally generated inventions as well as to provide R&D for major corporate clients. Recent projects have included the HomeChoice™ dialysis machine, developed for Baxter (Design News' 1993 Medical Product of the Year), and the INDEPENDENCE™ IBOT™ Mobility System, also developed for Johnson & Johnson.

A decade ago Dean founded FIRST (For Inspiration and Recognition of Science and Technology), and ever since has remained its driving force, its guiding spirit, and, in the eyes of thousands of school children across the country, its personal embodiment. FIRST uses wholesale marketing and media techniques to motivate the next generation to want to learn about science and technology. He has personally recruited scores of the top leaders of American industry, education and government in this crusade. As a result, each of the past three national championships of the FIRST robotics competition, which teams up professional engineers with high school students from across the country, has set a new record as the largest non-Disney event ever held at Walt Disney World's Epcot Center.

In addition to his own attempts to master science and technology, he has received significant public recognition for his crusade on behalf of science and engineering. He was, for example, labeled by Smithsonian Magazine "the Pied Piper of Technology" and profiled by the New York Times as "A New Kind of Hero for American Youth".

Among the honors received by Kamen: The Kilby Award, which celebrates those who make extraordinary contributions to society; the Heinz Award in Technology, the Economy and Employment; and the National Medal of Technology, awarded by President Clinton in 2000 for inventions that have advanced medical care worldwide, and for innovative and imaginative leadership in awakening America to the excitement of science and technology.

How do I contact Dean Kamen directly?

Unfortunately you cannot contact Dean directly. His schedule makes it impossible for him to read or respond personally to all the correspondence he receives. If you have a question, please send an email to contact@dekaresearch and we will forward your message either to him or the appropriate person here at DEKA. Bear in mind that we can't make any promises regarding confidentiality of e-mail messages or letters."

The Segway Launch

From Time Magazine, December 10, 2001

Reinventing The Wheel
Here "it" is: the inside story of the secret invention that so many are buzzing about. Could this thing really change the world?

BY JOHN HEILEMANN

"Come to me!"

On a quiet Sunday morning in Silicon Valley, I am standing atop a machine code-named Ginger--a machine that may be the most eagerly awaited and wildly, if inadvertently, hyped high-tech product since the Apple Macintosh. Fifty feet away, Ginger's diminutive inventor, Dean Kamen, is offering instruction on how to use it, which in this case means waving his hands and barking out orders.

"Just lean forward," Kamen commands, so I do, and instantly I start rolling across the concrete right at him.

"Now, stop," Kamen says. How? This thing has no brakes. "Just think about stopping." Staring into the middle distance, I conjure an image of a red stop sign--and just like that, Ginger and I come to a halt.

"Now think about backing up." Once again, I follow instructions, and soon I glide in reverse to where I started. With a twist of the wrist, I pirouette in place, and no matter which way I lean or how hard, Ginger refuses to let me fall over. What's going on here is all perfectly explicable--the machine is sensing and reacting to subtle shifts in my balance--but for the moment I am slack-jawed, baffled. It was Arthur C. Clarke who famously observed that "any sufficiently advanced technology is indistinguishable from magic." By that standard, Ginger is advanced indeed.

Since last January it has also been the tech world's most-speculated-about secret. That was when a book proposal about Ginger, a.k.a. "IT," got leaked to the website Inside.com. Kamen had been working on Ginger for more than a decade, and although the author (with whom the inventor is no longer collaborating) never revealed what Ginger was, his precis included over-the-top assessments from some of Silicon Valley's mightiest kingpins. As big a deal as the PC, said Steve Jobs; maybe bigger than the Internet, said John Doerr, the venture capitalist behind Netscape, Amazon.com and now Ginger.

In a heartbeat, hundreds of stories full of fevered theorizing gushed forth in the press. Ginger was a hydrogen-powered hovercraft. Or a magnetic antigravity device. Or, closer to the mark, a souped-up scooter. Even the reprobates at South Park got into the act, spoofing Ginger in a recent episode--the details of which, sadly, are unprintable in a family magazine.

This week the guessing game comes to an end as Kamen unveils his baby under its official name: Segway. Given the buildup, some are bound to be disappointed. ("It won't beam you to Mars or turn lead into gold," shrugs Kamen. "So sue me.") But there is no denying that the Segway is an engineering marvel. Developed at a cost of more than $100 million, Kamen's vehicle is a complex

bundle of hardware and software that mimics the human body's ability to maintain its balance. Not only does it have no brakes, it also has no engine, no throttle, no gearshift and no steering wheel. And it can carry the average rider for a full day, nonstop, on only five cents' worth of electricity.

The commercial ambitions of Kamen and his team are as advanced as their technical virtuosity. By stealing a slice of the $300 billion-plus transportation industry, Doerr predicts, the Segway Co. will be the fastest outfit in history to reach $1 billion in sales. To get there, the firm has erected a 77,000-sq.-ft. factory a few miles from its Manchester, N.H., headquarters that will be capable of churning out 40,000 Segways a month by the end of next year.

Kamen's aspirations are even grander than that. He believes the Segway "will be to the car what the car was to the horse and buggy." He imagines them everywhere: in parks and at Disneyland, on battlefields and factory floors, but especially on downtown sidewalks from Seattle to Shanghai. "Cars are great for going long distances," Kamen says, "but it makes no sense at all for people in cities to use a 4,000-lb. piece of metal to haul their 150-lb. asses around town." In the future he envisions, cars will be banished from urban centers to make room for millions of "empowered pedestrians"--empowered, naturally, by Kamen's brainchild.

Kamen's dream of a Segway-saturated world won't come true overnight. In fact, ordinary folks won't be able to buy the machines for at least a year, when a consumer model is expected to go on sale for about $3,000. For now, the first customers to test the Segway will be deep-pocketed institutions such as the U.S. Postal Service and General Electric, the National Parks Service and Amazon.com--institutions capable of shelling out about $8,000 apiece for industrial-strength models. And Kamen's dreamworld won't arrive at all unless he and his team can navigate the array of obstacles that are sure to be thrown up by competitors and ever cautious regulators.

For the past three months, Kamen has allowed TIME behind the veil of secrecy as he and his team grappled with the questions that they will confront--about everything from safety and pricing to the challenges of launching a product with the country at war and the economy in recession. Some of their answers were smooth and assured; others less polished. But one thing was clear. As Kamen sees it, all these issues will quickly fade if the question most people ask about the Segway is "How do I get one?"

Fred and Ginger

The world of technology has never been short of eccentrics and obsessives, of rich, brilliant oddballs with strange habits and stranger hobbies. But even in this crowd, Dean Kamen stands out. The 50-year-old son of a comic-book artist, he is a college dropout, a self-taught physicist and mechanical engineer with a handful of honorary doctorates, a multimillionaire who wears the same outfit for every occasion: blue jeans, a blue work shirt and a pair of Timberland boots. With the accent of his native Long Island, he speaks slowly, passionately--and endlessly. "If you ask Dean the time," Doerr chides, "he'll first explain the theory of general relativity, then how to build an atomic clock, and then, maybe, he'll tell you what time it is."

A bachelor, Kamen lives near Manchester in a hexagonally shaped, 32,000-sq.-ft. house he designed. Outside, there's a giant wind turbine to generate power and a fully lighted baseball diamond; in the basement, a foundry and a machine shop. Kamen's vehicles include a Hummer, a Porsche and two helicopters--both of which he helped design and one of which he uses to commute to work each day. He also owns an island off the coast of Connecticut. He calls it North Dumpling, and he considers it a

sovereign state. It has a flag, a navy, a currency (one bill has the value of pi) and a mutual nonaggression pact with the U.S., signed by Kamen and the first President Bush (as a joke, we think).

But if Kamen's personality is half Willy Wonka, the other half is closer to Thomas Edison. While he was still struggling in college, Kamen invented the first drug-infusion pump, which enabled doctors to deliver steady, reliable doses to patients. In the years that followed, he invented the first portable insulin pump, the first portable dialysis machine and an array of heart stents, one of which now resides inside Vice President Dick Cheney. This string of successes established Kamen's reputation, made him wealthy and turned DEKA Research--the R.-and-D. lab he founded nearly 20 years ago, in which he and 200 engineers work along the banks of the Merrimack River--into a kind of Mecca for medical-device design.

The seeds of Ginger were planted at DEKA by what had previously been Kamen's best-known project: the IBOT wheelchair. Developed for and funded by Johnson & Johnson, the IBOT is Kamen's bid to "give the disabled the same kind of mobility the rest of us take for granted"--a six-wheel machine that goes up and down curbs, cruises effortlessly through sand or gravel, and even climbs stairs. More amazing still, the IBOT features something called standing mode, in which it rises up on its wheels and lifts its occupant to eye level while maintaining balance with such stability that it can't be knocked over even by a violent shove. Kamen gets annoyed when the IBOT is called a wheelchair. It is, he says, "the world's most sophisticated robot."

As Kamen and his team were working on the IBOT, it dawned on them that they were onto something bigger. "We realized we could build a device using very similar technology that could impact how everybody gets around," he says. The IBot was also the source of Ginger's mysterious code name. "Watching the IBOT, we used to say, 'Look at that light, graceful robot, dancing up the stairs'--so we started referring to it as Fred Upstairs, after Fred Astaire," Kamen recalls. "After we built Fred, it was only natural to name its smaller partner Ginger."

With Ginger, as with the IBOT, Kamen explains, "the big idea is to put a human being into a system where the machine acts as an extension of your body." On first inspection, balancing on Ginger seems only slightly more feasible than balancing on a barbell. But what Kamen is talking about is the way Ginger does the balancing for you. Lean forward, go forward; lean back, go back; turn by twisting your wrist. The experience is the same going uphill, downhill or across any kind of terrain--even ice. It is nothing like riding a bike or a motorcycle. Instead, in the words of Vern Loucks, the former chairman of Baxter International and a Segway board member, "it's like skiing without the snow."

Exactly how the Segway achieves this effect isn't easy to explain; Kamen's first stab at it involves a blizzard of equations. Eventually, though, he offers this: "When you walk, you're really in what's called a controlled fall. You off-balance yourself, putting one foot in front of the other and falling onto them over and over again. In the same way, when you use a Segway, there's a gyroscope that acts like your inner ear, a computer that acts like your brain, motors that act like your muscles, wheels that act like your feet. Suddenly, you feel like you have on a pair of magic sneakers, and instead of falling forward, you go sailing across the room."

Pulling off this trick requires an unholy amount of computer power. In every Segway there are 10 microprocessors cranking out three PCs' worth of juice. Also a cluster of aviation-grade gyros, an accelerometer, a bevy of sensors, two batteries and software so sophisticated it puts Microsoft to

shame. If Kamen gets irked when the IBOT is called a wheelchair, imagine his pique when--if--the Segway is called a scooter.

Fish and Bicycles

The possibility that the Segway will be viewed as simply a high-end toy, a jet ski on wheels, is one of Kamen's greatest concerns, especially after Sept. 11. He wants his machine taken seriously, as a serious solution to serious problems. That anxiety was one of the reasons he and his team decided to concentrate at first on major corporations, universities and government agencies--large, solid, established institutions--rather than dive straight into the consumer marketplace.

Whether such institutions would embrace Segways, however, was an open question. Before last January's leak, Kamen had demoed his invention only when absolutely necessary, or for luminaries such as Steve Jobs and Amazon CEO Jeff Bezos. After the leak, he became even pickier. He entertained the Postmaster General, who was keen to put letter carriers on Segways, and the head of the National Parks Service, who wanted to do the same with park rangers and police. (Both are among Segway's first customers.) Kamen also stirred up interest at the Department of Defense, which was intrigued by the notion of giving Segways to special forces, and at Federal Express. But few other potential customers were allowed to pass through DEKA's tightly sealed doors.

A few weeks ago, with the launch approaching, Kamen began to let some others in. The Boston police department sent a clutch of cops to Manchester. The city of Atlanta sent a contingent of city planners. And Thanksgiving week, Kamen took his act to California. In one jam-packed day in Silicon Valley, he revealed the Segway to officials from San Francisco International Airport, the California department of transportation, the city of Palo Alto, Stanford University and Cisco Systems CEO John Chambers. Especially gratifying to Kamen was the reaction of Andy Grove, the chairman of Intel and, unlike so many Silicon Valley boosters, a bone-deep skeptic. Perched tentatively on the machine, the 65-year-old Grove was rolling slowly along when Doerr ambled over and pushed him in the chest. When the Segway kept him from losing his balance, Grove emitted a distinctly un-Grove-like giggle. "The machine is gorgeous," he said later. "I'm no good at balancing; it would take me a hundred years to learn to snowboard. This took me less than five minutes."

I asked Grove what he thought of the Segway as a business. "The consumer market is always harder," he said. "But when you think about it, the corporate market is almost unlimited. If the Postal Service and FedEx deploy this for all their carriers, the company will be busy for the next five years just keeping up with that demand."

A patient entrepreneur would revel in that assessment. But Kamen is a man running short on patience. For him, conquering the corporate market is merely a prelude to the battle to come. "The consumer market is where the big money is," says Michael Schmertzler, a Credit Suisse First Boston managing director and, with Doerr, Segway's other major financial backer. "But this is about more than money for Dean. Pardon the cliche, but he really does want to change the world."

With the Segway, Kamen plans to change the world by changing how cities are organized. To Kamen's way of thinking, the problem is the automobile. "Cities need cars like fish need bicycles," he says. Segways, he believes, are ideal for downtown transportation. Unlike cars, they are cheap, clean, efficient, maneuverable. Unlike bicycles, they are designed specifically to be pedestrian friendly. "A bike is too slow and light to mix with trucks in the street but too large and fast to mix with pedestrians on the sidewalk," he argues. "Our machine is compatible with the sidewalk. If a Segway

hits you, it's like being hit by another pedestrian." By traveling at three or four times walking speed, and thus turning what would have been a 30-minute walk into a 10-minute ride, Kamen contends, Segways will in effect shrink cities to the point where cars "will not only be undesirable, but unnecessary."

Kamen isn't so naive as to underestimate America's long-standing romance with the automobile. ("I love cars too," he says. "Just not when I'm downtown.") And he is well aware that uprooting the vast urban infrastructure that supports cars, from parking garages to bridges and tunnels, won't happen soon. Which is why he has pinned his greatest hopes not on the U.S. but abroad, especially in the developing world. At a meeting with Jobs a year ago, the Apple co-founder proclaimed, in typically hyperbolic fashion, "If enough people see this machine, you won't have to convince them to architect cities around it; it'll just happen."

Kamen agrees. "Most people in the developing world can't afford cars, and if they could, it would be a complete disaster," he says. "If you were building one of the new cities of China, would you do it the way we have? Wouldn't it make more sense to build a mass-transit system around the city and leave the central couple of square miles for pedestrians only?" Pedestrians and people riding Segways, that is.

"There's no question in my mind that we have the right answer," he continues. "I would stake my reputation, my money and my time on the fact that 10 years from now, this will be the way many people in many places get around." Kamen pauses and sighs. "If all we end up with are a few billion-dollar niche markets, that would be a disappointment. It's not like our goal was just to put the golf-cart industry out of business."

Remember Tucker?

One of the hardest truths for any technologist to hear is that success or failure in business is rarely determined by the quality of the technology. Betamax was better than VHS; the Mac operating system is superior to Windows. Even in the transportation business, there is the cautionary tale of Preston Tucker, who in the 1940s designed a "car of the future" packed with such safety innovations as a padded dashboard, disk brakes and safety glass--a car so far ahead of its time that only 51 were ever produced. In fact, the annals of high-tech history contain remarkably few cases in which the most innovative technology has emerged triumphant in the marketplace.

This is the sort of thing that keeps Kamen up at night. There are countless others. High on the list are congenitally skittish regulators who will decide if the Segway is safe and if it will be allowed to roll on sidewalks.

Kamen maintains, with characteristic chutzpah, that Segways are "even safer than walking." Only slightly less emphatic, and slightly more plausible, was the verdict of the Consumer Product Safety Commission, which began reviewing the device last May. According to Ron Medford, a senior CPSC official, the Segway has "safety features that are far more substantial than we normally see in a consumer product--features closer to those associated with medical devices." (Medford, it must be said, was so impressed that he is taking a sabbatical at DEKA, though he remains on the government's payroll.) To make the machine even safer, it comes equipped with three computerized keys that set speed and performance limits. The slowest setting, now called training mode, used to be jokingly referred to around DEKA as CEO mode.

The sidewalk issue is dicier. In order to ensure that Segways are permitted to move alongside pedestrians, Kamen's regulatory-affairs mavens will have to keep the machine from being classified either as a motor vehicle or as a scooter. At the federal level, the deal is done--though, for a while, the Occupational Safety and Health Administration wanted to classify the Segway as a "powered industrial truck." Technically, final sidewalk authority rests with state and local governments. Kamen is betting, however, that the decision will be made not by lawmakers but "de facto, by what becomes standard practice. If we have police and mail carriers riding on the sidewalks for a year, how is anyone in government going to say, 'It's O.K. for us but not O.K. for you'?"

No matter how inherently safe Segways may be, someone, somewhere is going to kill himself on one. "It's inevitable," says Gary Bridge, Segway's marketing chief. "I dread that day." Never mind that people die every day on bicycles, in crosswalks, on skateboards, in cars. The Segway is the newest new thing, and nothing does more to set hearts afire on the contingency-fee bar. "There are some very deep pockets around this thing," remarks Andy Grove. "I fear this could be a litigation lightning rod."

Not to mention a lightning rod for fierce competition. Although Kamen trashes the automobile at every opportunity and is plotting a future in which cars are barred from cities, he insists that the Big Three and their brethren will see the Segway as no threat. "Nobody in America or any developed nation will buy one of these instead of buying a car," he says. "People will buy these in addition to owning a car." But a former top auto executive thinks Kamen is kidding himself--or kidding me. "The car companies track market share by one one-hundredths of a percentage point," he says. "They're incredibly sensitive on that front, and this is going to dent somebody's market share."

Even if the auto barons leave the Segway alone, other players are unlikely to be so forgiving. When Kamen and his lieutenants draw up lists of probable rivals, companies in other branches of the transportation industry--firms that make ATVs, motorcycles, scooters, even snowmobiles--are near the top. But the lists have been long and varied, including a raft of appliance makers, engineering companies and, especially, consumer-electronics giants, such as Sony. Kamen's team is confident it has a long technological lead, as well as patents on most of its key innovations. "Reverse engineering this thing won't be easy," says Schmertzler. "This is not a pet rock." Yet if the Segway is a runaway hit, you can bet that a flood of knock-offs--much less sophisticated but also much cheaper--will soon wash over the market.

Will the Segway be a runaway hit? A device that reduces the need for walking, one of the healthiest activities known to man, may strike many people as the last thing our culture needs. (Kamen scoffs, "Because I give kids calculators doesn't make them stupider.") And three grand may strike many others as an awful lot to pay for something they've managed so far to live happily without. John Doerr, who helped bankroll Compaq in the infant days of the personal-computer industry, points out that the first PCs cost $3,000 to $5,000. The analogy is worth pondering. The brave souls who bought those early PCs were willing to cough up big bucks not simply to own computers that were small and powerful but also to be part of a kind of revolutionary vanguard. Will consumers today make the same calculation about the Segway?

If it's seen as sufficiently cool, they might. But here Segway faces a double-edged sword. If not for the media frenzy a year ago, Kamen and his invention would be receiving a good deal less attention. At the same time, that frenzy ginned up expectations so absurdly extravagant that they will be hard to live up to. There is a very real possibility that for those whose only experience of the Segway is on TV or in the press, the reaction to it may boil down to five lethal words: Is that all it is? And that

possibility is only enhanced by the fact that to many eyes giving the photos only a cursory glance, a Segway doesn't look like a revolution. It looks...well, sorta like a scooter.

But looks can be misleading, as anyone who's ridden a Segway can attest. Just ask Jeff Bezos. On a rainy morning in Seattle recently, Bezos dropped in at a meeting between Kamen, his team and a pair of Amazon execs. The meeting was being held in an Amazon "pick and pack" facility--a warehouse in which employees pick stock from shelves and pack it in boxes for shipment to customers. Kamen had come to sell Amazon some Segways by demonstrating that they would, as Bezos put it, "improve our picking productivity."

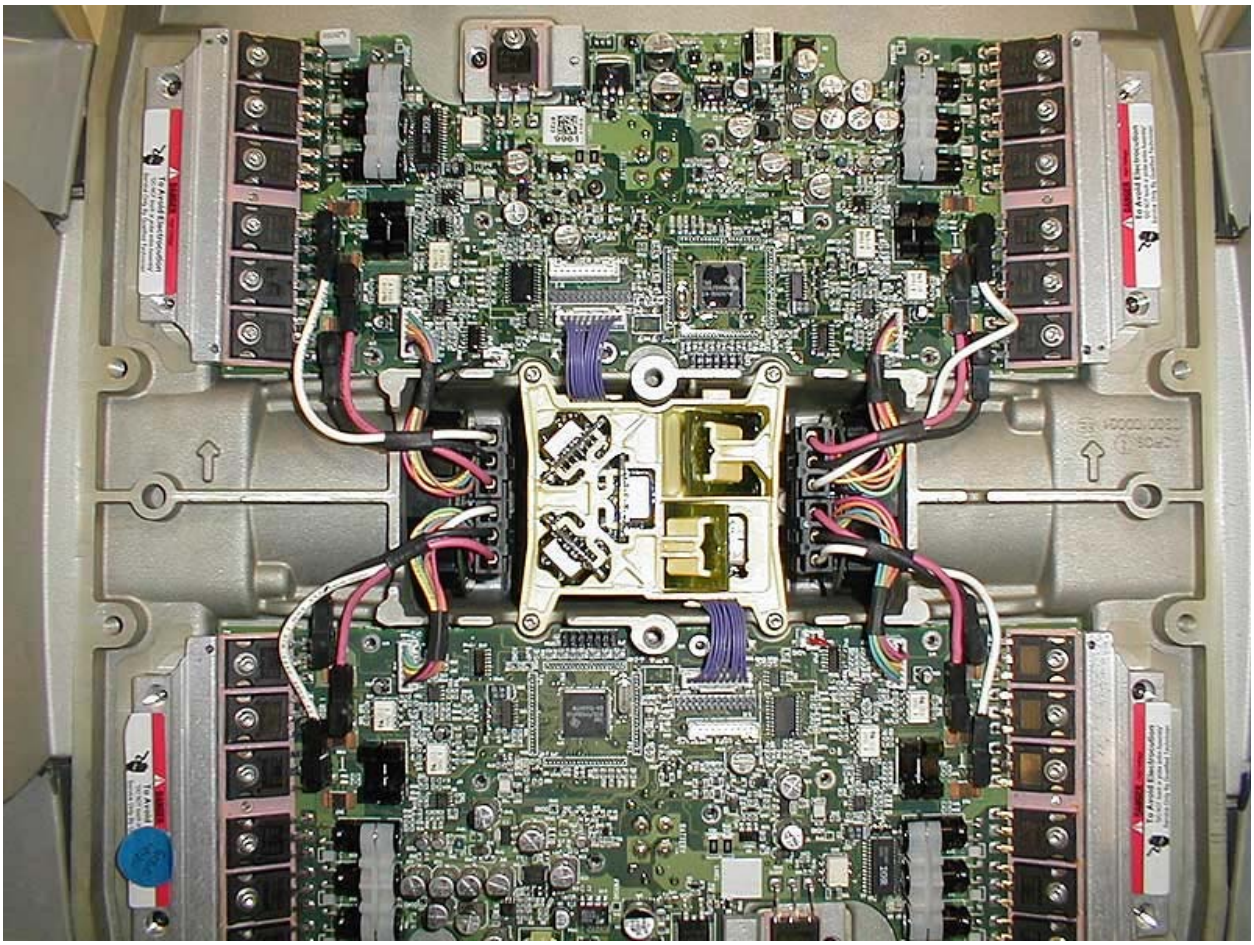
Like Grove, Bezos is confident that Segway will make a mint selling to the corporate market; also like Grove, he is less certain about its consumer prospects. "At Amazon, we didn't know at first, and nobody knew, whether people would want to buy books online, and the same is true for whether people will want to ride these," he says. "Walking is a superb mechanism for getting around--I don't see it being replaced anytime soon. And for long hauls, driving is darn good too. The question is whether there's a middle ground, some intermediate zone where these would be better than all the alternatives?"

Just then, Kamen rides up and hands his Segway over to Bezos. As the Amazon boss races madly around the warehouse, hooting and cackling and flapping his arms, someone yells out, "Yo, Jeff, what were you saying about the consumer market?" Whizzing past, Bezos shouts back, "There's definitely at least a consumer market of one!"

Appendix A – Segway HT Specifications (at time of announcement in December 2001)

Segway HT (source: Segway LLC, via http://www.segway.com)

- 12.5 mph (20 kph)
- 80 lbs.
- 11-17 miles range
- $9000



Motors, electronics, gyroscopes within Segway HT chassis. Note that there is a double set of electronics (top and bottom boards) for fault tolerance and redundancy.

Appendix B – The iBot Wheelchair

iBot self-balancing wheelchair.

The following is a Johnson & Johnson press release regarding iBot wheelchair.

Johnson & Johnson Begins Clinical Trials On Investigational Advanced Mobility System For People with Disabilities

New Brunswick, NJ (July 1, 1999) -- Johnson & Johnson today said it has begun clinical trials, involving people with disabilities, to test a new advanced mobility system that has unique functions not available on existing products.

The advanced gyro-balanced system is designed to operate on four wheels or two wheels, stabilizing the user by instantly and automatically adjusting and balancing itself. Among its many design features is its ability to allow a seated user to move about at eye-level while balanced on two wheels. Its rotating four-wheel base is designed to allow the user to climb stairs and traverse uneven and hilly terrain, such as grass, sand and rocky pathways. In its four-wheel operation the device is designed to climb over street curbs, while keeping the seated user level and balanced.

Called the INDEPENDENCE™ 3000 IBOT™ Transporter, the system is the invention of Dean Kamen, founder of DEKA Research & Development Corp., Manchester, NH, with whom Johnson & Johnson partnered five years ago to develop the advanced mobility system as an FDA approved medical device. Results of extensive product testing and the clinical trials, which will demonstrate its safety and functionality, will be completed and submitted to the FDA within the next 12 months. The company said it hopes to receive approval for marketing in 18-24 months.

The company said the INDEPENDENCE™ 3000 is an investigational device and it is working closely with the FDA to conform to regulatory requirements for development, initial product testing and clinical trials prior to application for marketing approval. Public inquiries will be answered but the device cannot be made available for sale until FDA review and approval have been achieved.

This technology makes use of sensors to continuously and automatically adjust the device to account for movement of the seat and the user's center of gravity. It is an integrated combination of electronic, sensor and software components. Backup systems have been designed to assure the safety of the user in all functions. It is powered by state-of-the-art rechargeable batteries and can operate all day, depending upon usage, on a single charge.

Johnson & Johnson said the INDEPENDENCE™ 3000, once approved, will be available by prescription only and the features of the device will be set to the size, weight and ability of the user.

The company said the INDEPENDENCE™ 3000 is expected to represent an attractive new choice for many of the approximately two million Americans with mobility related disabilities who now utilize wheelchairs, and millions more around the world who also seek greater mobility. In addition, as the population ages, many more people are expected to seek to maintain mobility and self-sufficiency.

The INDEPENDENCE™ 3000 will be priced in the range of $20,000-$25,000 and will include a multi-year service warranty. The company said the initial version is designed for adults and it has plans to develop a version for children, as well as for individuals with more unique needs, which would also have to be approved by the FDA.

Johnson & Johnson said development and marketing of the INDEPENDENCE™ 3000 would be conducted by a new subsidiary, called Independence Technology, a Johnson & Johnson company, which is developing other products using innovative technologies to help meet the needs and desires of people with disabilities. Throughout its developmental phase the company has worked closely with people with mobility-related disabilities, including employees of Johnson & Johnson, and an outside advisory board.

The company has established an Internet website that provides information about the product and a feedback service: http://www.indetech.com also accessible via http://www.jnj.com. A telephone information service has been established at 1-888-IND-3000.

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Appendix C – The Segway LLC Timeline

July 1999	FDA trials begin on the iBOT wheelchair, which incorporates “dynamic stabilization” technology.
1999	Proof-of-concept prototype of “Ginger” self-balancing transporter is developed by engineers at DEKA.
Early 2000	Kamen receives $80 million in venture financing for “Ginger” from Kleiner Perkins and Credit Suisse First Boston, and from several individual investors. This investment values Kamen’s start up company at over $500 million.
Mid 2000	Discussions with Steve Jobs and Jeff Bezos about strategy for design and launch of the Segway product.
January 2001	Kemper’s book proposal leaked. Media explosion over the invention described only as “IT” or “Ginger”
December 2001	Segway launched on ABC morning show *Good Morning America*. Initial version available for sale is commercial model priced at $9000.