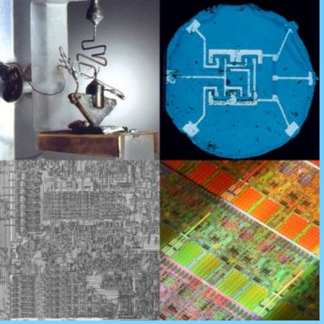

Tencor at 20 Years

Tencor (later evolved to be KLA-Tencor) is in the bedrock of the semiconductor equipment industry. It developed many products that were essential to chip manufacturing. Some are still made today.

Tencor turned 20 In 1996. This book started as a pet project by one of the employees, who had a passion for this company’s unique history. It documents not only how the company came into being and then thrived, but also a story so common to Silicon Valley but unique to so many parts of the world: a single individual, Karel Urbanek, escapes a tyrannical government to start with nothing, start a new life, and start a new company.

Twenty years at Tencor

This project had its genesis in the many conversations I had with the company's founders and other long-standing employees during my eleven years at Tencor. A personal pet project, this originally had neither a delivery date nor an official budget. In the process, however, this history took on a life of its own, and became an important project for everyone involved.

No company history can ever possibly mention everyone and everything that made Tencor what it is today. There are many, many people who are not mentioned here — people whose contributions were critical to the development of this Silicon Valley success. Truly, this book would have been ten times the size, could we have acknowledged everyone who came to Tencor and made a difference.

My grateful thanks to the many people who contributed their time, stories and photographs to the making of this book; to Paul Pease, whose early connection with the company made him the ideal person for this project; to graphic designer Janice Burton, who was an invaluable resource in pulling together all the pieces; to editor Chris Castillo, who dived into the project with enthusiasm; and particularly to Lida Urbanek, whose memories of the earliest days chronicled those important times and crystallized forever the legacy of Karel Urbanek to Tencor and the semiconductor equipment industry.

This is not, nor is it intended to be, an unvarnished expose of Tencor's past. It is instead, a compilation of fond memories about a place and time many people, including myself, consider to be one of the best experiences of their lives.

Roberta Emerson
Director, Corporate Communications
April 1997

FOREWORD

In the fall of 1976, seven men and a handful of investors put up $450,000 and promissory loans amounting to an additional $400,000 to start a new company in Mountain View, California. Twenty years later, that company, Tencor Instruments, had become an industry and market leader valued at over $1 billion on the stock market. This is Tencor's story, and the story of the group of individuals who had the vision to see the possibilities in a fledgling industry, the daring to leave secure jobs to follow that vision, and the drive, skill and luck to transform vision into reality.

INTRODUCTION

To follow the success story that helped Tencor grow from six employees to nearly 1,400, it is important to understand how the company's products supported—and in many cases facilitated—the major developments in semiconductor production. Almost since its beginning, the semiconductor industry has been shaped by a number of factors: steadily shrinking geometries; dramatically increasing device complexity; high manufacturing investment coupled with declining prices; and, especially in recent years, intense competition and rapidly shrinking product lifecycles. Consequently, the successful semiconductor companies are not just those that maintain a technological edge in semiconductor development, they are those that successfully manage production cost, product yield and time-to-market. It is fair to claim that many of today's top semiconductor manufacturers would not have succeeded without the process control, wafer inspection and measurement tools provided by Tencor.

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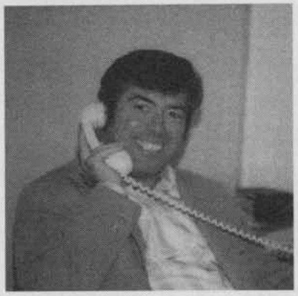
Before delving into the development of Tencor and its products, we first need to look at the people behind the story. Tencor was the second company started by this entrepreneurial group. To understand the dynamics of Tencor Instruments, it's important to follow the story of Randex Corporation, as well as the personal histories of the people who founded and who managed the company over the years.






The founders of Tencor:

Karel Urbanek,

John Schwabacher,

George Kren,

Bill Wheeler,

Barry Hart,

Ed Kerswill.

[Jerry Gabe, not pictured]

CHAPTER 1

Immigrants and Friends

Karel Urbanek was born and raised in Czechoslovakia, and — even though he became an enthusiastic American citizen — he remained proud of his Czech heritage and maintained close ties with his native country. His childhood and youth were spent in difficult circumstances in a country which was first ruled by the German Nazis and then by a Soviet controlled communist regime. His family, part of the educated elite, distanced themselves from the prevailing culture and sent their only son to the French school in Prague.

Based on his excellent academic performance, Karel Urbanek was chosen Valedictorian of the Class of 1963 at Charles University.

Urbanek's father taught him German and he later taught himself English by studying the English Bible. (His English, when he arrived in the United States, had a distinctly Biblical tinge to it!) Because of his family background, Urbanek was not allowed to attend a college preparatory high school. However, his academic achievements were so significant that despite his family and education, he was admitted to Charles University in Prague to study physics. He went on to become the Valedictorian of his class in 1963.

As a student, Urbanek recognized early that he could not remain in his native country as long as it was governed by the communist party (which he always referred to as a "criminal organization"). Emigration to the United States became an obsession. To prepare for this step, as well as to earn his way through college, Urbanek worked as a tour guide, escorting foreign visitors around Prague and the rest of the country during school breaks. His charm and his obvious brilliance made a strong impression on many of these tourists, and they became lifelong friends and important contacts for his future.

In 1960, Urbanek was assigned to escort the Marx family from San Francisco. He told them that his superiors always questioned him after he guided foreign travelers — especially Americans — around Prague. Czech society was tightly sealed off from the world in those days of the Cold War and his information might provide useful leads for the Communist regime's intelligence organization. Urbanek asked the Marxs to give him some interesting facts "so that he could be a good spy for the government," he winked, "and keep my job." The elder Marx, Sonny, was taken with Urbanek's manner and charm. He gave him his business card and strongly urged Urbanek to contact him if he ever came to the United States. Urbanek carefully stored Marx's card away with names and addresses of other contacts he had made as a tour guide.

*

During another fortunate assignment as a tour guide, Urbanek met a young Czech/American who was bringing a group of 18 high school students through Eastern Europe and the Soviet Union on a "People-to-People" tour. Lida Naprstek, a junior at Radcliffe College in 1963 majoring in Russian History, had been handed the choice chaperone/guide assignment because she spoke the languages and knew the territory. Urbanek was their tour guide. "His confidence and his masterful management of our tour group was awe inspiring," Lida Naprstek remembered. "He was obviously meant to do bigger things." She gave him her phone number, telling him to call if he ever got to the United States.

Urbanek's summer tour guide activities also let him amass a small fortune because he had access to hard-to-get foreign currencies. His canny trading raised the money he would need to escape to the U.S. and his dreams. At the time, under the repressive communist regime, traveling abroad for Czech citizens was almost impossible. Urbanek spent years planning an exit strategy. The route he chose involved buying a "vacation" to Cuba.

During the Cold War years, Cuba traded sugar for arms with Czechoslovakia, and was one of the only vacation spots available to Czechs. With his stash of cash, Urbanek bought a Cuba vacation and laid his plans carefully. Wearing his only good suit and carrying his heavy winter coat, he boarded the plane. Knowing it sometimes landed in Shannon, Ireland, sometimes in Nova Scotia, Canada, he was ready to spring out at either airport and ask for asylum. One of the flight crew told him they would land in both Shannon and Nova Scotia, so Urbanek waited until he was in Canada, then disappeared into the Halifax terminal and made his getaway. His first call was to Lida Naprstek in Cambridge, Massachusetts; his second call was to Sonny Marx in San Francisco.

An American consul in Halifax helped Urbanek find a legal way to enter the United States quickly. Through a French tourist Urbanek had met during his days as a tour guide, and with his excellent academic record in his physics studies, he was able to get a job with Lincoln Labs in Cambridge, working as a teaching assistant at MIT. There he again crossed paths with Lida Naprstek, who had just completed her BA and was leaving to study in Europe and Morocco.

During the year, the relationship with Lida continued, but, as she said, "Our whole relationship was in letters." After a year's separation, he visited her in Morocco. Three days later, they sailed to Gibraltar and were married.

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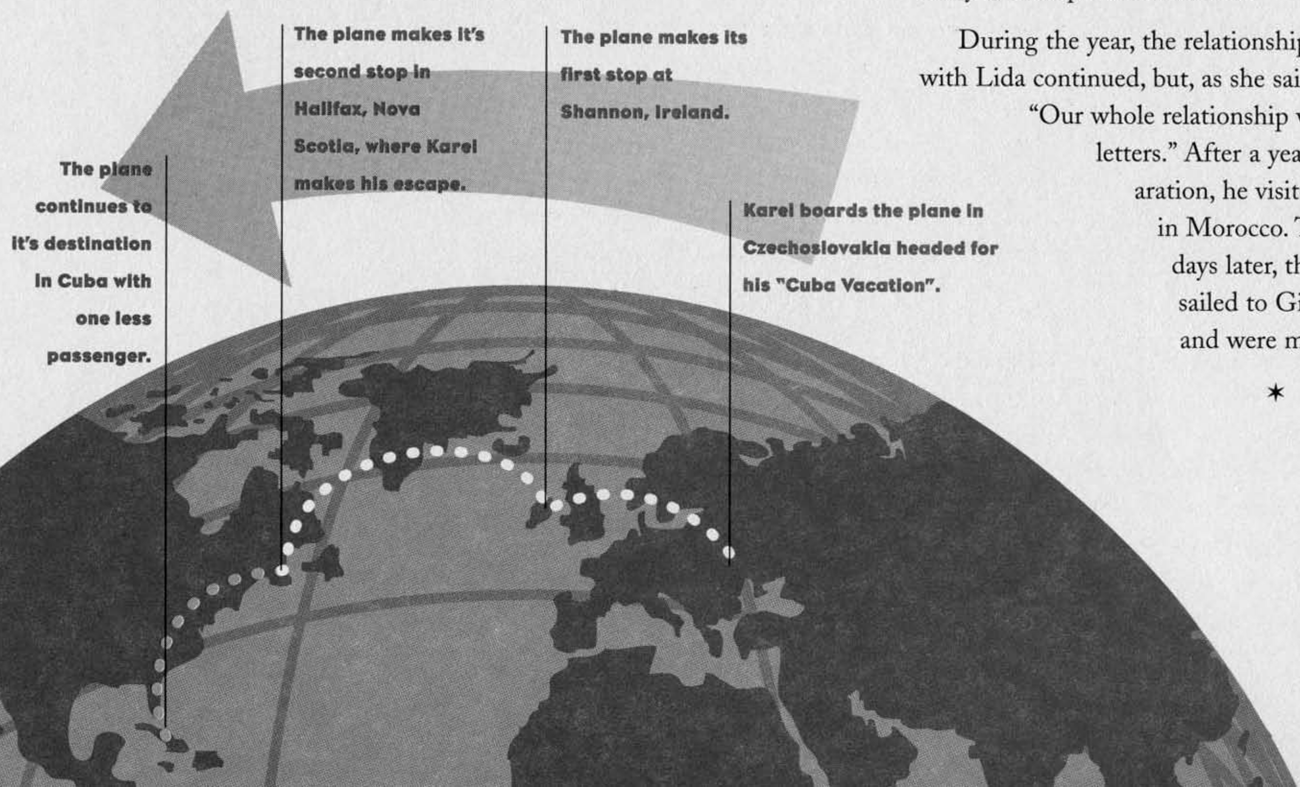
The Great Escape



In the summer of 1964, Lincoln Labs sent Urbanek to work on a project in Alaska. On his return, Urbanek stopped over in San Francisco and visited the Marx family. He was carrying a letter that would introduce him to the head of Lawrence Radiation Labs in Livermore, Edward Teller. He had been accepted to the Ph.D. program at U.C. Berkeley, but had decided that his true interests lay in industry, rather than academia.

Sonny Marx, an investment banker, was very supportive of his decision and suggested a number of companies where his resume would be well received. He applied to Varian Associates and Fairchild Semiconductor. Both offered him jobs. He chose Varian, a high technology company located near Stanford University, which at the time seemed destined to be a major player in the rapidly evolving semiconductor business.

Years later, after taking the job with Varian, Urbanek wondered what might have happened had he taken the job at Fairchild Semiconductor and then moved to its offspring, Intel Corporation.

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Karel Urbanek and Lida Naprstek at her graduation from Radcliffe.

CHAPTER 2

The Early Years–From Varian to Randex

There are several sub-industries in the semiconductor business. Semiconductor companies, often referred to as "chip makers", design and fabricate the actual integrated circuits (called "chips" or "ICs"), while equipment companies provide the high technology manufacturing tools the chip makers need to build their tiny electronic devices. A third sub-industry provides highly specialized materials and gases needed to process microminiaturized electronic circuits. Still another industry provides measurement tools, which the chip makers use to ensure their production equipment is working correctly.

Schwabacher and Urbanek became fast friends and mutual admirers. They connected instantly, forming a bond that would last two decades.

Varian focused on the second sector, creating the challenging and high-cost, high-technology equipment used to build the multi-layer semiconductor chips. The work assigned to Urbanek was in the area of high vacuum systems where thin films of metal are deposited on the silicon wafer in order to guide the electrons through the non-conducting parts of the circuit. (Which is why they are called *semi*conductors; they only *partially* conduct electricity.)

Urbanek was sent with another Varian employee, John Schwabacher, to investigate a new production technique called *sputtering*, which would become an important process in the manufacture of multi-level semiconductors. Along the way, this research would connect the two with Barry Hart, Bill Wheeler and others with whom they would work closely on the road to Tencor.

*

John Schwabacher was already working at Varian Associates when Urbanek arrived. Born in Germany, Schwabacher graduated from the University of

California at Berkeley with a degree in engineering. He then completed a second bachelors degree in physics and two years of graduate school at the University of Washington before serving as an officer in the United States Air Force. After completing his three years of military service, he returned to Berkeley, working for Tracerlab/LFE as vice president of sales and marketing for six years. Tracerlab was involved with nuclear reactors, radiation contamination testers and other industries that, at the time, seemed to offer great promise.

The vitality of the new semiconductor industries and other related high technology opportunities drew him to Varian "kicking and screaming," Schwabacher said. He and his wife had a lovely home in Kensington, north of San Francisco, and the Peninsula (the area south of San Francisco between San Francisco and San Jose) "was not an attractive locale in the mid-sixties." The Schwabachers didn't really want to move, but the nuclear business was fading and Varian was doing very interesting things. Schwabacher joined the company as product manager for a linear accelerator which was developed for clinical treatment of tumors. He then became product manager for low- and high-energy electron diffraction systems. Eventually he moved into the Vacuum Division,

"[Bill Wheeler—] one of the most dedicated and focused engineers any of us had ever met."

where he met Karel Urbanek, "a very creative scientist who was trying to run a Quadrupole Gas Analyzer under computer control." This was exciting, dramatically new and daring.

Schwabacher and Urbanek became fast friends and mutual admirers. They connected instantly, forming a bond that would last two decades.

*

Urbanek's immediate superior at Varian Associates was a quiet bird-watcher named Bill Wheeler—"one of the most dedicated and focused engineers any of us had ever met," said Schwabacher. Wheeler had already been working at Varian for some years when Urbanek and Schwabacher started working together. He had invented the Wheeler Flange and a number of other mechanical engineering breakthroughs that made it possible to create

It would take fifteen years, but Urbanek would later repay the Kren's generosity by helping George Kren get to the United States and making him part of Randex, and later a co-founder of Tencor.

and maintain the high vacuum work areas needed in the semiconductor equipment business. Whenever Urbanek had a tough engineering problem, he knew that Wheeler would be able to help him solve it.

Immediately after Urbanek joined Wheeler's group, Urbanek started lobbying to bring a friend from Czechoslovakia, George Kren, into the country to join the operation.

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George Kren and Karel Urbanek had been friends since high school in Prague; in fact, Urbanek even lived with Kren's family for a period of time after his parent's divorce. After high school, Kren went to the Czech Institute of Technology, Urbanek to the University. It would take fifteen years, but Urbanek would later repay the Kren's generosity by helping George Kren get to the United States and making him part of Randex, and later a co-founder of Tencor.

In the late 1960s, Kren was working for the National Materials Research Institute in Prague. Although Urbanek had invited him several times to come to the U.S., it wasn't until 1967 that Kren acted on the invitation and asked a friend at the Ministry of Technology to arrange a one year trip. It took nearly two years to complete the paperwork due to the political changes surging through the country, and Kren was still detained at the border. When he called, Urbanek told him, "Don't give up, Lida will send you a tourist visa, and we'll work out the details when you get here." Kren packed lightly because he really didn't expect to clear immigration proceedings, but, much to his surprise, the next thing he knew he was in England.

When Kren arrived in the U.S., Urbanek arranged for him to spend some time in Boston. After six months there, Kren drove across the country to visit his friend, and to "see what the country was like." He worked for six months after his arrival at Urbanek's new venture, Randex, but returned to Czechoslovakia at the end of the year because he felt he owed it to his friend at the Ministry, despite the uncertain political situation there. Once he got back, he was not permitted to leave. It took him over two and a half years, but in 1974, Kren again arrived in California. His first job was with Urbanek at Perkin-Elmer, later becoming part of the team to launch Tencor Instruments in 1976.

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Barry Hart got out of metallurgical engineering and into sales because he liked "the fancy brogues" his sales manager wore. In the early 1960's, he was the Northern California salesman for Varian's Vacuum Division, based in Palo Alto. Although his flamboyant yellow golf pants and splashy shirts created interruptive visual noise in the ivory tower halls of Varian's Vacuum Division, Hart's background, intelligence and energetic personality equipped him perfectly for the high technology industry.

Hart traveled an indirect and interesting route to become one of Tencor's founders. Born in Pasadena, California, Hart graduated from San Jose State College in Technical Industrial Technology (Plant Logistics). After surveying the job market he decided to return and get a degree in metallurgical engineering, thinking it would be a lot more interesting. He was right.

Hart worked for six years at American Standards' Advanced Technology Labs, designing atomic reactor core-loading structures. It was there he saw American Standards' chief salesman, George Cash. "Who's the dude with the flashy brogues?" he asked. When he heard that was what salesmen looked like and heard how much they could earn, Hart swerved into sales and never looked back.

Hart moved to Palo Alto and spent a short time as an applications engineer on Perkin-Elmer's Ultek Ion Pumps, before rejoining American Standard in Southern California. However, Hart's fondness for the Silicon Valley, as the Santa Clara Valley was beginning to be called, got him back to Varian, first as an applications engineer, then into sales. More and more,

Hart's background, intelligence and energetic personality equipped him perfectly for the high technology industry.

his knowledge of metallurgy became useful to the people he was calling on and to the scientists and marketing people at Varian who needed intelligence from the firing line. Hart was out there and he brought it back to them. Urbanek, involved with various development projects, trusted Hart's keen customer perspective.

*

Originally from Wisconsin, Ed Kerswill arrived in California courtesy of the United States Navy, and never went back. After several other jobs, Kerswill took a post at United Airlines and eventually found his way into the drafting department. He moved to Varian's Radiation Division, where he stayed for nine years before "looking for something more exciting to do." Although he interviewed with Urbanek in the Vacuum Division, he chose to go to the Sputtering Division because the technology looked more interesting. A few months later, Urbanek changed divisions and ended up his boss after all!

When Urbanek came to tell him, "we're going off on our own," Kerswill was originally not very interested. He'd heard that start-ups meant working long hours and weekends. With the help of another Varian employee, mechanical technician Al Lang, Urbanek finally persuaded him. At Randex, and later at Tencor, Kerswill did the drawings and documentation, as well as the mechanical design work.

Schwabacher later said of Kerswill, "He's a very straight-forward person. He has a tremendous sense of honesty and was willing to bring up things that other people would avoid mentioning, if he thought it needed to be said. As members of such a small team, that sometimes took great courage, but it was very valuable."

Kerswill found that he liked the feel of a small company and when the opportunity arose later to launch Tencor with the same group, he didn't need to be persuaded.

*

[Kerswill is] "a very straight-forward person. He has a tremendous sense of honesty and was willing to bring up things that other people would avoid mentioning, if he thought it needed to be said."

While they worked on engineering the vacuum pumps needed by the semiconductor equipment manufacturers, Urbanek and Schwabacher had a chance to see where the new deposition technologies were heading.

They took a trip around the country to meet and query both semiconductor manufacturers and equipment suppliers. It was immediately clear to them both that a new technology called sputtering would have enormous growth in the near future. Metals and non-metals alike could be sputtered to create thin film layers. The process could be engineered to be relatively simple, dependable and repeatable. It was a perfect opportunity for the future.

They reported their findings to their management and asked for permission to start a sputtering group. When met with a rather condescending "no", they turned to each other simultaneously and said: "We're leaving, aren't we?" It was 1970.

During the next few months, Urbanek and Schwabacher created a business plan for a new company. Urbanek's friend Sonny Marx had a circle of investors who would follow his lead on new company investments. Urbanek and Schwabacher took the sputtering technology proposal to Marx, who helped them raise $400,000 to start the company they called Randex.

With Schwabacher as vice president of marketing, Urbanek wanted Hart for national sales manager. He knew the two would make a great team. He also knew that neither of the two thought so. He was right on both counts. After several meetings at Urbanek's house, the two came to find much to respect in each other, forming a powerful marketing and sales team. Together with two other Varian employees, Ed Kerswill and Al Lang, they were ready to go out on their own.

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Like so many high technology startup companies, Randex had a long way to go from the original idea to an actual product. It took them two tries to work out the right product for the market. Using three targets, it could perform three sputtering operations, including a new and very popular platinum silicide process, without "coming to air."

The sales organization was headed by Barry Hart. As Schwabacher related, "We were a bunch of immigrants and needed somebody who could speak really excellent English." Hart was very tall, and red-headed besides; he was a standout in Japan. When Barry was around a Japanese fab (as the industry calls semiconductor fabrication areas), everyone knew it.

Schwabacher and Hart developed a winning style at Randex that they continued later at Tencor. Schwabacher would open the conversation with, "I'm not here to sell you anything. *He'll* do that." (pointing to Hart) "I'm just here to listen." It wasn't a good cop/bad cop routine. It was a working style that helped both companies leapfrog the competition. Schwabacher did listen attentively, and the customers appreciated it. By finding out at the earliest possible moment what the market wanted next, and figuring out how to make it, first the Randex, then the Tencor team was able to stay ahead of the market and ahead of the competition.

Some years later, Urbanek summarized this philosophy on working with customers, "Our greatest challenge is to learn and understand our customers' requirements much faster. It's not right to say we need to listen more. Listening by itself will get us nowhere. We need to *understand* better."

By 1973, sales had started to skyrocket. The projections for growth were a little frightening. There was big opportunity, but it would take a lot of capital to pursue it. That factor, coupled with the obvious lack of management breadth needed to handle the kind of hypergrowth ahead of them, led the founders to sell Randex to Perkin-Elmer. It was a very attractive buyout, returning a handsome profit on a relatively small investment.

The whole group, which had grown to include electrical technician Jerry Gabe and marketing director Daniel Tam, became part of Perkin-Elmer's Ultek operation in Palo Alto. Urbanek was made research director of the merged operation and committed to stay with the group for three years. He was given a big office and private lab — and no responsibilities. Schwabacher and Hart continued to market the company's products and, in doing so, kept in touch with the world market for semiconductor production equipment.

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CHAPTER 3

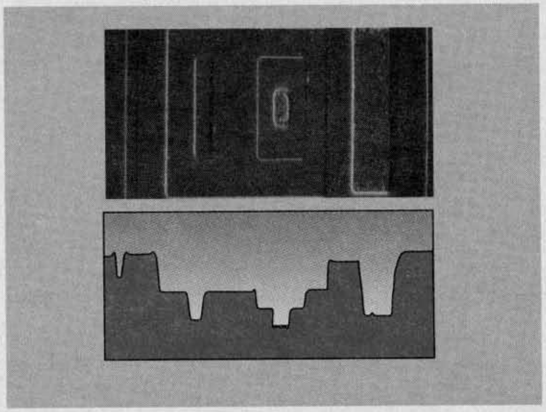
How thick is that film?

During the three years the Randex team worked for Perkin-Elmer Ultek, sputtering technology advanced rapidly. A wide variety of materials were being deposited in very thin films on silicon substrates to build the layers that create semiconductor chips.

However, a new major problem had developed — the need for very precise measurements of the film thickness in the various deposition layers. Measured by determining step height, the difference in height between one layer and another, thickness was a critical parameter. Even slight variations in thickness could significantly affect "yield," the final number of working devices that are cut from the silicon wafer.

In the mid-seventies, there were only two measurement instruments for this purpose available to semiconductor manufacturers. One was the Talystep, produced by a British company, Rank Taylor Hobson; the other was Sloan Technology's Dektak[1]. The Dektak was the more commonly used since, in the hands of a highly skilled operator, it typically generated superior data.

Unfortunately, the Dektak was very difficult to operate. Mention it to anyone who worked in semiconductor R&D or production during that era and you are likely to get responses that include words like *ghastly, beast, delicate, mean, hard to learn* or *a real problem*. It took a long time for a trained technician to set up a measurement and, if anything bumped the block of granite under it even slightly, or a truck rumbled by, the measurement was ruined.



The topography of a deposited film layer (top) reveals variations in thickness (bottom) and/or step height.

Urbanek, working alone in his Perkin-Elmer Ultek lab, did occasional sputtering projects for Advanced Micro Devices

1 Sloan Technology was later sold to Veeco Instruments of Plainview, New York, in the mid-1980s. The Sloan division of Veeco continues to sell Dektak brand profilers to this day.

Corporation (AMD). He was forced to measure the thickness of his sputtered films with the Dektak and grew increasingly impatient with its *prima donna* behavior. (Urbanek was not known for patience. Fellow workers remember him finding his office file cabinet locked and using a metal drill to open it rather than search for the key.)

He was sure there must be a better way to measure film thickness. He decided to find it the moment he was free to pursue his own interests.

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The idea had been to find two-syllable names that sounded good and would be easy to remember, but had no special meaning. Number three on the list was Tencor.

In late 1976, some of the Randex group made the move from Perkin-Elmer to begin exploring product opportunities. Everyone knew how hard it was to build a business team, but the Randex veterans knew the strong suits and foibles of their partners. In addition, they had now had two years in a large organization to sharpen their management techniques — and to remember how much easier and more satisfying it could be to have what Urbanek liked to call "your own sandbox", a place with the freedom to explore ideas in your own way.

Urbanek thought that plasma nitriding was an exciting new and valuable technology, and believed a Nitrider — a deposition system that would create a layer of silicon nitride useful in the semiconductor production process — would be a big seller.

The founders wrote a business plan, took it to the original Randex investors, and raised $450,000, with pledges for $400,000 more if needed. Since the Randex founders had made significant monetary gains on their original ten-cent founders' stock, Marx insisted that some of those gains be reinvested in the new company. This was a painful demand at the time; years later it would become a source of great personal economic benefit. Originally invested in $5,000 blocks, an original $10,000 investment in Tencor stock was calculated to be worth $2.8 million in early 1997!

Urbanek and his wife Lida brainstormed with Schwabacher on a name for the new company. They dug out the sheet of paper on which they had written ten company names that were available at the time they started Randex. The idea had been to find two-syllable names that sounded good and would be easy to remember, but had no special meaning. Number three on the list was **Tencor**. The name was still available. They took it, filed the papers, rented a space behind a doughnut shop on Old Middlefield Way in Mountain View, and started Tencor Instruments. It was the fall of 1976.

For tax purposes, Tencor was a partnership in the first year before being incorporated in January of 1977. By the end of 1977, the company had moved to the industrial office park at 2400 Charleston Road which remained Tencor Instruments' official corporate address for nearly 20 years.

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CHAPTER 4

Tencor - the Alpha-Step years

"There's no leeway for error in startups," Lida Urbanek observed much later when asked about this period.

How can a small company develop cash flow quickly? Build a cash cow. "The Sloan Dektak," Schwabacher recalled, "was a cantankerous piece of equipment, requiring a lot of operator attention and training to work." Both Urbanek and his chief electronics engineer George Kren had used Sloan's Dektak surface analyzer. In fact, Kren had actually taken delivery of the first Dektak. Both thought they could build a much better instrument to do the same job.

During the interval between leaving Perkin-Elmer and founding Tencor, Urbanek asked Bill Wheeler to determine if there was a better way to measure step height than that used by the Dektak. Wheeler spent a week or two on the problem and wrote a report suggesting how a different methodology would make it easier to use, more repeatable, and ultimately capable of being automated.

At a breakfast meeting around the pool at Dinah's Shack in Palo Alto, Urbanek and some of the other founders told Bill Wheeler that they were planning to start Tencor, and asked if he would work with them as a consultant. "No," Wheeler said, "but I will be the third member of your founding team." The financing was already lined up, and the idea of developing a profiler appealed to Wheeler. He dug into design concepts immediately, conferring with the other founders as it developed. Ed Kerswill and Jerry Gabe also left Perkin-Elmer to join the group again.

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Schwabacher galvanized a coterie of suppliers with whom he had worked at Randex. Industrial Designer Russ Davis took the first rough sketches of the Alpha-Step, as the profiler came to be known, and built a prototype package Tencor could use in early advertising. The Paul Pease Agency in Palo Alto created the first Alpha-Step ad while the lawyers were still getting all the i's dotted and the t's crossed on the legal papers.

In a strategic marketing move which would pay dividends in the years to come, Schwabacher immediately staked out the back cover positions on both leading trade publications, *Solid State Technology* and *Semiconductor International*, for Tencor's first ad announcing the introduction of the Alpha-Step. It was so unusual for an unknown start-up to spend the extra money for a back page position, the ad quickly got the industry's attention. Nearly 20 years later, Tencor ads still hold back cover positions in both publications.

Schwabacher's determination to help Tencor stand out and get launched quickly forced him to find creative ways to overcome a number of marketing obstacles. "The ad was created before the first products were even ready to ship," he recalled. "And we had to use artwork instead of photography for our first brochure at SEMICON. But it got us launched, and the product worked when it was shipped."

This was clearly a "bet-the-company strategy"—Schwabacher used his entire marketing budget in the first six months. In this case, however, it wasn't really a high stakes gamble. The engineering team had already worked together for almost six years. The sales and marketing team was solidly in place and everyone was headed in the same direction. Most importantly, the products really were just as good as the advertising claimed them to be.

*

Wheeler took a very practical approach to building the Alpha-Step. He wanted to design a machine that was easy to use and rugged enough to take out of the case and demonstrate within ten minutes—a total impossibility with the Dektak at that time.

Artist's rendering of the Alpha-Step.

At the same time, George Kren was designing the electronics for the new system, with automatic nulling, quick setup techniques and hard-wired logic that would perform the calculations quickly and repeatably in a semiconductor fabrication environment. From the start, the goal was to make the Alpha-Step as intuitive and rugged as possible. The emphasis on delivering production-worthy equipment has remained a Tencor hallmark ever since.

Although Jerry Gabe left the group after a very short time to pursue an opportunity at Perkin-Elmer, he has fond memories of the Tencor experience. Gabe was responsible for purchasing the materials

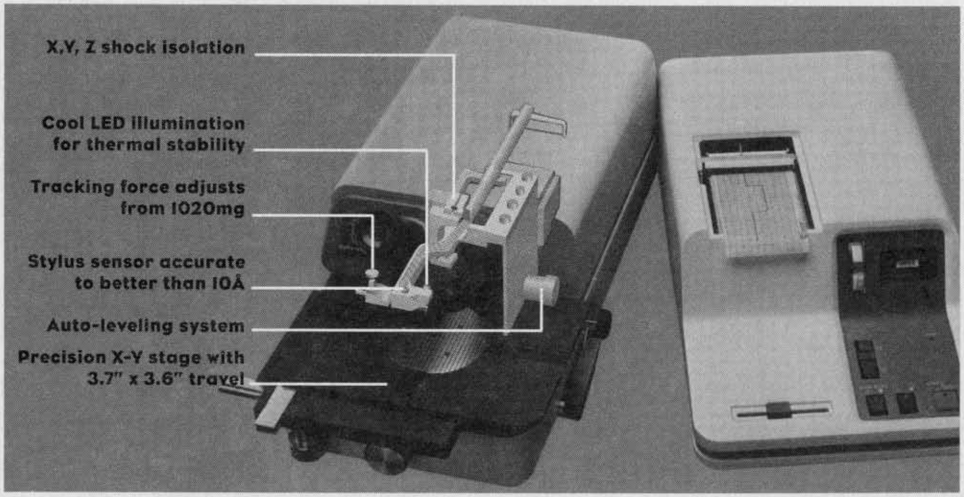
Just five months after the company was founded, the Alpha-Step debuted at Semicon West.

for the products and helped build the first prototypes. He remembers Urbanek as the driving force of the company. "The ideas came from Karel —we were his hands." Together, those hands were building the company's future.

The team's efforts to make the product "perfect" frustrated even Urbanek at times. Looking back, Ed Kerswill remembered, "George and Bill liked to work late. Karel would see the Alpha-Step working perfectly at the end of the day, but when he came back the next morning all the pieces would be spread out everywhere. Finally he said to me 'Mr. Kerswill, how can I stop them from doing this? I need them to give me something I can sell!' But they were always trying to improve it. We all wanted it to be the best machine out there."

Wheeler saw that a profiler really needed a cross-vane pivot to hold the stylus; he wanted it to be self-nulling, to automate the setup. "You have to imagine that the parts are flexible like rubber," he later said. The arm had to be rigidly supported; there should be no friction in the pivot, and it should have very low spring force.

The tip of the Alpha-Step's stylus had to measure unthinkably small vertical



The Alpha-Step design features called out in an early brochure.

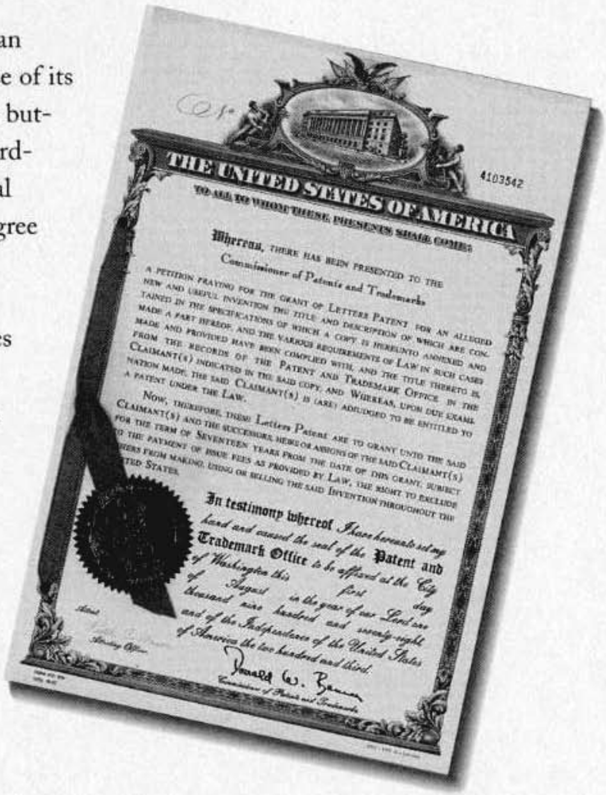
movements as it moved across the steps etched in the thin film on the wafer. Yet it had to be rugged enough to stand up to the normal stresses and temperature variations found in a lab. Wheeler found the Dektak profiler was so heat sensitive that a researcher could make a reading go awry simply by looking through the monocular eyepiece to watch the scan in progress. The warmth of a person's breath was enough to alter the results significantly. As Wheeler said, "These profilers would also make very good seismographs. They have to be that sensitive."

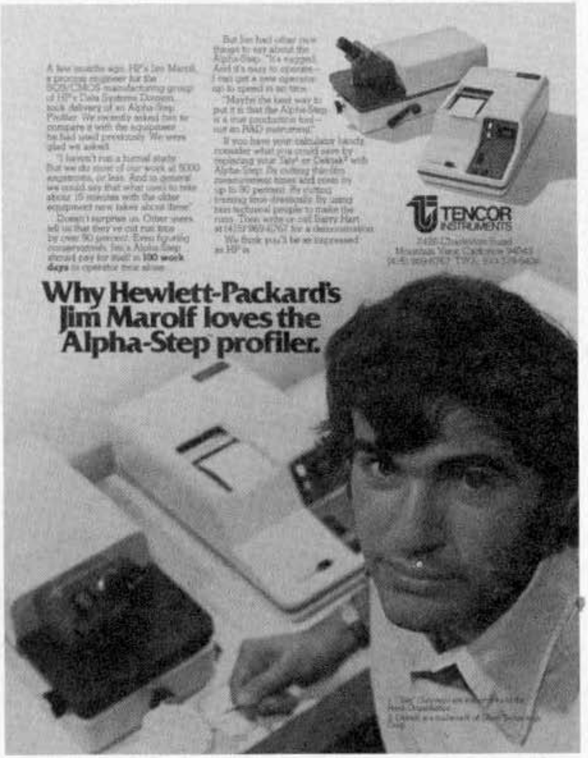
The stylus Wheeler designed was built with off-the-shelf parts. "When you're just getting started, you can't afford to custom manufacture anything, " he said. Kren found suitable LVDT cylinders "in the Big Green book (Thomas Register)" that used the reluctance of magnetism to generate the micro signals representing the tiny distances the needle dropped as it crossed over a cut line in the thin film it was measuring. "We got our styli from a phonograph needle house, Bruce Diamond Company in Massachusetts; we'd just break off the bottom part for what we needed."

The earlier Talystep system moved the sensor across the object being measured; Dektak moved the stage that held the silicon wafer. Taylor Hobson got higher precision and lower noise from its instrument. So Wheeler followed this lead, but added a gimbal design that was strong yet highly sensitive. Wheeler's design led to Tencor's first patent, Patent #4103542, granted in August 1978. In the twenty years that followed, nearly 70 patents would join the first.

*

The Alpha-Step was an immediate success because of its auto-leveling feature, one button control, sequential hardwired logic (it went digital only after 1982), high degree of integration and user-friendly interface. It was also unique, since the sales person could arrive for a demo, set it up and run a profile in about five or ten minutes. It was an industrialized lab quality instrument. Urbanek even insisted on literally kicking a packaging case containing an Alpha-Step across a room,





Tencor's first customer was so satisfied he gave a testimonial for the company's second ad.

then opening it to see if it would work. He had traveled enough to know the kind of abuse it would have to withstand in transit.

There was another major reason for the Alpha-Step's success: it gave power to the people. In this case, the people were semiconductor fab production crew leaders, called leads. Until the Alpha-Step came on the scene, the lead would have to figure out how to stay on the technician's good side or the tech could torpedo the lead's operation. If the lead needed a scan to check something, he couldn't afford to have the technician delay doing it, resulting in loss of valuable production time. Now, after a very short training period — just ten minutes! — anyone could perform these routine, but essential, tests without the technician's help.

Schwabacher said, "As soon as the first Alpha-Step was announced, it found a ready market, even priced at about twice the Dektak. The Dektak was priced at $6,000; the new Alpha-Step at over $11,000. But the market was ready, the product right, and they bought them as fast as we could build them."

In addition, a young engineer from Hewlett Packard, Tencor's first customer, was persuaded to give a testimonial for the second Alpha-Step ad. If the first ad got the attention of the industry, this second ad put Tencor on the map around the world.

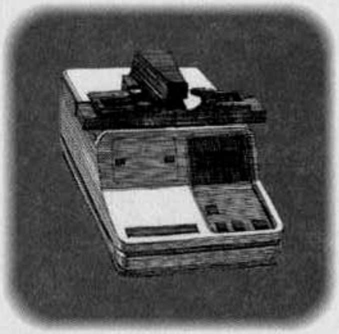
Graham Siddall, who some years later joined Tencor in a top marketing position, was on leave from Rank Taylor Hobson in Great Britain, working as a post-doctoral research fellow at Stanford University. He read the *Palo Alto Times* in April of 1977 when business editor Mike Myers ran a story about the formation of Tencor. Siddall remembers showing it to his boss who was over from England. His boss' response was immediate and decisive, "They don't stand a chance!"

*

The founder's ability and willingness to change direction when appropriate was also key to Tencor's early success. Ever the creative but eminently practical leader/scientist, Urbanek contended that the best way to keep the company healthy was to develop new products ahead of the market's perceived need, and to abandon products that weren't working before they had a chance to hurt you.

The Palo Alto Times covered the young Tencor on April 13, 1977.

The Nitrider was in the latter category. Although it was the reason for founding Tencor, it became obvious early on that the project was going nowhere, so the team agreed to abandon it. At the same time, a new measuring instrument, the Sonogage, was already under development. It used the changing intensity of sound waves to exactly calculate the thickness of a silicon wafer. A brilliant idea, sparked by the malfunctioning of an inexpensive piece of audio equipment, led to Tencor's second major product.



Sonogage RT^2

Urbanek came up with the technical basis for the Sonogage when his headset tube on an airliner developed a leak and he noticed a sound intensity change as he moved his finger away from and back towards the sound leak. From that intuitive leap, it was a relatively simple matter for Wheeler to find the tiny speakers and receivers in the catalog of hearing aid components and build the first Sonogage system. Wheeler developed an innovative wafer rotation system which lifted the wafer before rotating it, eliminating additional contamination from the measurement process.

Dick Bates and Barry Hart were a formidable sales team on the show floor and off!

In later versions, the Sonogage would also simultaneously measure resistivity and type of silicon material (P or N). These determinations were extraordinarily important in the early days of semiconductor manufacturing, when silicon was both scarce and expensive. People would save even broken pieces of silicon wafers. They would use the Sonogage to learn the important characteristics of these broken pieces before moving into process development and testing.

*

Tencor was growing quickly and the founders soon added several team members whose talent and skills were already known to them. One of these, marketing manager Daniel Tam, had been a member of the original Randex team. Tam's ability to translate complex technical ideas into layman's terms quickly became an invaluable asset to the sales team.

Tencor's first "field" employee was Dick Bates, Eastern regional manager. Hart and Schwabacher, who had worked with Bates at Perkin Elmer, wanted him for their sales team at Tencor, but figured it might be a while before they could employ him. However, Tencor's sales ramped so quickly, they lured him from International Plasma Corporation (IPC), where he had gone after Perkin-Elmer, before he had even completed his first year there.

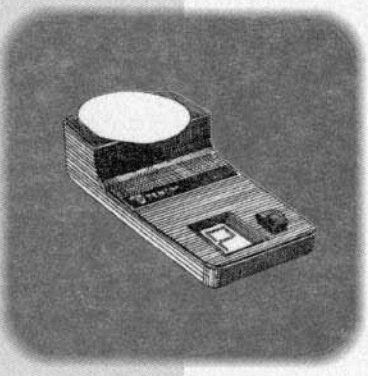
Bates remembers the early years as a time of great fun, but hard work and long hours. "At that time as a field person, you were it. One year during the holiday break between Christmas and New Year's, IBM East Fishkill had a major problem with their new Surfscan and wanted us

The Story of Tentype

Tencor's third product came from an entirely different impetus.

A week before Tencor attended its second SEMICON Show, Urbanek thought it would be nice to have a third product. During a seven-day crash development program, George Kren and Bill Wheeler designed and built a prototype system that would determine whether a silicon wafer was P- or N-type material. During this crash development cycle, the new P/N probe bore the code name of Schmoodlow, after Kren's miniature Schnauzer. (Schmoodlow is the Czech name for one of the Seven Dwarfs.)

A company contest named the product "NORP" (for N or P testing), but Urbanek hated the name. The probe, built out of Radio Shack odds and ends, worked just fine and was eventually introduced at the show as the Tentype. With its one-button operation, it offered the ultimate in product reliability. It was priced at $499, met a real market need and the unit sold quickly. Kren smiled when he remembered that some orders came through from Germany for Schmoodlows —one of the salesmen had carried the code name home with him!



The Tentype was a steady seller, but over time the company developed other products with higher selling prices and margins. The Tentype received little sales attention, and eventually it became apparent that the manufacturing effort wasn't worth the relatively small amount of revenue the product brought in. Tencor looked for a buyer and Paul Becker, who had been one of Tencor's original sales distributors, was interested. Becker, his wife and daughter had a company called Filtec which sold small measurement tools. Filtec acquired the Tentype from Tencor in the early 1990s and reportedly still sell a couple dozen systems per year.

there pronto. Mike Eiss, Tencor's first field service engineer, and I drove up there in a wicked snowstorm. It took us 24 hours to drive home! But that's what you had to do. We had to be responsive to customers even when the customers were totally unreasonable — which they frequently were."

This attention to customers was translated in many ways. During an industry slowdown in the early 1980's, Hart and Bates brainstormed for a way to get customers interested in learning about Tencor products. They finally decided to "take the mountain to Mohammed". They had a special van made which held one of each product and drove it around from customer lobby to customer lobby. At first customers weren't that interested, but eventually they ended up liking the convenience. When business picked up, customers remembered Tencor . . . and bought.

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In 1979, joining Tencor changed the life path of Claudia Casey. A bright young woman with only two years of junior college education thrown in haphazardly between years as a classical ballet dancer, studying in Europe and Russia, and getting married, Casey joined Tencor as a temporary employee to answer the phone at the front desk. Before she left 17 years later, she had become the company's controller and a corporate vice president.

After six months of phones, not Casey's strong suit, she was hired as a second accountant, her few college courses having been in accounting, mathematics and statistics. Urbanek, who always noticed and nurtured keen intelligence, found Casey a quick study and seeing her interest in learning more about accounting, began to mentor her. The first computer for office work arrived in 1980 — a Basic Four — containing accounting software that Casey thought was "pretty basic!" When Casey told Urbanek that she thought she should learn BASIC in order to computerize some of the large manufacturing labor distribution and costing spreadsheets she was then doing manually, Urbanek went out and bought a "Learn BASIC at Home" book and tossed it on her desk. "Go ahead," he said, and she did! Within days she was writing simple programs to move all her work to the computer. "I was hooked," Casey remembers. "It impressed, and really pleased me, that Karel would just let me do something that I didn't know a thing about instead of hiring it from outside. Karel never had any patience for a lot of accounting and administrative people taking up "valuable engineering space", so he let me buy all the computer tools I needed to keep working efficiently." Urbanek continued to urge Casey to attend seminars, take night courses and develop her skills over the next decade and a half.

Until Urbanek's death in 1991, Casey was his fiscal right arm, managing the myriad accounting, audit, shareholder and tax issues of a small but growing international company. "It was truly a juggling act," Casey later said. "But despite the hard work, it was a great opportunity to be in such a unique company at such a unique time in its history." Still a young woman, she retired from Tencor in 1996 to move to New Mexico with her husband.

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CHAPTER 5

The next generation arrives

During 1977, the job of designing the electronics for the new Alpha-Step fell to Kren's team. The group was short-handed, so Kren sent electrical engineer Frank Koenig to scout the Valley for engineers who could help design the new circuitry that would be required. Mike Mehr was just finishing his education. In 1977, he met Koenig during a campus visit. Koenig invited Mehr to meet George Kren for an interview.

Kren had a problem and asked Mehr if he could solve it. He needed a timing diagram for the Sonogage. "Can you do it?" With no equipment, no testers, just the circuit diagram, Mehr was able to do the timing diagram and even uncover a few potential glitches. Needless to say, he got the job.

Mehr got started right away on interfacing the Alpha-Step to an HP calculator. He also worked on Sonogage, getting it to talk to another HP 9825 calculator, capturing the control signals from the instrument and digitizing the signals. Mehr soon became Tencor's guru of digital interfaces.

Lee Galbraith quickly became a part of the Tencor team. [Shown here at an offsite meeting: (Top row) Clay Falkner, Jiri Pecen, Karel Urbanek, Keith Nordman. (Bottom row) Lee Galbraith, Bill Wheeler, George Kren.]

One of the most important events in the history of Tencor was a chance meeting between Mike Mehr and Lee Galbraith at a computer club session in May 1979. Galbraith had recently been transferred from Sandia Labs' Albuquerque operation to Sandia Livermore, a government-funded nuclear weapons lab, and wanted to get out of weapons development. Mehr told Galbraith that Tencor was looking for good people, and soon after, Schwabacher interviewed Galbraith at a local technical conference.

Urbanek was very interested in pursuing a line of research following T. H. Di Stefano's work at the IBM Research Labs. Di Stefano was using a new surface photovoltage methodology to identify yield-reducing flaws called "dislocations" on silicon wafers. When Urbanek heard that Galbraith had done his doctoral thesis on this technology, as it applied to Gallium Arsenide (GaAs) materials, he hired Galbraith on the spot.

Galbraith worked on the Alpha-Step and Sonogage products, but kept experimenting with the surface photovoltage idea. Meanwhile, he was following the developments in laser scanning in the technical press.

At SEMICON West in 1979, Galbraith, Urbanek and Schwabacher saw the incredible amount of interest elicited in the crowds by a rudimentary white light surface scanner that could locate dirt on the surface of wafers. It was made by a small company named Captec, which apparently never pursued the product category in later years.

This incident gave Galbraith the idea of applying some of the new scanning technology he had developed to the evaluation of wafer surface cleanliness — an important factor in semiconductor production. At this time, most wafers were three inches in diameter.

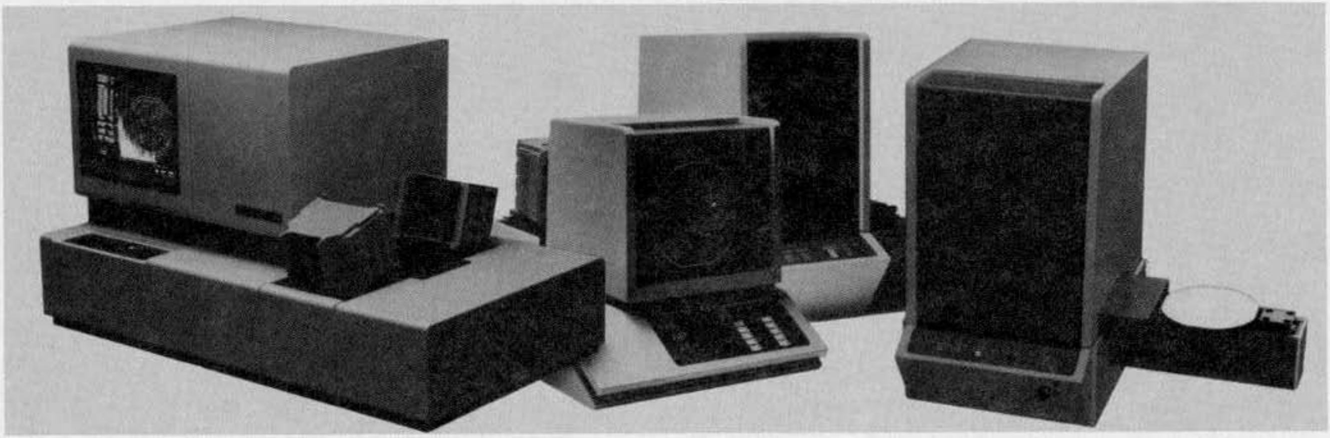
The Tencor team, headed by Galbraith, used a galvanometer and mechanical movement to conduct x-y raster scans, using wafer handling systems that already existed for the Alpha-Step and Sonogage. This approach eventually led to the development of Tencor's Surfscan product line.

The first prototype Surfscan was shown at SEMICON in 1980 but it didn't attract much interest. The need for automated detection was a hard concept

Karel Urbanek and Mike Mehr were ready for customers at Semicon West.

to sell. At that time, the critical particle size was one micron (1μm). The industry's established technique was to have an operator sit in front of a light with the wafer oscillating in front of them, manually locating particles where the light scattered off the surface. This laborious process worked quite well, unless the operator was sick or inattentive. At that time, Schwabacher related, "we were actually losing sales 'shoot-outs' to human operators!"

Fortunately, sales of the Alpha-Step, Sonogage, Tentype and a new metal-film-characterization tool, the M-Gage, all continued to do well, maintain high margins, and allowed the company to fund the development of a Surfscan which



By the mid 1980's the Surfscan family had grown to several models (shown here; Surfscan 4000, 164, 364)

would meet the industry's needs. The first truly successful Surfscan was produced on the third try. It could detect one micron particles eliminating noise or false signals caused by irregularities in the silicon wafer. This, and the fact that it was highly automated, generated interest throughout the semiconductor manufacturing world.

"We really gambled the fate of the company on developing the Surfscan," Schwabacher said. "It almost took the company under before we succeeded." History was to show that the Surfscan became very successful indeed; today approximately half of Tencor's annual revenues comes from Surfscan products. However, getting there was far from easy.

In those days, diffusion equipment was one of the primary causes of particulate contamination, but manufacturers of these tools were less than receptive to having their equipment pinpointed as the culprit. According to Schwabacher, it wasn't until a team of process engineers at National Semiconductor gave a paper showing that yield would rise if the particles from the diffusion equipment could be isolated and controlled, that the true power of the Surfscan technology began to be accepted throughout the industry.

Al Shultz, Tencor's advertising agent since the early 1980s, was once asked to name Tencor's greatest contribution to the semiconductor equipment industry. He replied: "Really perfecting automated surface defect detection systems at a time when the new smaller geometries were starting to demand it. The Surfscan designed by Galbraith, Kren, Koenig, Mehr and the rest of the team was a quantum leap forward. The important technologies developed for the early products were refined and became the core of later Surfscan generations."

Once the industry saw that this vital surface evaluation procedure could be automated, it adopted the Surfscan so completely that, as Graham Siddall later said, "Ease of use, performance and reliability sold the Surfscan systems. It readily became synonymous with wafer surface testing. 'Surfscanning the wafer' became as ubiquitous to fabrication engineering people as 'Hoovering the rug' had been to housewives in the 50s."

Eventually, the Surfscan became recognized for its contributions to high volume production and semiconductor manufacturers around the world began to purchase and install them as quickly as Tencor could ramp up production.

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Further development of the Surfscan led the engineering team down a path which turned out to be critical to the future of the product. George (Jiri) Pecen, another Czech-born Tencor engineer, insisted to George Kren that they explore digital, rather than analog, data

Making the Sale

In the early days, "making the sale" sometimes meant doing things people told you couldn't be done, recalled Dick Bates. "Back then, Tencor had several important accounts in the Minneapolis area but it was difficult enough to get a flight out, let alone get demonstration equipment there. Barry drove the Surfscan to Denver and I was to fly in and drive it to Minneapolis. It was winter and Lee Galbraith was worried the system wouldn't work properly if it got too cold. So Barry got a portable kerosene heater and put it in the van. On Sunday, when I got there, a thick kerosene film was all over the windows of the van. All Barry said when I called was, "OK, but did it get too cold?" But Lee went crazy — "It'll never work with film all over the optics! You can't demo it!" But as Dick later said, "As a salesguy in that situation, you say 'sure, sure, I won't demo it' but then you go and do it anyway." He can't remember for certain, but he thinks he got the order.

processing. As it turned out, this method gave Surfscans the tremendous benefit of being able to count individual particles or features, rather than just count the large pixels within which a particle was present.

Mike Mehr remembers that the first Surfscans used hard-wired logic that was programmed to find patterns in the data stream. When Mike arrived, he undertook a program to develop the software for the digital version. "When we did a back-of-the-envelope analysis," he said, "we could see that there was no way we could handle all the data produced by raster scanning in analog form. The new microprocessors were the only way to do the job. We were working with Zilog Corporation's Z80s to compress the data. Unfortunately, we weren't quite ready when the targeted SEMICON show rolled around; we had to use the Zilog development system under the table to make it work."

At the core of the Surfscan was an elliptical mirror collector, "an absolutely brilliant invention," Schwabacher remembers, for which Galbraith won a patent. Before he left Tencor in the early 1990s, Galbraith had his name on several important patents relating to the Surfscan.

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CHAPTER 6

A Decade of Growth

The 1980s were a time of steady growth based on internal profitability. Tencor's founders and management team were content to remain conservative, not looking for outside financing. They extended their industry market share by working closely with their customers to determine what instruments would be needed to make the next-generation of chips.

During this decade, major changes occurred in the semiconductor industry. The average size of a silicon wafer went from four to five to six inches, eventually moving to eight inches in the early 1990s. The line widths used on circuits dropped dramatically, from three or four microns to less than one micron. The number of transistors on the industry bellwether, a DRAM (dynamic random access memory) chip, grew from a few thousand to several million. During this time of rapid change, Tencor managed to grow and thrive because the company maintained a focus on designing and building new production test and measurement systems for the larger wafers and smaller line widths needed by the leading semiconductor manufacturers. It was a high risk strategy, and Tencor suffered its share of product disappointments. But the company learned early on — based on its experience with the Nitrider, which never saw the light of day — that the cheapest way to handle a product that doesn't find market acceptance is to abandon it early.

Success, it's said, has many fathers, and failure none.

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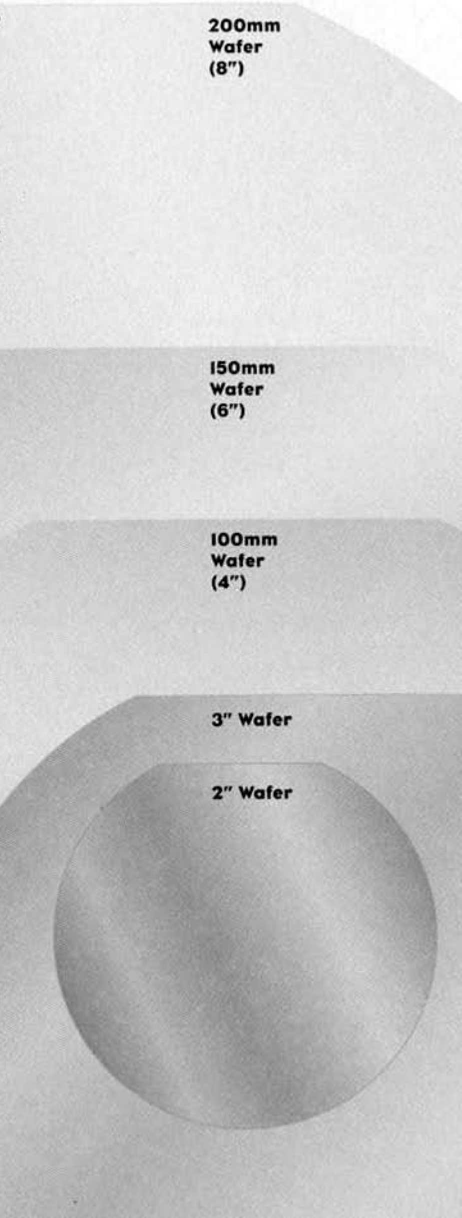
Urbanek and Schwabacher created a company culture that was rooted in the concept that people who show initiative and dependability should be rewarded with on-the-job training and growth opportunities. The environment was a blend of incredibly intense long hours of hard work and the kind of let-your-hair-down parties that happened only in Silicon Valley during that era. Claudia Casey remembered Tencor "always had two big parties a year, the Christmas party, which remained fairly sedate, and the summer picnic, which typically got out-of-hand in some fashion." Urbanek's sense of fun came out at these events; he



Early company picnics included plenty of food and fun.

Throughout the years Tencor management continued to meet offsite at Lake Tahoe or other retreats (circa 1989).

enjoyed the water fights, practical jokes and impromptu volleyball matches. Casey recounted, "It was one of those wonderful start-ups where everyone was working their tails off, but no one thought that they weren't having fun. Sure there were difficult times — but we shared a lot of laughter and fun times as well!"

Lida Urbanek found company offsite meetings, held over long weekends at a cabin on a private beach at Lake Tahoe, particularly memorable. While the group brainstormed about technical opportunities for their new product, they also enjoyed the camaraderie and opportunity to meet the families of their colleagues. The only arguments that erupted were over who was going to get to sleep in the tent.

Cindy Dooley, later to become the company's vice president of human resources, started at Tencor in 1983 when there were about 75 people on staff. She remembers that during the company's first rapid growth phase, her hardest job was finding and hiring good software engineers. Competition was fierce, and Tencor was never willing to over-pay merely to attract people. The HR staff needed to get creative, especially when moving somebody from back East. "Tencor's best selling points were — and remain to this day — the integrity of the work environment, the stimulating job content and the great people with whom you get to work. The company has always had wonderful esprit de corps," reflected Dooley. "Tencor was a great place to work," Mike Mehr said. "Even if it was 50-60 hours a week, it was never a sweat shop, and we always had the right tools to get the job done."

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One of the reasons Tencor was a great place to work was the freedom to be creative. Dick Bates remembers a novel approach used to gain the competitive edge. "It was 1985 and we were in the midst of a recession," Bates recalled. "We were competing head-to-head with Sloan in the profiler market. They had just introduced a new generation of product and Tencor's next generation was more than a year away. We had to learn where we were losing market share to them. The situation really frustrated John Schwabacher. Clearly we needed promotional fireworks to draw attention to Tencor and away from the new Sloan product. John came up with the idea of a car sweepstakes. Originally John wanted to give away a BMW, but they wouldn't cooperate. Porsche, however, was pleased to participate. Karel found out about the plan and wanted to stop it, but it was too late.

It turned out to be a great gimmick in a down economy. In order to participate in the sweepstakes, potential customers had to fill out a questionnaire that would provide us with sales information. We asked questions like: 'Who in your plant is using a surface profiler, and what is it being used for?' We unearthed a multitude of user sites that had previously been locked in by Sloan, and ended up with a long list of potential new customers. But even better, by the next year an industry survey showed we'd surpassed Sloan in market preference, establishing a leadership position in profilers for the semiconductor industry we've held ever since."

Who got the Porsche? As Bates recalls, it was won by a guy in a small thin film manufacturing plant outside Minneapolis. He ended up trading it for a pick-up truck!

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Urbanek recognized the value of rewarding achievement. He once promised everyone that if the company ever sold a million dollars worth of equipment in a single year, he would install a wine fountain with red and white wine flowing freely. When sales hit the million-dollar mark, however, better judgment — and legal restrictions! — prevailed and he bought the best espresso machines, the best Italian coffee beans and grinders, and started a Tencor tradition which lasts to this day. More than just a reward, the Espresso machines were a symbol of Tencor's emphasis on quality. "If you're going to have a cup of coffee at Tencor, it will be a cup of quality coffee," Urbanek said.

Urbanek had only a few suits, but they were hand tailored for him on London's Saville Row. And when his engineers

In 1985, Tencor boldly set out to compare its Alpha-Step 200 to the Porsche 944.

needed a quality instrument to help them do a project, there was never a quarrel. Quality was the hallmark of Tencor Instruments, and Urbanek gave it that stamp. The Espresso Attitude has prevailed at Tencor—"Don't just do it, do it well."

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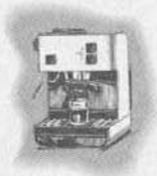
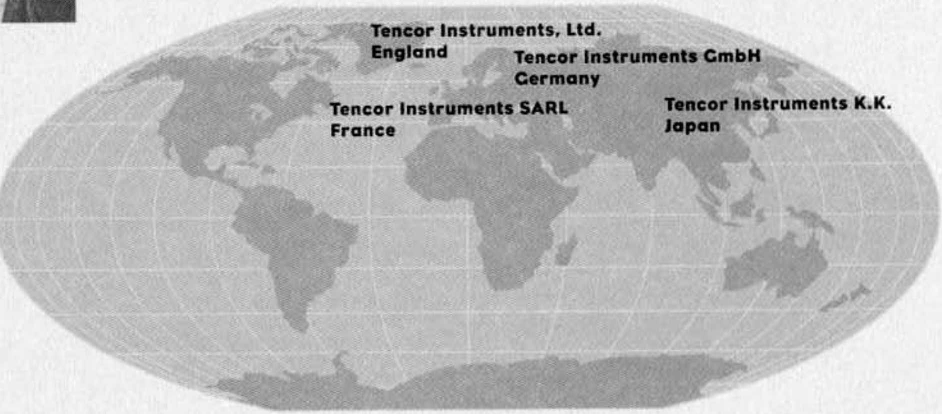
Urbanek and Schwabacher, with their European roots and their experiences at Varian and Randex, recognized early the inevitable globalization of the semiconductor industry. By the middle of the decade, they had already established a foothold in several key international markets through strong distributor relationships. Urbanek could speak impeccable French and loved the sophistication and culture of the French people. France was the first Tencor office established overseas, followed quickly by Germany in 1985.



Fritz Hebenstreit was hired by Schwabacher to open the German office. Staffed with just Hebenstreit, service engineer Michel Hromek, administration manager Margret Schulz and a secretary, the German office was quickly making a significant contribution to the company's European revenues. Technical engineer Kurt Aisenbrey soon joined the small group from Tencor's German distributor, J.P. Kummer. The group grew business in the region over the years, and in early 1995, Tencor GmbH succeeded in booking the largest single fab order in the company's history to that time—a 30 system, $10 million order for a new Siemens AG fab in Dresden, Germany.

Ron Blatteis (center), who joined Tencor in the late 1970s, frequently represented the company at shows in Asia. He later spent two years in Japan presiding over Tencor's growing sales efforts there.



The Tencor GmbH office today remains remarkable for its stability; although it had grown from the original four to 23 people by 1996, only two people have ever resigned from the group.

During the 1980s, Tencor also established an office in the United Kingdom, as well as a fledgling Japanese subsidiary to work with major distributor Tokyo Electron Limited.

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By the mid-1980s, Tencor was beginning to evolve a more mature corporate structure. With Hart moving out of day-to-day operations and business growing quickly, Schwabacher appointed John Scott, a 22 year veteran of the semiconductor equipment industry, to take over Tencor's U.S. sales efforts.

When Scott arrived, he was impressed with Karel's tremendous connection to the entire the company, "He walked the company and he knew everybody." He also wanted Scott to know everybody. Saying "John, you'll be very busy soon and you'll never have a better chance to learn the company," Urbanek sent him to sit in R&D and manufacturing for two weeks. Scott said later, " He had me talk to everyone about how I could drive the sales organization to best help the business, even before I went on the road to meet the sales team and customers. No one else I'd worked for had ever had the insight to recognize how important that was. It turned out to be phenomenally beneficial. The people I talked to felt they'd had an opportunity to influence the direction we took field operations — it helped unite the sales group with the rest of the organization, and we formed bonds which would be critical in meeting the challenges to come."

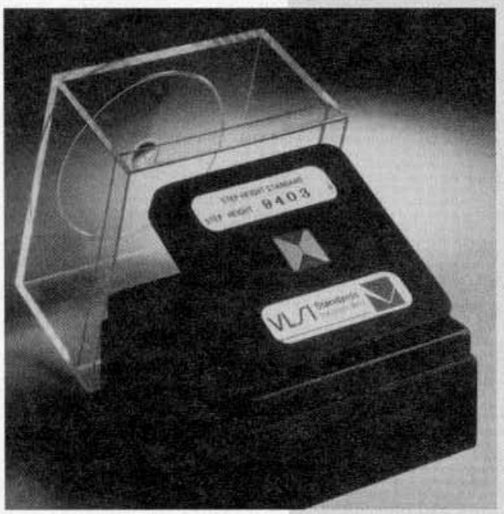
"The Sky's the Limit" was the theme for Tencor's $4 million month event.

The challenge of growth came quickly, but the company grew and celebrated together. Scott remembers the period as "a great time. During the late 1980s, we held barbecues in the parking lot to commemorate the $3 million month, then the $4 million month and finally the $5 million month. But before long the milestones were coming much too quickly to even organize a party!"

VLSI Standards – A Company Within a Company

One of the most interesting traditions in the Silicon Valley has been the creation of a successful business from the seeds of another. In early 1984, a bright idea, hatched within the Tencor organization, emerged as VLSI Standards — a new enterprise focused on developing measurement standards for the semiconductor industry.

A fellow Czech, Dr. Josef Berger had known Urbanek from the Randex days. Urbanek asked him to help his engineering team prove that they were able to see one micron particles on the new Surfscan. Lee Galbraith came up with the idea to make a contamination standard, a standard with specific particle sizes which, when run through the Surfscan, would confirm the system's capabilities.



Step Height Standard

Berger quickly recognized that the industry needed not only contamination standards, but other standards as well. He created a business plan, and both Schwabacher and Urbanek agreed that it could be a profitable enterprise. "Karel called it our 'kitchen' where we were going to 'cook' standards," remembered Berger. Urbanek agreed to invest the $1.2 million it would take to get it started. At that time, most standards came from the National Bureau of Standards (NBS) — later to be called the National Institute of Standards and Technology (NIST) — or from small manufacturing shops. Berger thought that he could improve on what was available, providing more consistent and reliable standards. He brought together Rury Ervin, who had worked with him at HP Labs and at Trilogy Systems, and Robert Monteverde, whom he recruited from U.C. Berkeley's graduating class, and got started "building the kitchen."

Many of VLSI's future customers would be Tencor's competitors, so Berger knew that they had to cultivate an independent identity, despite Tencor's initial funding. Eventually, even major Tencor competitors learned that the VLSI Standards team would hold their business confidential from Tencor. "We gave Karel monthly updates, but he was willing to leave us alone to pursue the business. He was a very astute businessman, and realized that if he wanted to distinguish himself from his competitors, he needed to prove that his product's measurements were the most accurate. Standards could help him do so."

Another pleasant surprise was that, instead of being a competitor, the NBS turned out to be a collaborator, working with VLSI to develop several new standards. VLSI focused on producing the most reliable standards, paying attention to every detail, from the quality of the materials used, to the precision of their manufacturing process. Within the small company, Berger cultivated an environment which encouraged everyone to know the company's business goals, and prized independence and creativity.

Jim Greed, who took over as president of the company in 1991 after Berger returned to Tencor, has continued on with the company's mission of producing the most reliable and consistent standards available. Now a wholly- owned subsidiary and part of Tencor's Metrology division, VLSI Standards has grown to a $10 million business which employs approximately 35 people and manufactures more than 8,000 standards a year in a Class 1 facility in San Jose, California. The trend in the semiconductor manufacturing industry towards ISO9000 certification has helped stimulate the standards business worldwide. VLSI Standards , itself an ISO9001 certified company, has achieved international acceptance as semiconductor manufacturers continue to gain awareness of the value of calibration standards — a value Berger and Urbanek were able to recognize, and act on, long ago.

Although Tencor's founders were culturally attuned to Europe, the tremendous growth potential in Asia, particularly in Japan, was impossible to ignore. A white paper written by John Scott on the benefits of building a direct presence in Japan persuaded Urbanek to take a close look at developing the region. When Scott took over sales and service worldwide in 1988, he would eventually push forward development not only in Japan but later in Korea as well.

The hatchery process at work (Mostafa Heravi, Neil Price, Rusmin Kudinar, Jerry Juracich).

*

In 1986, another key player joined Tencor, one who would make a significant impact on how Tencor's products were made and perhaps more importantly, on how they were developed. Charlie Leader had spent his entire career up to that point at large public companies such as General Electric and Eaton Corporation. Hired by Clay Falkner to take over manufacturing, Leader had never worked in a private company and greatly enjoyed the informality and freedom he found at Tencor. "Karel was never that interested in the manufacturing side of the business. He was very clear about what he expected, but he was willing to trust me to get it done," Leader recalled.

Leader presided over manufacturing during the most tremendous years of growth the company had ever seen up to that point. "John [Scott] would give me a forecast and barely a month later something would have changed and he'd be in my office with a revised, greatly increased, number. We always found a way to do it, but it was a challenge." The manufacturing effort quickly outgrew its 15,000 square foot building and Leader pushed for the development of a new facility — one with cleanrooms so the equipment, designed to detect particles and contaminants, could be built in an environment free of them.

Probably his most significant contribution to Tencor's success, Leader pioneered the development of Tencor's first "Hatchery" in the late 1980s. While a Hatchery was a well known manufacturing concept, it was unknown to the Tencor environment. "In those days engineering used to design a product, then toss it over the wall to manufacturing saying 'see if you can build this,'" remembered Leader. The Hatchery concept centralized the two groups forcing them to work on the development together — from prototype to pilot. It worked. The groups became better attuned to each other's concerns and an environment of teamwork emerged. Everyone was far more willing to go the extra mile for the common good as a part of the team.

In one case it wasn't a mile, but the lack of it that caused the problem. The first Hatchery was located in the building at the back of the Mountain View industrial park, barely 100 feet from the thousands of cars and tractor trailers thundering down Silicon Valley's main artery, Highway 101. One of the first products to be developed in the Hatchery was the next-generation profiler, the Tencor P-1. Significantly more sensitive than earlier models, the profiler easily picked up the vibrations from the freeway traffic. The team eventually concluded that the only way to perform adequate final quality assurance (QA) testing was to do it at 3:00 in the morning when the traffic was at a minimum. Needless to say it was not a popular job, but a crucial one, and it got done.

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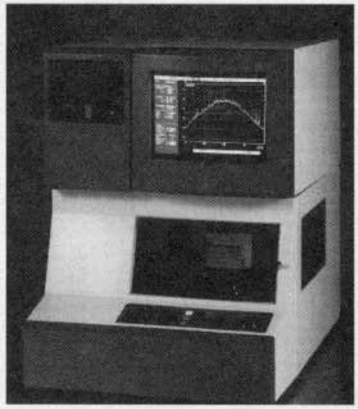
In 1988, Dr. Armand Neukermans introduced Urbanek to Dr. Graham Siddall, a Ph.D. in physics from the University of Aberdeen in Scotland. Neukermans had worked with Siddall at HP Labs, and had himself been recruited from there by Urbanek a few years earlier to lead the company's research engineering efforts.

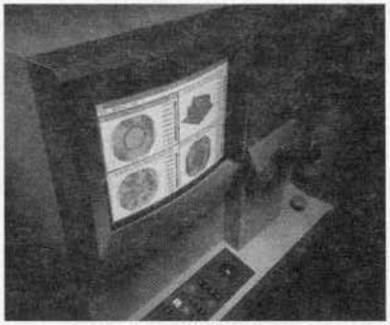


Tencor P-I
Surface Profiler

After researching x-ray lithography for H-P Labs in Palo Alto some years earlier, Siddall had subsequently joined GCA, developing their very high-end photolithographic steppers for semiconductor manufacturers. In 1988 he was living in Carlisle, Massachusetts.

At first, he was not interested in relocating to California, but Urbanek, who valued the kind of advanced education Siddall possessed, and who recognized the contribution his skills could bring to the growing company, wanted him. He pestered Siddall, even to the point of saying he was going to "show up on your doorstep next Friday and not leave until I've convinced you to join us." Which is what he literally did. Urbanek turned on his personal charm and showed that he was a shrewd businessman; he knew that to get Dr. Siddall, he had to convince Mrs. Siddall, which he proceeded to do.

Urbanek wanted Siddall to fill a new post — vice president of technical marketing. He saw the growing need to build a better



Tencor TF-1 Thin Film Monitor

bridge between the customer and engineering and believed that Siddall, with his technical background and industry contacts, could provide that link. Siddall remembers that one of his early initiatives was to develop technical seminars and user meetings with customers. Urbanek strongly supported him in these efforts, encouraging him to persevere after the first poorly attended Surfscan User Group meeting, saying, "You've really started something here." Over the years, these efforts did prosper, eventually growing into the widely-attended Surfscan User Group meeting the company holds each fall, and the series of technical seminars held throughout Asia each spring.

U.S. sales managers, Anthony Aniello, Western region and Daniel McGee, Eastern region, preside over the launch of the Surfscan 7000 at Semicon West 1988.

*

When Siddall arrived, the company was going through a major paradigm shift. As with most small, entrepreneurial companies, Tencor had always worked on products sequentially, introducing one system before moving onto the next. In 1988, the company introduced three major products at once, the Tencor P-1, which brought automation and programmable software to the profiler product line, the Surfscan 7000, the first detection system for use on patterned, rather than unpatterned wafers, and the Tencor TF-1, the company's first thin film measurement system.

By far the most sophisticated product the company had ever introduced to date, the Surfscan 7000 used new optics and digital processing techniques to differentiate between light scattered by the circuit patterns on the wafer, and light scattered by particles. The product quickly gained market interest, but equally quickly brought a host of new challenges. The 7000's sales process was longer and more complex, and installation and support required more experienced technical people. The demands of the new 7000 drew attention and resources away from the other products. The P-1, which built on established profiler technology, was smoothly launched, but the Tencor TF-1's new optical spectroreflectometry technology proved more difficult.

The TF-1 was competing in an entirely new market area for Tencor, one where Prometrix was already gaining market share and where Nanometrics, the industry workhorse, was well established. The TF-1 attracted market interest, but a lack of dedicated engineering and marketing resources allowed rival companies such as Prometrix to capture the lion's share of the market.

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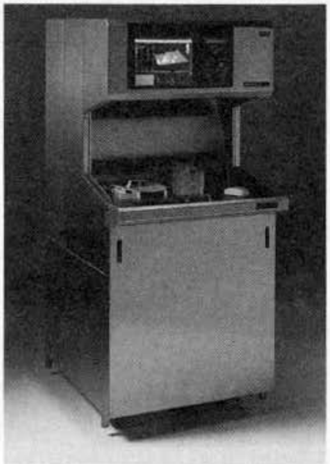
The engineering process at Tencor was also evolving. Dr. Brian Leslie, a Ph.D. in physics from the University of Aberdeen in his native Scotland, was recruited by Graham Siddall and Armand Neukermans in early 1989. Siddall, who had been responsible for bringing Leslie first to Stanford University, and then to HP Labs, recognized not only his fine technical skills, but even more valuable, his exceptional sense of organization and engineering discipline. When he arrived, Leslie was tasked with getting the next generation Surfscan for unpatterned wafers to market. Most of the attention in the past few years had been focused on the Surfscan 7000. The new Surfscan 6200 was to bring significantly higher sensitivity on unpatterned semiconductor wafers, Tencor's core Surfscan business.

Leslie divided his group into task oriented teams, and working closely with George Kren and Charlie Leader to identify critical milestone dates, focused the group on specific goals with achievable, if ambitious, delivery dates. The product launch in October 1990 was one of the smoothest in the company's history. In the seven years following the introduction of the first model, a thousand Surfscan 6000 series systems were shipped.

Leslie moved on to manage the development of the next three models in the Surfscan 7000 series, and then the development of the ground-breaking Surfscan AIT in 1995, before becoming vice president of engineering for the wafer inspection division in 1996.



Surfscan 6200 Unpatterned Surface Inspection System

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Just as the new decade was beginning, Urbanek was suddenly and shockingly diagnosed with the deadly skin cancer, malignant melanoma. During the next year, Urbanek's health declined —gradually at first, then precipitously. Although he tried all the traditional and non-traditional treatments, the skin cancer had invaded his system and could not be eradicated.

There was no clear line of succession. Urbanek had never delegated much long-term decision-making responsibility to his management team, and during the last stages of his illness, such decision making was difficult. As Siddall later characterized it, "To him, the company was like a crystal vase that you put in a prominent place in your home, kept bright and shiny, and admired from every part of the room. The company was so important to him, and his standards were so high, he found it almost impossible to delegate major responsibilities, even to old friends."

In the end, however, the semiconductor industry, like time and tide, waits for no man. Without a single clear leader but with a tremendous spirit of cooperation, Tencor's management team was able to lead the company through this challenging time. The management team, the first to follow the company founders, was then comprised of Siddall, Scott, Leader, Casey, and Neukermans. Each brought something to the table. Casey's contributions at this time were very valuable. Of the group, she had the longest standing connection with the original founders and their vision. In addition, she had built a close working relationship with Urbanek and had perspective into how the company had been run in the past. Together the team moved ahead with the plans Urbanek had begun.

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CHAPTER 7

New President, New Tencor

When it became clear that Urbanek did not have long to live, the management team worked with members of the company's board of directors to identify and attract a candidate who could take over the job of president and CEO.

Both Siddall and Neukermans had worked for Hewlett Packard Company, the Palo Alto neighbor whose management style Urbanek admired and tried to emulate at Tencor Instruments. Siddall and Neukermans first met Jon Tompkins, also an H-P veteran, as a business and character reference for a candidate under consideration for the job. Tompkins was just beginning to explore new business opportunities after enjoying a nine month sabbatical. He had left the post of president and CEO at Spectra-Physics, a company he had helped build into the leading supplier of industrial lasers, after its acquisition by a Swedish company. In the course of the conversation, it became evident not only that Tompkins himself would be a good candidate for the position, but that he was very interested in pursuing the opportunity. It was the end of March 1991.

Tompkins spoke to Urbanek only twice; once in person, at Urbanek's home when he was interviewing for the job as CEO, and a second time on the phone, after Urbanek had asked his wife, Lida, to call Sonny Marx and tell him, "He's the one. Hire him." Just three weeks later, Tompkins was pronounced the new president and CEO. Urbanek died on May 28, 1991. He was barely 53 years old.

Karel Urbanek's death was characterized as "a major loss to the semiconductor industry" by William Reed, president of the industry association Semiconductor Equipment Materials International (SEMI). As vice chairman of the association during the year before his death and in many other capacities prior to that, Urbanek worked diligently behind the scenes to help SEMI and the industry move forward. As Lida Urbanek was to later say, "The semiconductor

San Jose Mercury News ■ Saturday, June 1, 1991

Karel Urbanek, Tencor founder

Karel Urbanek, who joined six other co-founders to form Tencor Instruments in 1976 and then led the firm's growth during the next 14 years to $56 million in annual sales, died Tuesday of cancer in his Atherton home. He was 53.

Because of his illness, Mr. Urbanek had discontinued active daily management of the Mountain View firm earlier this year and had become chairman of the board. He was succeeded as president and chief executive officer by Jon Tompkins in April.

When Mr. Urbanek, John Schwabacher, George Kren, Barry Hart, Ed Kerswill, Jerry Gabe and Bill Wheeler decided to establish a start-up in 1976, the seven were the company and they had no product, said Wheeler, who remains with Tencor as an engineer and product developer.

But they had an idea to develop user-friendly metrology instruments, and the seven-employee company worked for 10 months before the first device was sold to

Karel Urbanek

■ **Born:** March 22, 1938, Prague, Czechoslovakia. ■ **Died:** May 28, 1991, Atherton, Calif. ■ **Survived by:** Wife, Lida of Atherton; children, Irene, Karel, Andrew and Matthew Urbanek, all of Atherton. ■ **Services:** Memorial at 10 a.m. Saturday at the Menlo Park Presbyterian Church, 950 Santa Cruz Ave., Menlo Park. Private burial. ■ **Memorial:** Contributions may be made to Stanford University Medical Center for cancer research or to the donor's favorite charity.

Hewlett-Packard in August of 1977, Wheeler said. The first instrument was a profiling machine to measure the thickness of the film deposited on silicon wafers. The firm employs 300 workers today, he said.

Mr. Urbanek "was talented and articulate," Wheeler said. "He brought strong leadership and long-term planning to the company."

Mr. Urbanek's specialty was gas discharge physics, and he left Varian Associates, where they both worked, Wheeler said, to employ that specialty in designing and manufacturing sputtering equipment. Mr. Urbanek founded Randex Inc. in 1969, sold out to Perkin-Elmer and remained with the firm until 1976, the year Tencor opened.

Mr. Urbanek was also a participant in Semiconductor Equipment and Materials International (SEMI) as a director and vice chairman.

"Karel was a modest man who preferred to maintain low visibility for himself while working diligently behind the scenes to help SEMI and the industry to make progress," said William Reed, SEMI president. "His death is a major loss to the semiconductor equipment industry."

equipment industry, and Tencor itself, were Karel's lifeblood. He had always been the driving force behind the company and Tencor bore the imprint of his unique personality and talent."

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Jon Tompkins possessed a combination of education and business experiences that, in many ways, made him Urbanek's ideal successor. With a BSEE from the University of Washington and an MBA from Stanford University, he had both the technical and the business background that are prerequisites for running a successful technology company. He'd started his career at H-P in sales and marketing before moving to Spectra-Physics, the first commercial laser company. At Spectra he had had the opportunity to head various units, including a three-year stint in Germany as general manager of their European operations. He left Spectra in 1979 and spent several years investing in several high-technology start-ups in the Pacific Northwest, including Xytec Corporation, a start up focused on real-time process monitoring for manufacturing, which he directly managed for three years.

Jon Tompkins

Living in Bend, Oregon, during this period fulfilled a dream for Tompkins, allowing him to live with his young family in a bucolic farming atmosphere just minutes from ski slopes, world-class golf links, and some of the best fly-fishing in the country. Tompkins even tried his hand at raising cattle for a short period of time — before he discovered that they were far less tractable than even the least cooperative employee!

After returning to the Silicon Valley in 1984 to serve as president of Varian's Semiconductor Equipment Group, Spectra wooed Tompkins back, first as a senior vice president responsible for the laser division, then appointing him chief executive officer in 1988. With his broad management background, it's hardly surprising that Urbanek was so quick to choose Jon Tompkins as his successor.

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When Tompkins arrived in 1991, sales throughout the industry were losing momentum and it was affecting Tencor as well. One of Tompkins' key assignments from Urbanek and the Board of Directors was to find a liquidity path for the company's long-term investors and the Urbanek family — to make Tencor a publicly-owned company. However, the timing to approach the public market could not have been less auspicious. Projections for the remainder of 1991 showed demand for semiconductor capital equipment was softer than management had budgeted and unfortunately, immediate action was necessary to lower the company's break-even point. If the company was to be an attractive investment, it had to maintain its historic profit levels.

Tompkins, as almost his first visible act as the new president of Tencor, had to preside over the company's first staff reduction, along with a 5 to 10 percent temporary pay reduction from the top down. Although only about 25 jobs were lost, the impact shuddered through the fast-growing company and morale suffered. Tompkins also had to implement tight spending controls.

Tompkins' first action as CEO had been to get a detailed analysis of the company's financial situation. Tencor's accounting system was a sound one and had been regularly audited by Price Waterhouse since 1980, but it was unique to Tencor. Urbanek had never asked his long-term financial officer, Claudia Casey, to prepare quarterly reports. She formatted the financials the way Urbanek wanted, using an ad hoc system that worked fine for her boss's needs in managing the closely held corporation. Tompkins, trained as an engineer during his undergraduate years at the University of Washington and as a business manager during his MBA studies at Stanford, was puzzled. He spent his first weekend on the job taking the monthly reports and building the more familiar "quarterlies" out of them in order to get inside the company's finances quickly.

There was no formal written business plan, only a budget for the year, allocated at a rate of one-twelfth per month. It worked, but it was not a familiar methodology to Tompkins, whose background was in public companies. In order to go public, all financials had to be structured in compliance with SEC regulations. Tencor's financials were just fine for a privately-held company, but did not meet the needs for a public company. Recognizing this, in November 1991 Tompkins brought on a chief financial officer, Bruce Wright, who had considerable experience in

Tompkins possessed a combination of education and business experiences that, in many ways, made him Urbanek's ideal successor.

working with companies that were going public.

At the time, Wright was living in South Lake Tahoe working for a holding company which took a "grow and harvest" approach to developing start-ups. Having reached the end of a harvesting cycle, he was looking for a new challenge. Both former college basketball players and engineers with an advanced business degree, Wright and Tompkins clicked immediately. They found in each other a similar management style and common goals for the company—Wright quickly became Tompkin's "power forward" on his growing management team. Wright and Casey fast developed a good working relationship, based on mutual respect and an appreciation for each other's strengths.

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The industry downturn and focus on preparing for the IPO made the summer of 1991 a time of cost consciousness throughout the company. Casey's reputation for frugality was already common knowledge in the accounting department where she had been known to issue memos regarding excesses in office supply expenses. As Laurie Buzzell, who worked her way up from accounting clerk to manager of payroll and stock administration before transferring to Human Resources, laughingly recalls, "Claudia used to get us to reroll our adding machine tape and run it back through the machine, saving money and trees!" At Casey's retirement party many years later, Wright joked that it's the little things like that which add up and help a company maintain the kind of strong financials Tencor has enjoyed over the years.

The reorganization that followed gave Tompkins and his team a chance to ensure that all parts of the company felt they were valued equally.

Tompkins split Tencor into two major divisions to match the major market segments served: Wafer Inspection and Metrology. Graham Siddall was appointed general manager of the wafer inspection division. Tompkins took the opportunity to add to the management expertise on his new team, bringing in another Spectra veteran, Dr. Michael Kahn, to head the new Metrology division.

The reorganization that followed gave Tompkins and his team a chance to ensure that all parts of the company felt they were valued equally. Every part of the organization was as important as any other and all employees, whether in administration, service, engineering or manufacturing were to be treated the same.

The initial public offering (IPO) process was initiated almost as soon as Wright got on board. Wright and Tompkins targeted the IPO for early in 1992. Lehman Brothers was chosen to be the lead investment banker, joined by smaller Needham and Company.

They were scheduled to start the "road show", presentations about the company made to potential major investors, in England. They figured the European market, smaller and less critical than the U.S., was a good place to warm up and get some practice. Tompkins, Wright and Siddall completed two days of presentations, but as they waited at London's Heathrow airport to return for the U.S. road show, news came from Lehman's New York office that the window of opportunity for high technology IPOs was rapidly closing. It was recommended that Tencor defer making the public offering until the fickle financial market would again be ready to invest in technology stocks.

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That year, 1992, was a tough one for the industry. It was the first year ever of negative growth for the semiconductor production equipment industry. Tencor, however, was in a good cash position because it had been able to maintain its margins during the belt-tightening period.

During the year, Tencor purchased Flexus, a small company with a product that fit into Tencor's scope of operation perfectly. The acquisition was a logical step in Tompkins' plan to grow the company through well-funded internal development, strategic alliance and the acquisition of companies with promising, complementary product lines.

Three months after the aborted 1992 IPO, Ken Levy, founder of KLA Instruments and who knew both Karel Urbanek and Sonny Marx, approached Tencor, offering to purchase the company as an alternate path to liquidity. KLA was already a public company making equipment for semiconductor manufacturers. It had pioneered an image processing technology widely used in the industry and was regarded as a leader in yield management technology.

While Tencor's management was not fully convinced that a merger, at that time, was necessarily the best option for Tencor, the rest of the year was spent in negotiations with KLA. By the beginning of 1993, no definitive agreement had been negotiated. At the same time, the economic situation had changed and Wall Street was showing a heightened interest in semiconductor equipment companies.

The Story of Flexus

Flexus was founded in 1988 by Dr. Ilan Blech and Dov Hirsch. Blech, known for his expertise in the area of materials development, taught at Technion — Israel Institute of Technology — where Hirsch attended, but they didn't meet until 1987 in the U.S. On his own, Blech had developed and sold a few film stress measurement tools, but he needed help in building the business. Hirsch left Applied Materials, and after a year of selling systems out of Hirsch's garage, Blech also left his full-time employment to pursue the business.

At the time of acquisition, Flexus was a \$3.5 million company with five employees, selling 60 systems per year. The Flexus products became Tencor's FLX product line of film stress measurement products. In 1992, its sales helped add a slight increase in revenues to an otherwise flat year for Tencor.

In 1995, the new Tencor FLX-5400 demonstrated the combined strengths of the Flexus technology with Tencor's production-oriented automation. [Dov Hirsch, Bruce Shand, Van Strohm, Ilan Blech.]

Tencor's management decided that unless a definitive agreement could be immediately concluded, going public offered more attractive benefits than a merger with KLA. Merger negotiations were discontinued in January 1993.

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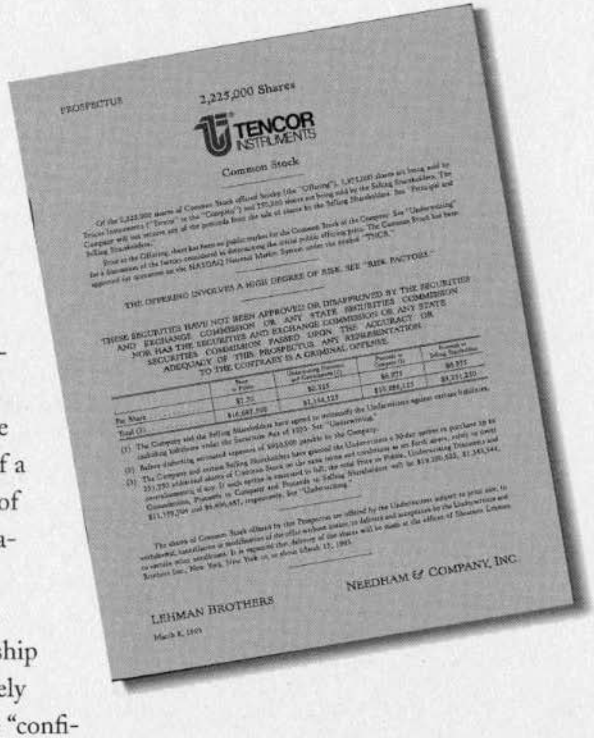
Recognizing from past experience the transitory nature of good IPO opportunities, Tompkins and his staff knew they had to move quickly. With government approval already obtained the previous year, this IPO process moved quickly. In less than three months, Tompkins and Wright launched the road show, traveling across the country pitching Tencor to the investment community. "For two weeks you live out of a suitcase, running from airport to limo to hotel," describes Wright. "In a city like New York, you might meet as many as 70 people during the course of a single day. Sleeping is scheduled, but eating is somewhat more difficult. Sure, you go to lots of breakfasts and lunches, but you're always the one speaking while everyone else is eating. After a while you learn to bring a "care package" — things like granola bars you can eat in the limo. Of course, if all else fails, you can always eat a lot of peanuts on the plane!"

The first semiconductor equipment house to go public in more than five years, Tencor was not an easy sell to the investment community. No one knew much about the industry and explaining the complex connections between the electronics industry, the semiconductor industry and the semiconductor equipment industry, was challenging. Wright and Tompkins spent hours answering questions and reviewing the Tencor story with Wall Street analysts.

The company went public in March 1993 at $7.50 a share. Tencor's successful IPO was quickly followed by a number of other semiconductor equipment manufacturers who decided to capitalize on the same opportunity. Ironically, although Tencor's first year as a public company was a successful one financially, the company remained a Wall Street secret. During most of that first year, the stock hovered at barely $12 per share.

As if on cue, once the company went public, the business started turning around. Sales grew by approximately 25 percent, profits by approximately 26 percent during the next 12 months. Interest in Tencor grew and the company took the opportunity to float two follow-on offerings in quick succession, one in September 1994 and another in April of 1995, building the company's coffers for the future.


PROSPECTUS
2,225,000 Shares
TENCOR INSTRUMENTS
Common Stock
LEHMAN BROTHERS
NEEDHAM & COMPANY, INC.

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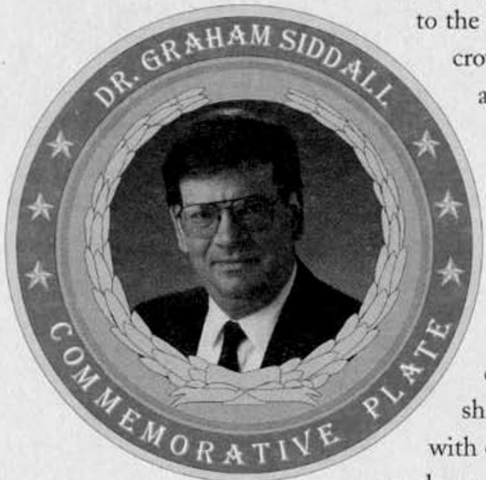
Becoming a public company was a major culture change for everyone. All of a sudden the shadow of Wall Street accompanied every action. Information such as bookings rates and ship schedules, once widely shared, now became "confidential." Profit and loss, once less critical, became a primary focus in each business area. Employees were cautioned against insider trading and legal review was required for nearly every step of the financial process.

Throughout this period, both Tompkins and Wright worked to foster the spirit of casual teamwork that was inherent to Tencor's culture. "A large part of what has made Tencor successful is the fact that everyone treats each other as equals — and no one takes themselves too seriously," reflected Wright. Playing on his own mischievous sense of humor, he took it upon himself to inject laughter into the typically sedate employee meetings. At one such meeting, while undertaking to explain the fundamental concepts of "cost of goods sold", "gross margins" and "net income" to employees, Wright invented a scenario describing a company launching a new product — the Graham Siddall Commemorative Plate. Wright played out his financial tutorial to the uproarious laughter of the crowd. The joke was much appreciated by Siddall, and the two spent the next few meetings poking fun at each other and the rest of the management team.



The Graham Siddall Commemorative Plate

From the early days under Urbanek, Tencor's culture had always promoted sharing the company's success with employees. Growth of the employee stock option plan, initiated during the 1980s, fit well into this environment. At the time of the IPO, even employees who did not have stock options were given 100 shares of the newly issued stock so everyone could share in the company's public success. Today, through stock option and purchase plans, many employees are also shareholders, giving everyone both a stake and a responsibility in the company's success.

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One of the key factors in the upswing in sales was a legacy of earlier planning. For many years Tencor's presence in Japan was no more than a single manager interfacing with the enormous distributor, Tokyo Electron Limited (TEL). Just before his illness forced him to pull back from day-to-day operations, Urbanek acted on the recommendations John Scott and the management team had made in late 1989, appointing Dr. Seiji Yoshii to the post of president of Tencor Instruments Japan Co. Ltd., in May 1990.

Although Urbanek's deteriorating health slowed down the process, Lida Urbanek remembers that one of his final instructions to the management team was, "Don't detour from the goal of going direct in Japan." Yoshii, who had been a senior executive at Applied Materials Japan, was intrigued by the opportunity to develop the Japanese subsidiary and was clearly someone who could influence Tencor's presence with customers there. Tencor's Japan Technology Center was established in Nagatsuda, an industrial suburb outside Tokyo. With 10,000 square feet and state-of-the-art cleanrooms, the Technology Center was to provide customers with local technical and applications support.

When Tompkins arrived in mid-1991, Yoshii had appointed a few key individuals, but had not had an opportunity to pursue his ideas for the growth of Tencor's presence in Japan because of Urbanek's ill health. Tompkins, already heavily involved in battling the industry downturn, was clear in his direction. Japan needed to find a way out of the revenue slump before further investment could be made there.

Together Tompkins and Yoshii crafted a three-phase strategic plan: Phase I involved taking over importation of most products, applications and technical support, as well as sales of profilers to non-semiconductor customers. Phase II would move direct control over service for Japanese customers to Tencor, Phase III would transfer direct control over the company's regional sales activities to Tencor. All of this would take three years, one for each phase. Rolling out the multi-year, multi-phase plan in Japan was costly, reducing company profits by $2 million to $3 million each year from 1992 to 1994. However, Tompkins and Yoshii were well aware of the long term benefits and remained strongly committed to the plan, even when making such investments during slow years was painful.

Building critical mass in all areas, including Japan, was an important component in Tompkins' growth strategy as well. In an interview with Channel magazine in late 1994, he explained, "The complexity of the semiconductor manufacturing process means that to sell equipment you have to be able to support it on

The opening of the Japan Technology Center was celebrated in October 1990 with a technical seminar which attracted more than 100 customers. [TEL Representative Carl Minomura, Karel Urbanek, Seiji Yoshii]

the spot, not by flying in a support team when there is an emergency. [The most successful companies will be those] that develop critical mass. . . who become so global that their countries of origin are transparent to their customers."

The investment in Japan paid-off, resulting in a dramatic upswing in sales in the important Asian market during the boom years of the mid-1990s.

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CHAPTER 8

Prometrix

Prometrix was another player in the semiconductor equipment market which would play a significant role in the Tencor story.

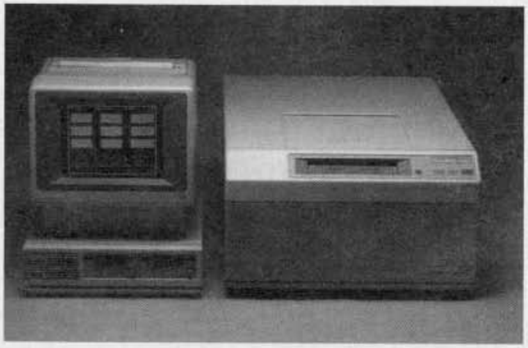
Richard Elkus Jr., a long-time veteran of Silicon Valley, saw the opportunities offered by the rapid growth of semiconductor manufacturing. Joined with Dr. David Perloff, Talat Hasan, and Dr. Chet Mallory, Elkus was instrumental in Prometrix Corporation's success.

Perloff, Hasan and Mallory had worked together in semiconductor manufacturer Signetics' research department developing automated instruments which were used to characterize wafers for semiconductor processing. These tools were adopted by both Signetics and Philips for their respective semiconductor fabrication processes.

In March 1983, the three made the decision to leave their large company environment, moving across the street from Signetics to start their own company with financing from personal credit cards and home equity loans. Perloff, Mallory and Hasan had already developed the technology for what was to become the OmniMap and had actually received some orders. However, they were having trouble putting together the funding needed to build up inventory and manufacture the product. Their attorney Bob Tufts referred them to Dick Elkus.

Top: Prometrix founders Chet Mallory, Talat Hasan, Dick Elkus, and Dave Perloff at an early company event.

Below: Talat Hasan demonstrated the new Prometrix products for an interested crowd at Semicon Japan 1984.



OmniMap RS20
Resistivity
Mapping System

Elkus, who had led the team at Ampex that introduced the VCR to the world, was known in the business community for his interest in emerging technologies. Tufts thought he might be interested in his clients' new technology. Although Elkus was not sure he was interested, he agreed to take a look at what they had. One afternoon, he dropped by the small Prometrix office in his tennis whites and carrying his racket to take the promised look at their fledgling product. He must have liked what he saw, because by the end of the afternoon they'd decided to pursue the opportunity together. By that summer they had formed the management team that would take Prometrix to great success in the process measurement market. Elkus, with his extensive management experience at Ampex, Gould Medical Instruments, Geometrics, Pacific Instruments and Integrated Systems, was the natural choice for chairman and CEO.

LithoMap LM20
Lithography
Characterization
System

The new company's first product was the OmniMap, used by semiconductor process engineers to test resistivity on monitor wafers during the development of new and advanced fabrication processes. "We had lots of orders right from the start, and even had it in a trade show booth by Semicon that May" said Hasan. OmniMap got Prometrix the industry attention it needed and generated the cash flow the R&D team needed to go after other goals.

In addition, the group soon received a prized contract from Xerox Corporation to develop and define a product to map the lithography process. The resulting LithoMap product was an immediate success since it had the ability to model the performance of all available steppers and aligners, including those from industry leader GCA.

While at Signetics, Perloff had invented the automated mapping techniques used to characterize wafers and his presentations at technical conferences had generated great interest. The Prometrix group was able to create the first commercial product using Perloff's unique, previously proven methods, bringing the ease of computerized mapping to the industry at large. In 1989, Perloff was recognized for this seminal work by industry association Semiconductor Equipment Materials International (SEMI) when he was awarded the annual SEMI award for significant contributions to the semiconductor industry.

Prometrix took off. The Fiscal Year One (1984) plan called for sales of $1.7 million; actuals were $5.25 million, with 40 percent pre-tax profits. Even during 1985, the worst year ever for the instrument end of semiconductor market, Prometrix generated over $6 million in revenue.

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In 1988 Prometrix was competing against Tencor in film thickness measurement with its new Prometrix FT-500 systems, used to monitor the film thickness on wafers during the manufacturing process. Prometrix had established a presence in the thin film measurement market early with the SpectraMap, introduced nearly two years before Tencor's product, the TF-1. The new FT-500 was a formidable opponent and frequently won in direct competitive sales situations. Clearly the two companies were very aware of each other's activities.

SWIFT

Although Urbanek and Elkus had once discussed the possibility of the two companies getting together in one form or another, it would not happen during Urbanek's lifetime.

In 1992, despite the competition in the thin film arena, Prometrix and Tencor became involved in a joint venture to develop, manufacture and market SWIFT, a database manager for semiconductor production data. The project began with a software team at Prometrix who wanted to develop a system capable of gathering data from a variety of measurement and inspection tools and using that data to identify processing trends. While Prometrix recognized the value of such a system, there wasn't a good fit with the company's current tools since the most valuable data for such an analytical system related to defects or contamination on the wafer surface. Tencor's inspection systems provided masses of such data. Seeing the market opportunities available with the analysis tool, Elkus and Tompkins reached an agreement to jointly develop SWIFT. It gave the two companies a chance to get better acquainted and to appreciate the other's qualities.

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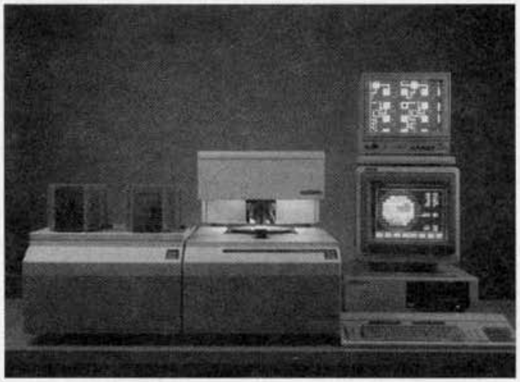

Prometrix FT-500

Film Thickness Probe

CHAPTER 9

Prometrix—The Time Is Right

Although casual discussions regarding a possible merger between Dick Elkus and Karel Urbanek had not borne fruit, there became solid business reasons for both companies to consider the idea. Prometrix was growing quickly and was making money, but Elkus and his team saw the need for more capital to support the increasingly important global market. Achieving critical mass was becoming necessary to support customers who were now using their systems 24 hours a day.

Jon Tompkins and Dick Elkus signed the agreement to merge the two companies in December 1993.

The company had two choices, to go public or merge with another larger company, but the decision was not clear cut. Elkus felt the best way was to pursue a deal with Tencor. "With their complementary product lines, the combined company would be able to become a truly major player. But it was important to me to have consensus from the team on this decision, and it was a difficult, emotional issue," he later said. Together with Dave Bayly, their VP sales, and Gary Bultman, VP marketing, the founders spent a long evening discussing the pros and cons of such a deal before making the decision to explore the merger. As an alternative plan, Elkus worked with investment bankers to take the company public if the merger discussions fell through.

Tompkins and Elkus entered into serious discussions about merging the two companies, but there were many complex issues to resolve. Elkus wanted to wait until after a technology agreement had been concluded with Sopra S.A, bringing technology critical for the next generation of thin film products in-house. In addition, he wanted to be sure that the deal was structured in a manner which would allow the Prometrix team to play a major role in the united company. It would take several months of discussion, but the two companies were able to sign a definitive merger agreement in December 1993 and the deal was closed the following February.

The new merged company was proof of the axiom that the whole is greater than the sum of its parts. The synergy between Prometrix' and Tencor's technologies and product lines provided customers with a single resource offering a broad range of wafer inspection and measurement solutions. In addition, the Prometrix product line, now supported by Tencor's extensive global network of sales and service offices, was reaching a broader range of customers than ever before. While Prometrix' revenues at $35 million were just under half Tencor's $72 million in 1993, both companies' growth, cash and margins tracked neatly to the other, creating a significantly larger company with very little change to the overall financial model. As Elkus later said, the deal between Tencor and Prometrix was "a merger made in heaven."

Many of the mergers that have occurred between high technology companies in recent years have been less than successful. Tencor has been an exception to that rule, demonstrating a successful track record in mergers and acquisitions.

A management team of ten people, five each from the two companies, tackled the mechanics of merging the technology groups, work forces, sales organizations and infrastructure. Prometrix became its

A Strategic Move for the Future

During the following year, in his new role as vice-chairman and executive vice president of the new company, Dick Elkus would lead the way in another significant acquisition. George Kren had been following the fortunes of a small company based in Liechtenstein which had developed contamination detection equipment. They were using a method which spun the wafer under a fixed laser, rather than moving the wafer in a straight line under an oscillating laser. The company, Censor AG, was in grave financial difficulties and Kren, convinced of the potential in these technologies, wanted them at any cost. With Censor on the verge of bankruptcy, Elkus saw a way to get the technology without the burden of purchasing the company's entire assets. After several long flights to Liechtenstein, Elkus, Kren and Graham Siddall negotiated a deal to obtain just the important patents and technical rights. These technologies would later prove critical in the fast development of the Surfscan SP1, the company's first product for the next generation semiconductor wafer size—300mm.

own division, preserving those attributes which had made the company a success, and bringing that success to Tencor. In addition, rather than the massive lay-offs that sometimes accompany a merger, the new Tencor had 50 open job requisitions to fill. Revenues rose 69 percent compared to the previous year. Net income rose 240 percent. Earnings per share nearly tripled, despite a one-time $2.3 million expense associated with the merger.

Morale soared, and employees of both companies came to see themselves as part of a single, powerful entity. One of the most visible changes which occurred at this time was the development of a new Tencor logo. Recognizing that it would be important psychologically for both Tencor and Prometrix employees to experience the impact of the new corporate structure, the new management team saw a logo redesign as an ideal means to communicate the change.

Roberta Emerson, who joined Tencor in early 1986 and grew with the company to eventually head the corporate communications group, described the process as both every communications person's dream and their worst nightmare. "It's a fun project, but definitely a challenging one. A corporate logo is the visual representation of the company's image and culture to individuals around the world. Any company's management team and employees naturally react to logo changes in a very personal, emotional way."

Focus groups were held both near the company headquarters and in Austin, Texas, to gauge customer reaction to the current Tencor and Prometrix identities. "Agreeing on such a subjective thing as the 'best' design or the 'right' color was nearly impossible," Emerson added. A number of new designs were reviewed and discarded before a streamlined Tencor logo with a new blue-green color was agreed upon. Acknowledging the shift to solution and system orientation in the industry, the new logo also dropped the emphasis on the word Instruments. The launch of the new logo, timed just prior to the Semicon Southwest trade show in Austin, Texas, that September, helped signal that Tencor, joined together with Prometrix, was now a new company.

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The Prometrix merger and the earlier acquisition of Flexus were prime examples of Tompkins' stated strategy to grow Tencor through a combination of internal development, acquisitions and alliances. Over the following years, technology development agreements were signed with Sematech which greatly facilitated development of products such as the Surfscan AIT and SwiftAccess. In addition, Tencor acquired patent rights from bankrupt Censor A.G. as well as certain patent rights for atomic force microscopy (AFM) from Park Scientific Instruments. While the company chose not to pursue AFM technology, the ensuing research later led to the development of the company's Tencor HRP product line, launched in late 1996.

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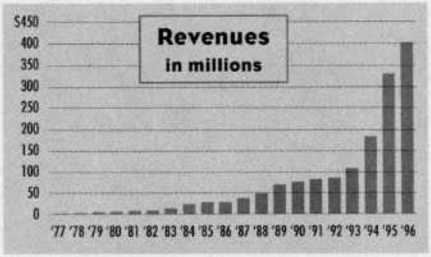
CHAPTER 10

Riding the Semiconductor Roller-Coaster

Tencor, along with the rest of the semiconductor equipment industry, rode with the industry cycles in 1995 and 1996. Rising international demand for semiconductors in the computer industry, as well as a variety of consumer industries, spawned a dramatic increase in demand for semiconductor manufacturing equipment. According to VLSI Research, total semiconductor equipment sales nearly doubled in one year, rising from approximately $18.9 billion in 1994 to $30.8 billion in 1995.



1995 and 1996 continued Tencor's revenue growth.

How did Tencor fare? In 1995, the company equaled or exceeded the industry trend. Revenues rose 81 percent to $330 million and net income rose a huge 169 percent to $65 million. Earnings per share rose 132 percent to $2.09 per share.

Prometrix UV-1250SE Thin Film Measurement System

Suddenly Wall Street, which had shown little interest in the semiconductor equipment industry, was paying attention. Positive mention of Tencor appeared in *Investor's Business Daily* and in *Fortune* magazine. *BusinessWeek* featured the company on its Inside Wall Street page, quoting analyst Arnold Schmeidler, "Tencor is one elegant way to play the red-hot semiconductor business." Industry stocks surged ahead, with Tencor rising along with them. After a stock split at $70.00 in June 1995, the share price rose again to a peak of $48.75 in mid-1995.

Tompkins had brought to Tencor a focus on "time based competition." Knowing that the only way to succeed competitively was to keep advancing the technology ahead of the competition, he and his management team focused on getting engineering, marketing and management to work together more closely on technology road maps and product strategies which could meet the quickly changing needs of the industry. The significant new product rollouts seen in 1995 were a part of this new corporate mindset. That year Tencor introduced the Surfscan 6420 for inspection on rough film layers and the Surfscan AIT (Advanced Inspection Technology). The contributions of Prometrix were also apparent in the introduction of the Prometrix UV-1250SE, based on the Sopra technology Elkus had insisted on obtaining before the Prometrix merger, and the SwiftAccess data analysis system, a descendent of the original SWIFT product the two companies had worked together on in 1992.

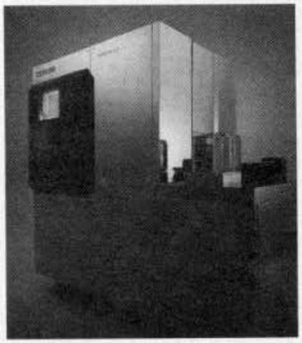
The most significant of these products, the Surfscan AIT, propelled Tencor's inspection systems beyond traditional particle and contamination detection. Building on the proven laser-based technology of the Surfscan products, the AIT was developed to detect process defects. These difficult to detect problems in the film layers, such as pattern breaks and incorrectly developed patterns, represent "killer" defects in the manufacturing process since they render an integrated circuit useless if not caught and fixed early enough. The AIT technology brought the possibility of fast detection of certain types of these critical defects—previously only seen using KLA's image-processing technology. Once again, Tencor was betting the company on the Surfscan.

Rod Browning, who joined the company right out of college in 1985 and grew with it to eventually become general manager of the Wafer Inspection Division, was responsible for managing the AIT project. "The AIT was an exciting, challenging and exhausting project for everyone involved," said Browning. "Getting to run with this from beginning to end was a tremendous opportunity for me. It was also a real learning experience. Before this assignment, I'd had direct responsibility over most of the things I'd worked on. This project required that you put the right people in place and put your trust in them. We had a great team of people, but everyone was running at 200 percent."

John Scott, who had left Tencor in 1994 to become president of the Ultrapointe division of Uniphase, worked again with Tompkins in late 1995 to craft a strategic agreement to have Tencor become the exclusive OEM (original equipment manufacturer) for their Ultrapointe confocal laser microscope defect review station. This product would be known as the Tencor CRS. The two companies also agreed to launch a cooperative effort to accelerate further development of automatic defect classification (ADC) software.

Introduced with much fanfare in October 1995, the AIT's "Inspect the Future" launch theme was carried out at an analyst meeting in New York and a technical presentation and party for customers at the Semicon Southwest trade show in Austin, Texas.

Surfscan AIT Patterned Wafer Inspection System



The groundbreaking for the new site was held in December 1995 and Tencor began to move in one year later. [Bruce Wright, Graham Siddall, Calvin Quate, Jon Tompkins, Milpitas Mayor Peter McHugh, Al Colby, Gary Bultman, Dennis Fortino, Mike Kahn]

Following Claudia Casey's retirement in 1995, Fred Ball left the partnership track at Price Waterhouse to become corporate controller. Ball, who had been Tencor's chief auditor for several years, recognized the opportunity to be in the right place at the right time and had developed a deep appreciation for the management style at Tencor. As he tells it, "When I got here things were moving so fast we were just going flat out. But the amazing thing about the Tencor culture is that we're so used to going at such a fast pace that if you see a break, instead of taking a rest, you immediately start looking around for something else you can do to fill the gap. You work hard, but it's tremendously rewarding."

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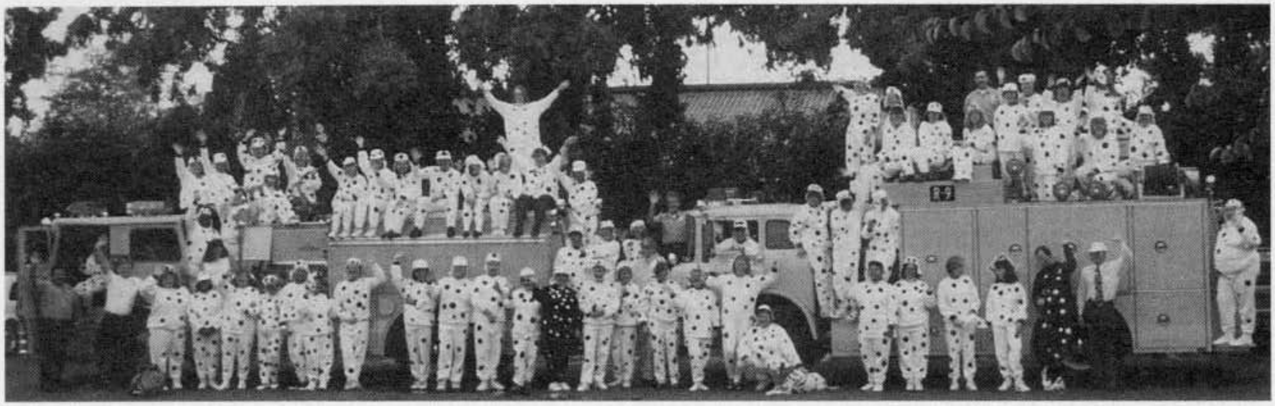
Tencor's dramatic growth in sales and revenues eventually necessitated both an increase in headcount and a facilities expansion. In that single boom year of 1995, Cindy Dooley and her staff hired 450 new people. This was a remarkable number, especially considering it was on top of the 50 percent growth the company had seen in the prior year due to the Prometrix merger.

By the end of 1995, headcount had grown 57 percent, bringing the total number of employees to 1,300. With 17 leased buildings spreading from the company's original Mountain View site down to Santa Clara, where Prometrix had been located, Tencor's management made the decision to purchase a new facility — one large enough to meet the needs of the growing company for years to come. After a significant search throughout Silicon Valley for an existing site, an empty lot in Milpitas, formerly a vegetable farm near the intersection of Highways 237 and 880,



was purchased and ground was broken in December 1995 for Tencor's new home.

During this period of tremendous growth, it was very important to Tompkins not to lose Tencor's unique and special corporate culture. To this end, he routinely spoke at employee meetings and new hire sessions, sharing his perspective on what Tencor had become and what it would take to continue that success. As Dennis Fortino, who joined in 1995 as general manager of the Metrology division, later said, "Ask anyone what the corporate culture at Tencor is and they'll tell you, 'Good guys can win—we can treat each other with respect and be effective.'" Jon's maxim for the working environment at Tencor was clearly heard.

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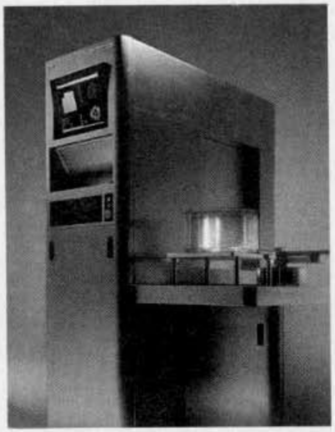
The next year, 1996, brought a cyclical downturn in the semiconductor industry, driven by excess capacity, excess semiconductor inventories and falling DRAM prices. Demand for semiconductors dropped and with it the need to rapidly expand manufacturing capacity. In 1996, the semiconductor equipment industry only grew to approximately $35.6 billion, or about 13 percent growth.

That downturn sent a corresponding shudder through the semiconductor equipment industry. New orders for manufacturing equipment declined as new fab building abruptly dropped off.

Tencor fared better than much of the industry, remaining profitable, although growth in 1996 was moderate compared to the previous year. Revenues still rose 22 percent to $403.2 million for the year.

101 Dalmatians: Belying his sedate demeanor as chief financial officer, Wright maintained his reputation for fun and games at Tencor, serving as the Fireman when the entire Administration group dressed up as Dalmatians for Halloween in 1995.

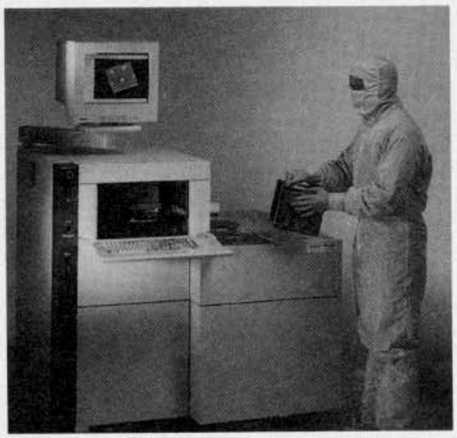


Surfscan SP-1 Unpatterned Surface Inspection System

In order to weather the downturn, which was predicted to last more than a year, Tencor's management was forced to make some difficult choices. Discretionary spending was cut, and for only the second time in the company's 20-year history, Tencor instituted a workforce reduction of approximately 15 percent in late August. It was a painful, but necessary decision if the company was to remain profitable and prepare itself for the industry's next upturn.

In spite of the economic challenges, Tencor continued to push forward, delivering the fruits of earlier labors. Based on the technology purchased from Censor, the company introduced its Surfscan SP1, jumping ahead of the competition with a wafer inspection technology designed to move into the 300mm wafer size and 0.18 micron technologies of the future.

Tencor HRP-200 Surface Profiler



Late in the year another key product, the Tencor HRP-200 high-resolution profiler, was launched. Rather than introduce a late atomic force microscopy (AFM) product into an already established market, founder Bill Wheeler was again tasked to push the frontiers of profiler technology. He worked with the profiler development team to develop a system which would provide the best of both worlds, combining features of the stylus profilers which had fueled Tencor's success with the imaging provided by AFMs. The HRP breathed new life into the company's profiler business, extending its applications to complex semiconductor processes, such as chemical-mechanical-planarization (CMP), as well as the disk drive manufacturing process.

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CHAPTER 11

After 20 Years—Looking to the Future

In November 1996, Ken Levy again approached Tencor with a proposal to merge with KLA. Times had changed, the industry had changed, and the two companies had changed. Customer needs were forcing the development of new advanced technologies ever faster and widespread global manufacturing was demanding an almost seamless worldwide presence. Perhaps the time to create a single company, focused on developing yield management solutions, might be right.

The two companies entered into discussions, and in January 1997, announced they had agreed to merge. The move was viewed positively by the industry. In a January 1997 Dataquest Alert, industry analysts congratulated the management of the two companies on their vision stating, "The synergy of products, field support and product developments of the two companies will greatly enhance the value provided to the customer base." The new company, to be known as KLA-Tencor, would have revenues of over $1 billion and employ nearly 4,000 people. Together the two companies would be able to deliver a comprehensive solution for yield management, unmatched by any other company in the industry. The combined synergy of technologies and strong international distribution would be able to provide better customer support as the semiconductor industry becomes increasingly global in the next century.

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Twenty years after its founding, Tencor, which started out as a "sandbox" where Urbanek and a few close colleagues could explore ideas, had become a leader in a multibillion-dollar industry. One wonders if the seven—Urbanek, Schwabacher, Kren, Wheeler, Hart, Gabe and Kerswill had any idea of what their sandbox would grow into, or how it would help build the tools that have fueled the Information Age.

Stet Fortuna Domus