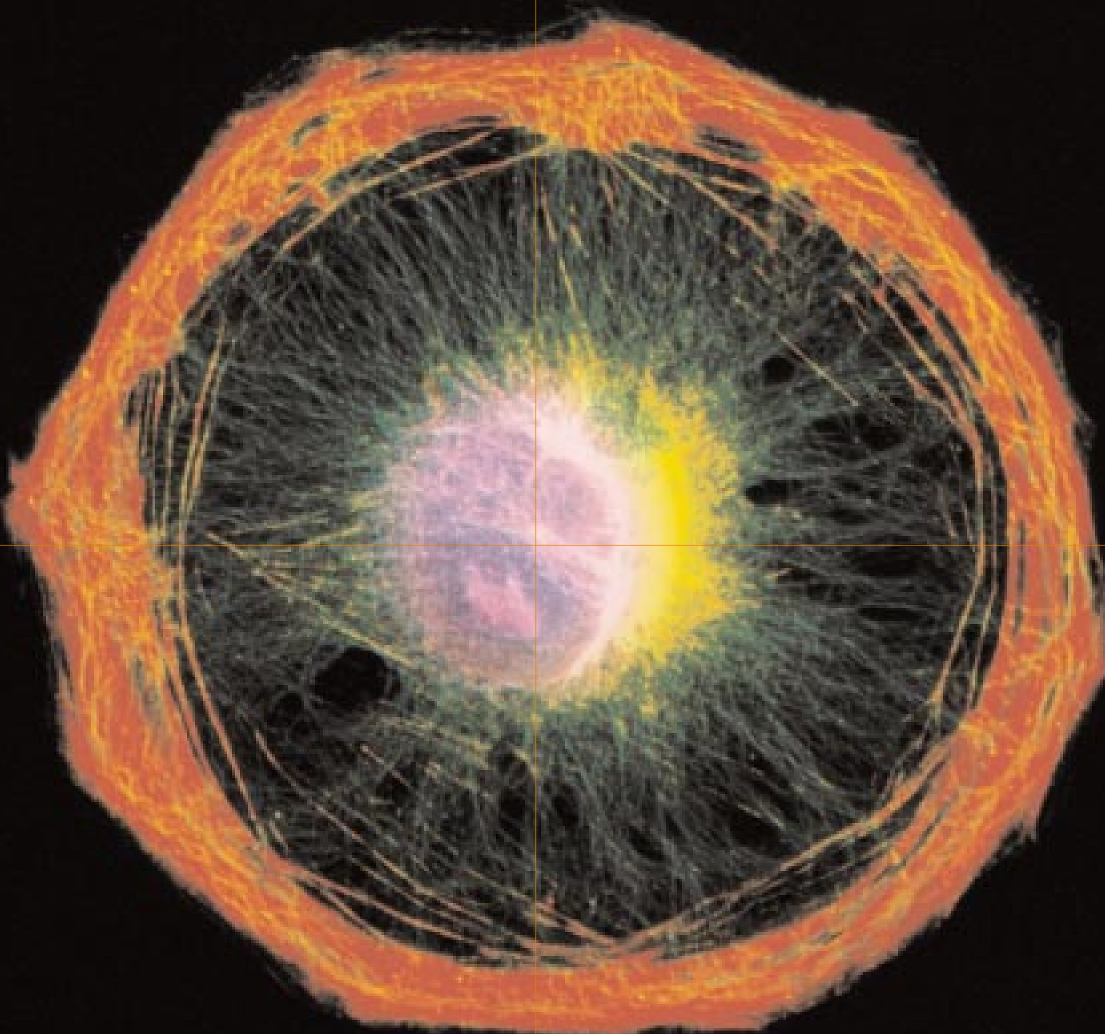
'02VARIAN

Varian Medical Systems 2002 Annual Report



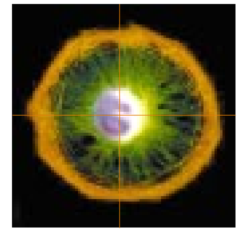
IMRT: Targeting Cancer

Digital X-Ray Imaging: Looking Into the Future

Nowhere to Hide: X Rays and Homeland Security

VARIAN medical systems

Varian Medical Systems, Inc. (NYSE:VAR) is the world's leading supplier of integrated radiotherapy systems for treating cancer and a leading supplier of X-ray tubes for imaging in medical, scientific, and industrial applications. The company employs approximately 2,750 people at manufacturing sites in North America and Europe and in some 50 sales and support offices worldwide.



A cancer cell derived from a fibroblast tumor line is depicted in a laser scanning confocal micrograph. The cell nucleus is shown in purple. Parts of the cell cytoskeleton are shown in orange (actin) and green (vimeutin). Fibroblasts are connective tissue cells.

FINANCIAL HIGHLIGHTS

	Fiscal Years		
(Amounts in millions, except per share amounts)	**2002**	2001	2000
Sales – as Reported	**$873.1**	$773.6	$689.7
Sales – Pro Forma	**n/a**	n/a	$677.2[1]
Net Earnings from Continuing Operations – as Reported	**$ 93.6**	$ 68.0[2]	$ 53.0
Net Earnings from Continuing Operations – Pro Forma	**n/a**	$ 71.3[3]	$ 49.2[1]
Net Earnings per Diluted Share from Continuing Operations – as Reported[4]	**$ 1.33**	$ 0.99[2]	$ 0.82
Net Earnings per Diluted Share from Continuing Operations – Pro Forma[4]	**n/a**	$ 1.04[3]	$ 0.76[1]
Net Orders	**$973.6**	$858.2	$762.1
Backlog – as Reported	**$698.2**	$597.8	$472.6
Backlog – Pro Forma	**n/a**	n/a	$513.2[1]

[1] FY00 is presented on a pro forma basis (assuming SAB 101 was applied retroactive to prior periods) for comparison purposes.
[2] FY01 reported net earnings exclude cumulative effect of accounting changes.
[3] FY01 pro forma net earnings exclude the effect of the $5 million dpiX investment write-off and the cumulative effect of an accounting change (SAB 101).
[4] FY01 and FY00 have been restated for the two-for-one stock split (effected in the form of a stock dividend) paid on January 15, 2002.

Except for historical information, this summary annual report contains "forward-looking" statements within the meaning of the Private Securities Litigation Reform Act of 1995. Statements concerning industry outlook, including market acceptance of or transition to new products or technology such as IMRT, software, and advanced X-ray products; growth drivers; our orders, sales, backlog, or earnings growth; future financial results and any statements using the terms "expect," "anticipate," "should," "will," "planning," "continue," or similar statements are forward-looking statements that involve risks and uncertainties that could cause our actual results to differ materially from those anticipated. Such risks and uncertainties include, without limitation, demand for our products; our ability to develop and commercialize new products; the impact of competitive products and pricing; the effect of economic conditions and currency exchange rates; our ability to maintain or increase operating margins; our ability to meet demand for manufacturing capacity; the effect of environmental claims and expenses; our ability to protect our intellectual property; our reliance on sole source or limited source suppliers; the impact of managed care initiatives or other healthcare reforms on capital expenditures and/or third-party reimbursement levels; our ability to meet U.S. FDA and other regulatory requirements or product clearances; our dependency on a small number of customers for a significant amount of our sales; our reliance on a limited group of suppliers, and in some cases sole source suppliers, for some product components; the potential loss of key distributors; the possibility that material product liability claims could harm future sales or require us to pay uninsured claims; the risk of operations interruptions due to events beyond our control; and other risks detailed from time to time in our filings with the Securities and Exchange Commission. We assume no obligation to update or revise any forward-looking statements because of new information, future events, or otherwise.

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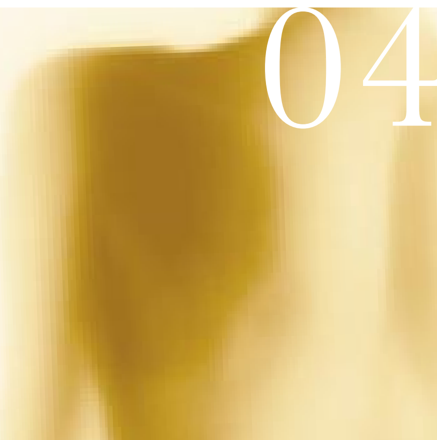
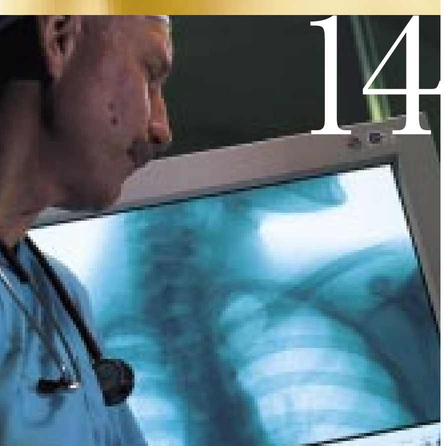




TO OUR STOCKHOLDERS,

Welcome to *'02 Varian*, a magazine and summary annual report highlighting the achievements of Varian Medical Systems in fiscal year 2002. We have a lot to talk about. Fiscal 2002 was a highly productive and successful year for our company.

Levy

Vieser

For fiscal year 2002, the company reported:

- A 13 percent increase in net orders to $974 million
- A 13 percent increase in sales to $873 million
- A 2 point boost in the gross margin to 39 percent
- A 2 point increase in our return on sales to 16.6 percent
- A 17 percent increase in our year-ending backlog to a record $698 million
- A 31 percent increase in net earnings to $93.6 million ($1.33 per diluted share) compared to prior year pro-forma earnings[2]

We increased our year-end cash and marketable securities by 36 percent to $299 million, even after spending $55 million to repurchase 1.4 million shares of common stock. The company generated operating cash flow of $156 million for the year, helped in part by a sharp reduction in days sales outstanding, which stood at 80 days at the end of the year. Shareholder equity was $473 million at the end of the fiscal year, up 20 percent from the prior year.

All three of our business segments achieved success during the year, but in different ways. The Oncology Systems unit capitalized on a booming radiation oncology market, which is well funded and supported by reimbursement rates that are favorable to Intensity Modulated Radiation Therapy (IMRT), the most advanced form of modern radiotherapy. Our X-Ray Products group responded effectively to tough economic conditions including difficult challenges in Japan by improving factory efficiency, enhancing product quality, and introducing new products that opened new market opportunities. The Ginzton Technology Center put our emerging BrachyTherapy business on its feet and extended our technical capabilities. While varied, these achievements come by virtue of a characteristic that is shared throughout our company – the ability to execute.

ONCOLOGY SYSTEMS

Oncology Systems boosted annual sales and net orders by 18 percent over the previous year and managed a 40 percent increase in operating profits. This growth came from market expansion and an increase in our already significant market leadership position.

As of the end of the fiscal year, we had equipped many more radiation oncology clinics for Varian SmartBeam™ IMRT, which enables doctors to improve outcomes by focusing higher doses of radiation more precisely on tumors while reducing complications by avoiding surrounding healthy tissue. The number of clinics treating patients with IMRT had jumped to 188 – more than double the number that were offering this treatment last year. With ongoing product enhancements, growing media coverage, and stronger patient demand, the pace of adoption remains rapid.

Our commitment to provide a "best-in-class" product for every facet of radiotherapy and to integrate these products into a user-friendly, fast, reliable system has proven to be a winning strategy. We consider ourselves to be second to none in software for treatment planning and management and in image-guided three-dimensional radiotherapy systems components.

At the annual meeting of the American Society of Therapeutic Radiology and Oncology (ASTRO), we introduced our Acuity™ planning, simulation, and verification system, which will make it substantially easier for clinics to begin treating patients with IMRT. We also gave customers a glimpse of the future by displaying a prototype Clinac® linear accelerator with an on-board imaging system, which will enable clinics to track and adjust for tumor motion during treatment. With IMRT, this is becoming an essential capability. Both Acuity and the on-board imaging system feature a flat panel imager and X-ray tube built by our X-Ray Products business.

X-RAY PRODUCTS

Our X-Ray Products group overcame a very tough first half and got back onto the growth track in the second half, creating new market opportunities while tightly controlling costs to maintain profitability. In the second half this group reached new agreements with two major customers who have committed to buying more tubes. Our engineers developed several new products, including X-ray tubes for CT scanning and airport explosive detection systems, in record time. These new products are already being shipped to customers. The group also initiated production of our new PaxScan® 4030A flat-panel X-ray imager, a significant entry in what is expected to be a large market in the future. With disciplined management, X-Ray Products also cut the cost of product failures and improved factory efficiency.

GINZTON TECHNOLOGY CENTER

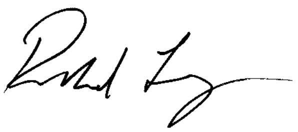
The Ginzton Technology Center successfully fulfilled its incubation mission with our BrachyTherapy business. We acquired the GammaMed® business from MDS Nordion, creating a $30 million annual brachytherapy business with a strong global presence. Our BrachyTherapy group also introduced a new version of the VariSeed™ software product, which enables doctors to improve treatment precision through intraoperative planning. The Ginzton group passed several milestones in key research projects. Engineers demonstrated the feasibility of cone beam CT scanning on our Clinac and Acuity products, real-time respiratory gating, and the use of marker seeds to track prostate tumor movements.

We reshaped the organization through several key management appointments designed to build upon our talent, consolidate and streamline operations, accentuate and share best practices, and better focus resources into emerging enterprises. Timothy E. Guertin, president of Oncology Systems and a 25-year veteran of the business, has been made executive vice president of the company. We expect that the new structure will serve us well as our orders approach the $1 billion mark.

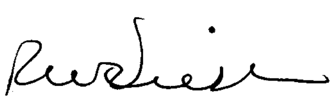
In *'02 Varian*, we highlight the technologies that we expect will carry us forward in our ongoing campaign to expand a highly profitable business based on fighting cancer, improving X-ray imaging, and enhancing inspection and security capabilities. We expect that you will find the information herein as compelling as we do.

Before signing off, we must acknowledge the fine work of our employees. They have executed our strategies with a commitment and passion that come from knowing that we are making a difference for the better. Their many achievements in fiscal 2002 have positioned our company for another excellent year in fiscal 2003. We all look forward to sharing our progress with you and we thank you for your support.

Sincerely,



Richard M. Levy
President and CEO



Richard W. Vieser
Chairman of the Board

$156M

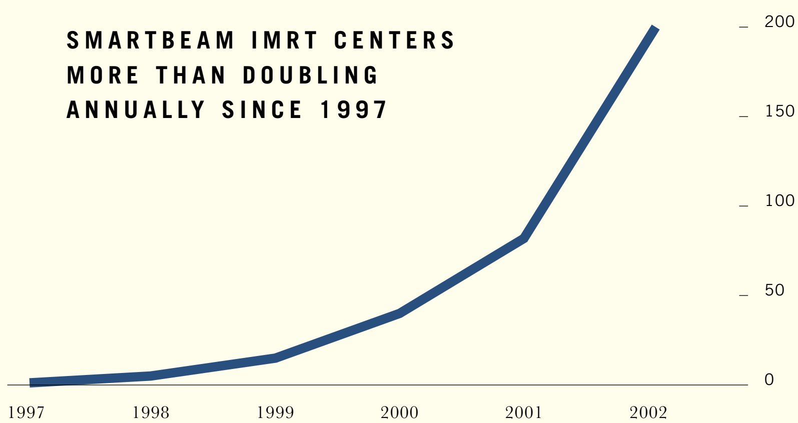
OPERATING CASH FLOW

$698M

RECORD BACKLOG UP 17%

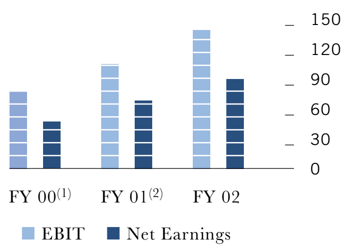
188

SMARTBEAM IMRT CENTERS MORE THAN DOUBLING ANNUALLY SINCE 1997



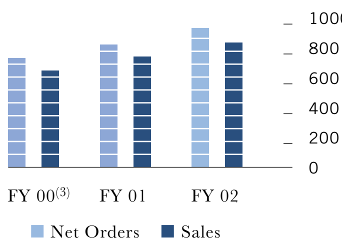
>30% GAIN IN EBIT AND NET EARNINGS

(Dollars in millions)



13% GAIN IN NET ORDERS AND SALES

(Dollars in millions)



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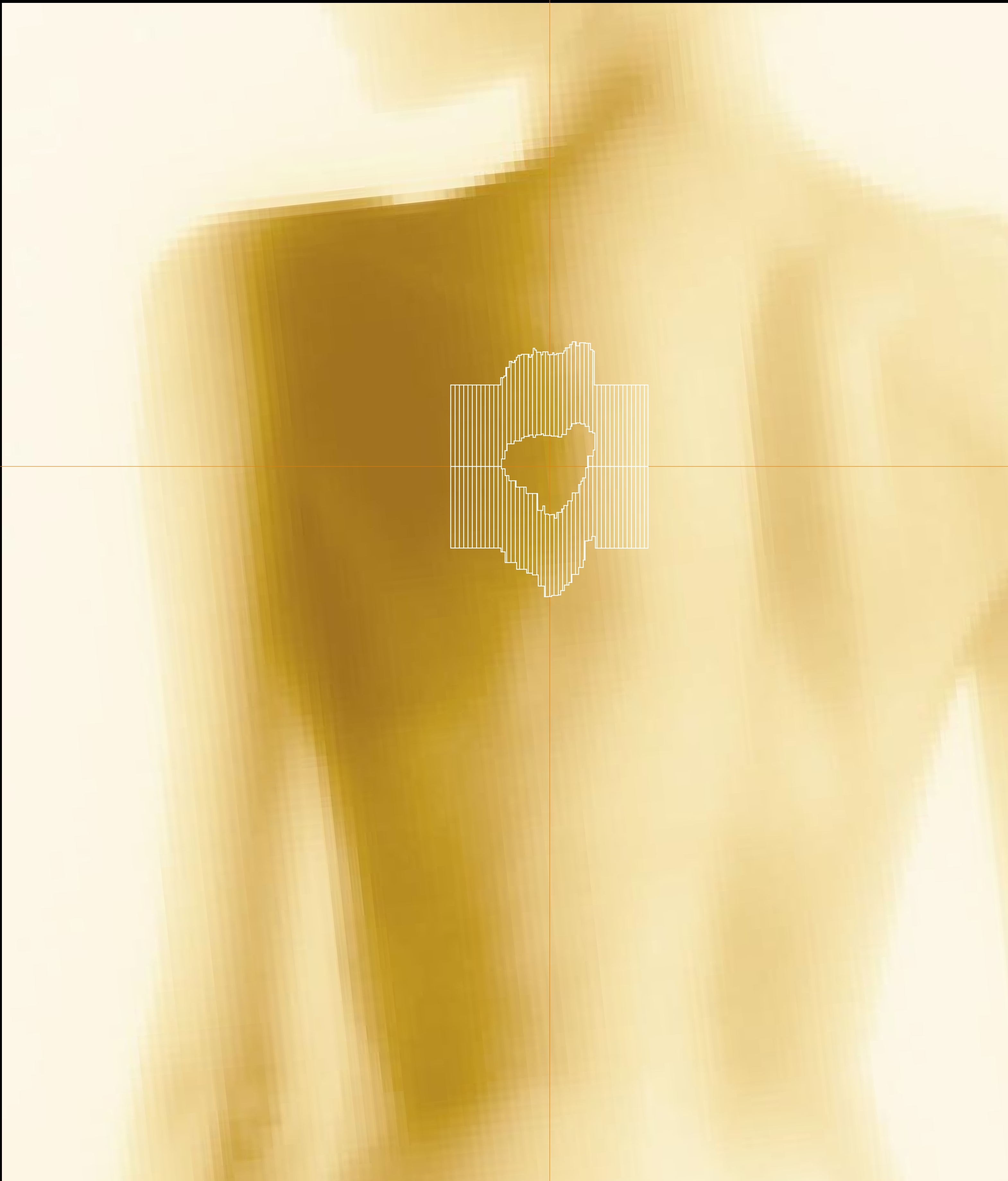
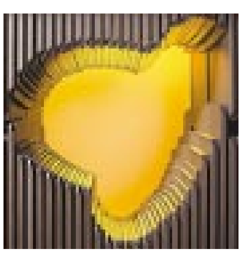


Targeting Cancer
IMRT

The situation reads like the scenario for a science fiction movie. The enemy is an alien intruder that invades the human body, with deadly consequences. This enemy comes in many different forms and assumes a bewildering assortment of odd shapes, which can change when it is under attack. In their search for weapons with which to fight back, humans have developed an amazing technology — one that can seek out and identify the enemy as it hides within its intended victim; track and target its location, adjusting to any changes of shape or position; and destroy the invader with an intense beam of radiation that does minimal harm to the host body. The bad news about this scenario is that the enemy described is an all too real disease — cancer — the second-leading cause of death in the United States (after heart disease) and the slayer of millions worldwide every year. The good news is that the weapon described is real, too. It is a technology called Intensity Modulated Radiation Therapy (IMRT) and it is offering many cancer patients perhaps their best hope ever for successful treatment.



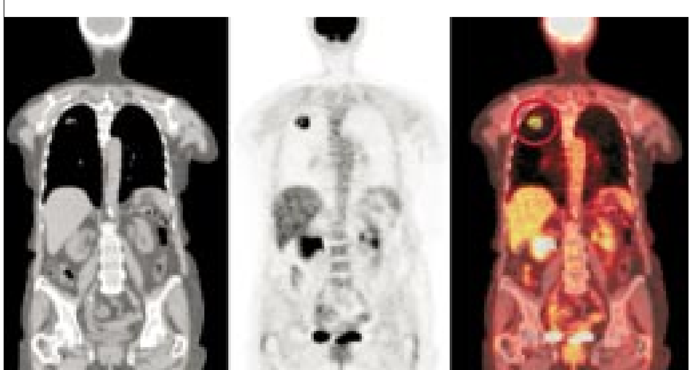
The Millennium multileaf collimator shapes radiation beams with 120 computer-controlled "leaves" or "fingers."

A WOMAN NAMED SARAH

Take a look at what happens in the hypothetical case of a woman whose name, let's say, is Sarah. She is 42 years old, is married, and has two daughters, ages 12 and 10. She has gone to her primary care physician complaining of a nagging cough and occasional shortness of breath. She appears to be in good health otherwise, exercises regularly, watches her weight, and has never smoked. Nonetheless, chest X rays and follow-up tests confirm that she has lung cancer, the leading cause of death among the known forms of cancer, claiming more victims in the U.S. than breast, prostate, ovarian, and colon cancer combined. She is among the nearly one out of every five victims of lung cancer who neither smoke nor live with a smoker. What's worse, the tumor has been classified as a type that, because of its size and general location, is inoperable using conventional pulmonary surgery.

Other medical conditions make chemotherapy problematic. Like more than half of all the other cancer patients who are treated in the United States, Sarah is advised to undergo radiation therapy, also known as radiotherapy. As recently as five years ago, Sarah's lung cancer would probably have been untreatable with radiotherapy because large doses of high-energy X rays, much like the chemicals used in chemotherapy, inflicted extensive collateral damage to surrounding healthy tissue. To minimize the effects of collateral damage, oncologists often had to limit the treatment dosages, which in turn cut down on the effectiveness of the therapy. This drawback would have been particularly acute in Sarah's case, because lung tissue is especially sensitive to radiation damage and lung tumors are highly resistant to radiation treatment.

Fortunately, Sarah has a new treatment option that has only recently become available. She can be treated at one of about 200 radiation oncology clinics around the world now using new SmartBeam™ IMRT technology developed by Varian Medical



These diagnostic images of a lung cancer case were created using a Discovery™ LS scanner from GE Medical Systems, which combines PET and CT scanning in a single machine. On the left, a CT image shows anatomical detail, but the cancer is hard to see. In the central PET image, cancer shows up distinctly as a spot on the upper portion of the patient's lung, but anatomical details are hard to see. On the right, a fused PET/CT image can help doctors precisely localize the cancerous tumor.

With SmartBeam™ IMRT, Sarah's oncology team will put her tumor in a crossfire, targeting it with precisely shaped beams. They will envelop the tumor in a sculpted radiation cloud where the beams intersect.

Systems. SmartBeam IMRT has been compared to shooting at a target with the precision of a high-powered laser. With IMRT, the target area covered by the X-ray beam is narrowed and matched to the shape of the tumor. This enables the oncology team to direct and narrowly concentrate potent doses of high-energy X rays at Sarah's tumor while minimizing complications from hitting surrounding healthy tissue.

With SmartBeam IMRT, Sarah's oncology team will put her tumor in a crossfire, targeting it with precisely shaped beams delivered from several directions or angles. This will envelop the tumor in a finely sculpted radiation cloud within the area where the beams intersect.

THE PREPARATION

Before beginning Sarah's treatment, doctors will need digital high-resolution 3D images of her tumor and the surrounding anatomy. With sophisticated diagnostic imaging, the oncology team can establish the exact location and shape of Sarah's tumor. This will make it possible to develop the treatment plan needed to deliver a high enough dose to eradicate the tumor without harming the surrounding tissue.

To obtain the needed images, Sarah's doctors may choose to use Computed Tomography (CT) in combination with Positron-Emission Tomography (PET). With CT scans, thin, low-energy X-ray beams are swept across a tumor-harboring area to generate a number of detailed cross-sectional images, or "slices." For PET scans, patients are injected with glucose marked with a radiotracer such as fluorine-18, which emits positively charged electrons, or "positrons." These positrons interact with surrounding tissues, producing photons that can be detected by the PET scanner. Since rapidly growing cancer cells metabolize glucose up to 20 times faster than healthy cells, the glucose concentrates at tumor sites. Cancer cells that have taken up the marked glucose appear on a PET image as a clearly visible bright spot.

Before imaging commences, Sarah's team has to deal with the problem of tumor motion during imaging. This is especially critical in cases of lung cancer, where oncologists have tumors moving 1.5 to 2 centimeters (nearly an inch) during respiration.

To cope with this, Sarah's oncology team will use Varian's RPM™ Respiratory Gating System to (CONTINUED ON PAGE 9)

An Ancient and Persistent Foe

Cancer is the term commonly used to describe what is actually not a single disease but more than 200 individual disorders, each characterized by the presence of mutant cells that proliferate through uncontrolled growth and division. This uncontrolled proliferation leads to the formation of tumors that can invade and take over surrounding healthy tissue. Eventually, cancerous cells can metastasize – that is, break away from the primary tumor and, traveling through the circulatory and lymphatic systems, establish new cancer sites in other areas of the body.

Cancer in its various forms has plagued humanity dating back almost to the beginning of recorded history. Incidents of breast cancer, for example, were reported on papyrus manuscripts by the physicians of ancient Egypt, who at around 1600 B.C. recommended that diseased tissue be cauterized. Hieroglyphic inscriptions nearly a thousand years earlier report cancers of the stomach and uterus, which were treated by compounds of barley, pig ears, and other ingredients. Last year, cancer claimed in excess of six million lives throughout the world. In the United States, about 1.3 million Americans are diagnosed with cancer each year, and about 500,000 Americans die annually from one or more forms of the disease, which is an average of about 1,500 people a day. According to the National Cancer Institute, about one in three Americans will be diagnosed with cancer during their lifetime. In the U.S., one of every four deaths is from cancer, according to the American Cancer Society.

About 80 percent of the cancer-related deaths in the United States are caused by only a dozen types of cancer. In descending order, they are lung, colon, breast, prostate, melanoma, uterine, kidney, pancreatic, ovarian, stomach, and cervical. Some forms of cancer can strike even the very young, but cancer primarily affects adults past age 55, which is why the rate of cancer incidence, particularly that of the four major types – lung, colon, breast, and prostate – can be expected to rise as the “baby-boomer” population ages.

Major advances have been made in identifying oncogenes – genetic mutations that can promote the development of specific forms of cancer. With the deciphering of the human genome, the pathway to understanding the genetic roots of cancer development is now open. This has led to speculation about the potential for discovering “cures” through gene therapy (the deactivation of oncogenes or the activation of genes that suppress oncogenes) or through immunotherapy (the harnessing of the human immune system to genetically engineer unique cancer-fighting antibodies). Advances along this front in the war against cancer surely await, but recent findings by cancer researchers and molecular biologists sound a cautionary note. Genetics is only one of several risk factors in the development of cancer. Diet and environmental elements can also play important roles. For example, epidemiological studies consistently show that American and Western European women are five to six times more likely to develop breast cancer than Asian or African women. And while the mutation of a gene called BRCA1 has been identified as a source of inherited breast cancer, women with a family history of breast cancer account for no more than six percent of all new cases. Such findings point to cancer as being caused by a complex interaction of events. This indicates that the prospects for discovering a genetic “magic bullet” capable of curing any one of the major forms of cancer are unlikely anytime soon.

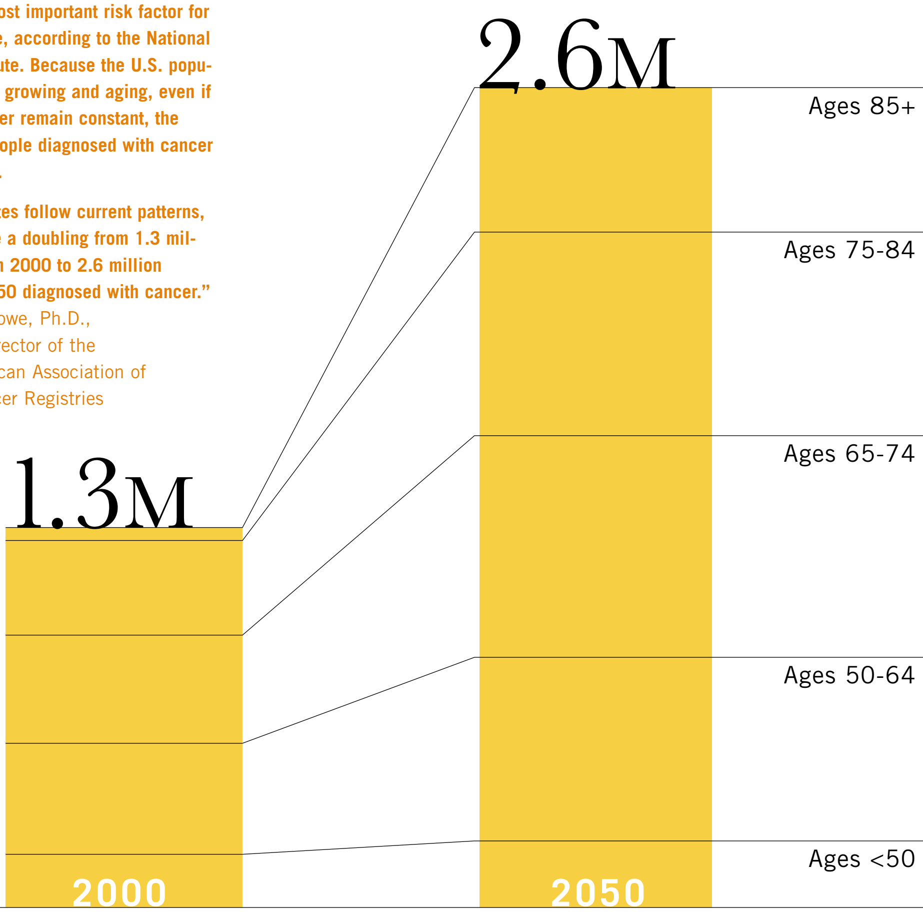
Nonetheless, cancer patients today have more reason than ever before to take heart, as oncologists have at their disposal an increasingly sophisticated arsenal of therapeutic weapons. Through the combined firepower of new and improved radiation and chemical therapies, and increased genetic knowledge, this ancient and persistent enemy of humankind may finally be tamed. ■

PROJECTIONS OF CANCER CASES IN THE U.S. BETWEEN 2000 AND 2050 BY AGE

Chart data derives from NCI’s SEER program (The Surveillance, Epidemiology, and End Results (http://seer.cancer.gov), NCI (http://www.nci.nih.gov/) and population projections from the U.S. Census Bureau (http://www.census.gov).

The single most important risk factor for cancer is age, according to the National Cancer Institute. Because the U.S. population is both growing and aging, even if rates of cancer remain constant, the number of people diagnosed with cancer will increase.

“If cancer rates follow current patterns, we anticipate a doubling from 1.3 million people in 2000 to 2.6 million people in 2050 diagnosed with cancer.”
– Holly L. Howe, Ph.D.,
executive director of the
North American Association of
Central Cancer Registries

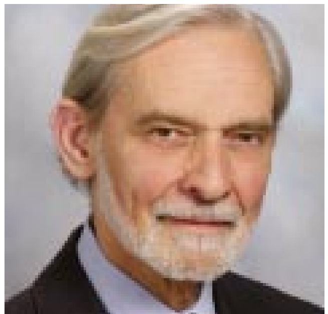


PHOTOGRAPH BY KENNETH GARRETT, NATIONAL GEOGRAPHIC

What They're Saying from the Front

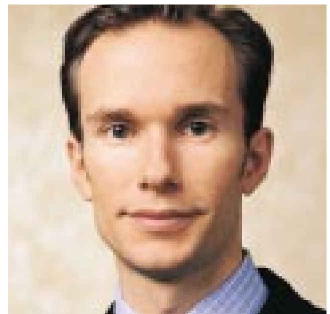
"A safe estimate is that a quarter or possibly a third of our cancer patient population will soon be undergoing IMRT."

Patrick Swift, MD



"IMRT is a more sophisticated way of achieving our goals and it is very much a part of our future."

James Cox, MD



"IMRT lets us treat irregularly shaped tumors with high conformality, thereby improving the therapeutic ratio."

Richard Emery, MS

"IMRT permits us to have dose distributions that were previously impossible. It has opened up some extraordinary possibilities."

Ted Lawrence, MD

To learn about the effectiveness of a weapon, who better to ask than those who have actually used it in battle? In the war against cancer, oncologists who have used Intensity Modulated Radiation Therapy (IMRT), the latest technology in radiation treatments, have been enthusiastic and strongly supportive in what they have to say.

Patrick Swift, MD, medical director for Radiation Oncology at the Alta Bates Comprehensive Cancer Center in Berkeley, California, says he is "hard-pressed" to find any downsides to IMRT.

"We treated our first patient with IMRT on October 1, 2001, and now all of our prostate cancer patients are on it," Swift says. "A safe estimate is that a quarter or possibly a third of our cancer patient population will soon be undergoing IMRT and we've been moving carefully and methodically because we want to make sure we're doing it right."

Swift says his center is focusing its IMRT efforts on prostate, head and neck cancers, and a simplified variation on breast cancers. He thinks, however, that IMRT has excellent potential for the treatment of brain tumors, particularly brain tumors in children.

"The clear thing you're trying to do for the kids is control a deadly disease right now, so you want the dose escalation that IMRT makes possible," he says. "Plus, you want to prevent side effects, which are tremendously deleterious. So many of these kids with posterior fossa tumors go deaf now from conventional radiation therapy. Treating certain pediatric brain tumors with IMRT lowers the risk of deafness."

Professor James D. Cox, MD, heads the Division of Radiation Oncology at The University of Texas M. D. Anderson Cancer Center. He says his staff began using IMRT about three years ago and now treats nearly 1,000 patients with the technology every year.

"The demand has been out there," he says, "but we haven't had the resources in terms of physicists to work with us, so we had a slower ramp-up phase than we would have liked. We'd seen the progress with 3D conformal therapy and how it had improved our ability to give higher doses and decrease side effects in normal tissue. IMRT is a more sophisticated way of achieving both those goals and it is very much a part of our future."

Richard Emery, chief medical physicist and director of radiation services at St. Vincent's Comprehensive Cancer Center in New York, says their first patient was treated with IMRT in the spring of 2001 and the number has since grown to 200, most with cancer of the prostate.

"IMRT's number one upside is that it lets us treat irregularly shaped targets with high conformality, thereby improving the therapeutic ratio. In other words, more dose to the target and less to the normal tissue," Emery says. "IMRT has taken us to another level of care for our patients. It's deeply satisfying to have a technology that can be curative without the side effects associated with conventional therapy."

The downside to IMRT most often cited is the added demands on staff in terms of training and preparation. Ted Lawrence, MD, Isadore Lampe Professor of Radiation Oncology at the University of Michigan, who has been involved with IMRT since the technology's inception, says, "If you're going to deliver a very conformal dose of radiation, you have to have a very high level of knowledge as to where the tumor is. Setup and planning are critical."

However, the added demands on staff can deliver a substantial payoff to the patient, as Lawrence acknowledges.

"IMRT permits us to have dose distributions that were previously impossible," he says. "It has opened up some extraordinary possibilities and will let us test whether it will achieve a revolution in cancer treatment." ■

synchronize the acquisition of CT and PET images with Sarah's breathing cycle. While setting Sarah up for imaging, the team will place a small plastic cube with reflective markers on Sarah's chest. A video camera will track the up-and-down movement of the cube. The X-ray beam from the scanner will be synchronized with Sarah's breathing, so that images are taken only when the lung is in the proper position. Varian's respiratory gating system will come into play again when Sarah is treated so that beam delivery can also be synchronized with her respiratory cycle.

Once Sarah's oncology team has the images needed to begin planning her treatment, they will use Varian's SomaVision™ image processing software to generate three-dimensional views of Sarah's tumor and the surrounding anatomy. The medical team will use the software to mark, or "contour," the 3D images, indicating the area to be treated as well as the organs to be protected.

The next step for Sarah's team will be to prepare her treatment plan. At this point, the radiation oncologist will prescribe the ideal radiation dose for the tumor, as well as maximum dose limits for the surrounding healthy tissue. To determine how the dose will be delivered, Sarah's oncology team uses Varian's Helios™ inverse treatment planning software. Once the dose levels have been entered, Helios goes to work, using its unique algorithms to calculate and devise a detailed treatment plan just as a computer mapping program determines the best route to a destination. The plan includes beam shapes and exposure times as well as electronic instructions that will automate and control the delivery system through 30 to 40 treatment sessions. The next destination for Sarah will be post-planning simulation.

SIMULATION

Prior to actually treating Sarah, her oncology team will first conduct a dry run using Varian's new Acuity™ imaging system. This enables the oncology team to properly position Sarah on the table and run through a simulated treatment session.

Proper patient positioning is critical to ensure that the tightly focused X-ray beams are targeted accurately. Sarah, like most radiotherapy patients, will be tattooed with small marks that will be aligned with lasers in the treatment room, to ensure that she is in precisely the right spot in relationship to the radiotherapy machine. The Acuity system, which mimics the treatment machine, will enable the medical team to take X-ray images of Sarah in her treatment position, and compare them with reference images from the treatment plan. This will enable the team to fine-tune the plan and verify that it will work as intended.

THE TREATMENT

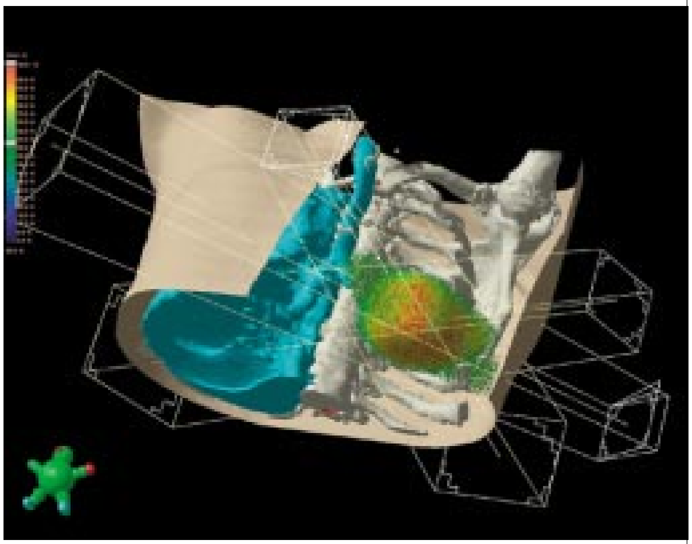
Before Sarah begins the next phase of the IMRT process, let's look at the room in which she will receive her treatment. It measures about 19 feet by 16 feet. In this room is an imposing machine hovering over a futuristic treatment table or couch that might have come from the set of a science fiction film. The machine is a Clinac® medical linear accelerator (linac) manufactured by Varian.

Linacs are critical to the success of IMRT and all other radiotherapy treatments based on X rays. Reaching tumors deep within the body requires intense penetration power with X rays at energies ranging from 4 to 25 million volts (MV). X-ray tubes, such as those in an X-ray machine being used for diagnostic purposes, typically generate X rays at energies between 60 thousand and 150 thousand volts, far short of what is needed. Linacs, on the other hand, originally developed as a tool for smashing atoms and first adapted to medical applications by Varian in 1960, have no problem meeting the energy requirement.

When the power and intensity of linac X-ray beams are applied to tumors over a number of treatment sessions, the accumulated radiation dosage is enough to fatally damage cancerous cells.

To concentrate a dose of radiation on the tumor, Varian outfits its Clinac with a beam-shaping device called a Millennium™ multi-leaf collimator (MLC). An MLC consists of a computer-controlled array of up to 120 parallel and individually adjustable tungsten bars, or "leaves," that move to shape the aperture through which the radiation passes. It (CONTINUED ON PAGE 11)

> The radiation oncologist will prescribe the ideal radiation dose for the tumor as well as maximum dose limits for the surrounding healthy tissue.



A treatment plan for treating lung cancer. By delivering radiation from a number of different angles, the beams converge on the tumor, seen here enveloped in a "dose cloud." The radiation dose is concentrated in the tumor (red) and falls off toward the outside margins (green).

VARIAN MEDICAL SYSTEMS ILLUSTRATION

How a Linac Works

A linear accelerator, or "linac," generates X-ray radiation via the acceleration of electrons that are extracted off the surface of a heated metal disk. The electrons are accelerated through a vacuum chamber by microwaves to nearly the speed of light, an action that greatly boosts their energy levels. These speeding electrons bombard a metal target, usually tungsten, causing it to emit X rays, which are collimated into pencil-thin beams that can be adjusted to cover the 4- to 25-million-volt spread of energies needed to penetrate tumors. The beams are intense, meaning they contain a large number of X-ray photons.

Varian's Clinac EX linac can deliver a dose rate of X rays up to 600 centigray per minute and concentrate them on an area 2 millimeters in diameter, which is about the size of this spot. ●

1

Radiation therapy begins with a linear accelerator, which speeds electrons toward a target to generate a radiation beam aimed at the patient's tumor.

2

The multileaf collimator shapes the radiation beams and varies their intensity. This enables physicians to target higher radiation doses to the tumor while sparing healthy tissue.

4

A computer system uses three-dimensional images of the tumor and surrounding anatomy to optimize a treatment plan for delivering radiation according to the oncologist's specifications.

3

The radiation beam is precisely tailored to the shape of a patient's tumor. This shape changes as radiation is delivered from different angles, so that the tumor is always targeted and healthy tissues are protected.

VARIAN MEDICAL SYSTEMS ILLUSTRATION

will enable Sarah's oncology team to precisely and automatically conform their beams to the shape of the tumor in her lung.

With IMRT, Sarah's doctors can divide the area being treated into thousands of segments as small as 2.5 mm by 5 mm and give each one a specified dose. The adjustable leaves of the MLC are used to control not only the shape of the beam, but also the exposure duration for each segment of the tumor, effectively "modulating" the dose within the treatment area. This way, higher doses can be concentrated in some parts of the tumor while lower doses can be used in other areas where sensitive tissue may need protection.

Now it is time for Sarah's first treatment session. She enters the treatment room, which is softly lit and quiet. Her radiation therapist positions her on the treatment table. A small plastic cube is again placed on her chest so the respiratory gating system can again compensate for breathing motion. During treatment, the system will turn the Clinac's X-ray beam on and off as the tumor on her lung moves in and out of position. If Sarah coughs or moves, the beam switches off, further protecting her healthy tissues.

Sarah is ready. The therapist leaves the room, closes the door, and moves to a computer workstation to administer the treatment.

Inside the room, the Clinac rotates and locks into a fixed position at the first of the planned beam angles. The beam goes on and the leaves of the MLC begin moving the aperture across the treatment field, changing its size and shape in order to deliver the prescribed dose. This "sliding window" approach to IMRT puts the leaves of the MLC in continuous motion while the beam is on and yet maintains a pattern that conforms to the 3D shape and size of the tumor.

Sarah hears a low humming noise but feels nothing. The Clinac rotates and delivers beams from several angles until the treatment is completed.

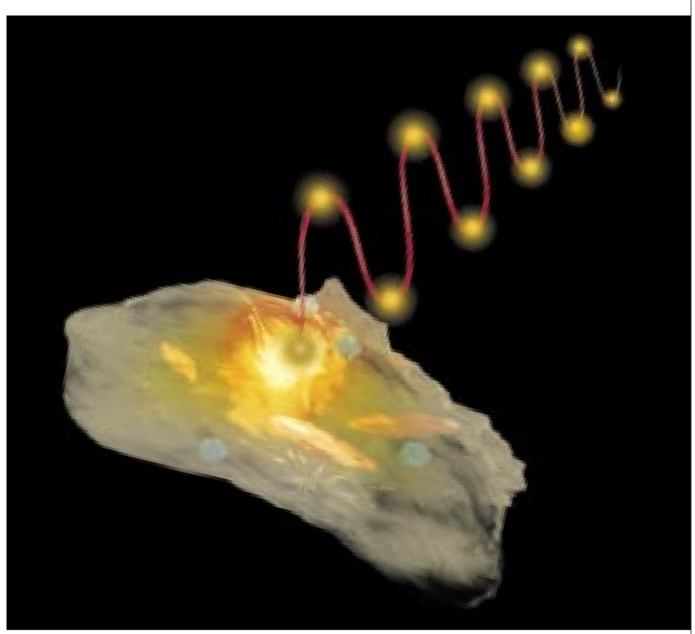
During treatment, Sarah's medical team uses Varian's PortalVision™ device on the linac to instantly capture X-ray images of Sarah's anatomy as viewed through the beam aperture. By using Varian's image-processing software to compare the PortalVision views on a computer monitor with diagnostic images and the treatment plan, the team is able to verify treatment accuracy and make any adjustments that might be needed in her position or the plan for future sessions.

It is 10:00 a.m. when Sarah enters the IMRT treatment room. Ten minutes later, her placement and immobilization on the positioning couch are completed and her treatment begins. Five minutes later, the session is complete. Sarah is free to return home to her family and resume her daily activities.

Sarah will have to undergo multiple treatment sessions, on a Monday through Friday schedule, over a period of weeks. Otherwise her life should not be disrupted. What is the outcome of her IMRT treatment? Hopefully, follow-up tests will show that Sarah's tumor has been functionally eliminated. She will have to be re-scanned, perhaps six months after treatment has been completed, for the possible appearance of new lesions and to be sure that all of the original tumor was destroyed. If either situation should prove to be the case, she will have to undergo another round of treatment and the process will continue until all the lesions are gone. In the end, however, the likelihood is good that she will be cured of her lung cancer.

Sarah's doctors can divide the area being treated into thousands of small segments. Higher doses can be concentrated in some parts of the tumor while lower doses can be used in areas where sensitive tissue may need protection.

Is this too rosy a scenario to project for Sarah? No, nor would it have been had our patient been George, 57, diagnosed with prostate cancer, or Robin, 54, diagnosed with breast cancer, or Bill, 63, who had cancer of the head and neck. IMRT is being used to treat all of these major cancers. According to the early clinical results and the testimony of oncologists who are at the forefront in the fight against cancer, it can be highly effective. For example, in a study conducted by (CONTINUED ON PAGE 12)



A beam of high-energy photons strikes a cancer cell. In radiotherapy, the aim is to bombard cancer cells with highly energetic photons (X rays), which interact with water molecules in the cells to create ions or "free radicals" that damage DNA. Healthy cells can repair themselves to a degree and continue to metabolize. However, cancer cells often have faulty repair mechanisms and thus lose the ability to replicate. Repeated exposure to high energy X rays eventually impairs or kills all cancer cells, eradicating the tumor.

ILLUSTRATION BY BRIAN SPATOLA, GEORGE RETSECK AND BRYAN CHRISTIE

Already in the works is a Dynamic Targeting™ initiative that will provide real-time high-resolution images for tumor localization and motion tracking during treatment.

researchers at Memorial Sloan-Kettering Cancer Center in New York between April 1996 and January 2001, 772 patients with prostate cancer were treated with IMRT at fairly high doses made possible by IMRT's precision. The 3-year relapse-free survival rates for favorable, intermediate, and unfavorable risk group patients were 92 percent, 86 percent, and 81 percent, respectively. Compare that success rate with comparable rates of only 75 percent, 55 percent, and 35 percent in an earlier study in which prostate cancer patients were given a more conventional treatment at a lower dose.

Sloan-Kettering's chief of radiation oncology, Steven Leibel, MD, has said, "IMRT is revolutionary in its ability to modulate the radiation beam. It can do what standard conformal therapy can't. IMRT has become the standard mode of conformal treatment delivery for localized prostate cancer treatment at our institution."

Leibel says the Sloan-Kettering Cancer Center, which treated its first patient with IMRT in 1995, now treats roughly a quarter of their patients with the technology, approximately 1,000 patients a year. George T.Y. Chen, Ph.D., head of radiation physics, Department of Radiation Oncology at Massachusetts General Hospital, and professor at Harvard Medical School, says his department, which began using IMRT a couple of years ago, is now using IMRT to treat between 10 and 15 percent of their patients.

"IMRT is in its infancy and so we don't know, for example, what the 10-year success rate will be," Chen has said. "In some cases, such as cancer of the head and neck, the impact is obvious. It provides the opportunity to spare critical structures such as the parotid gland and this enables us to reduce the side effects of radiation. It's a technological revolution that's really changing radiotherapy. The oncology community is very excited about it."

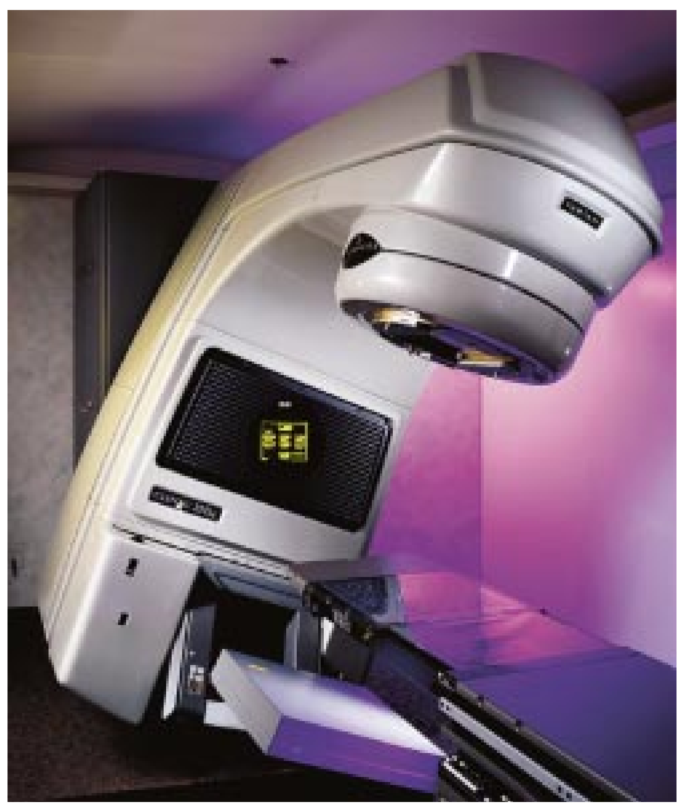
The opinions of Leibel and Chen have been echoed by other leading oncologists across the nation (see "What They're Saying from the Front" on page 8).

Although less than ten percent of the world's nearly 5,500 radiotherapy centers for cancer treatment are currently offering IMRT to their patients, the numbers using Varian's SmartBeam IMRT climbed from one in 1995, to 40 in 2000, to 98 in 2001, to an estimated 200 by the end of 2002. Expectations are for continued expansion around the world.

The IMRT procedures being implemented at radiotherapy centers now are a first-generation technology. Already in the works as a next evolutionary step is a Dynamic Targeting™ initiative that will eventually equip Clinac linear accelerators with an X-ray-based on-board imaging system. The aim of this research initiative is to attach Varian's latest amorphous-silicon flat-panel image detector directly to the Clinac on a pair of robotic arms that move relative to one another. The goal is to provide oncology teams with images and motion tracking capabilities that can help them guide the beam during a treatment session.

Varian unveiled a research prototype of this next step in Dynamic Targeting at the 2002 American Society of Therapeutic Radiology and Oncology (ASTRO) meeting.

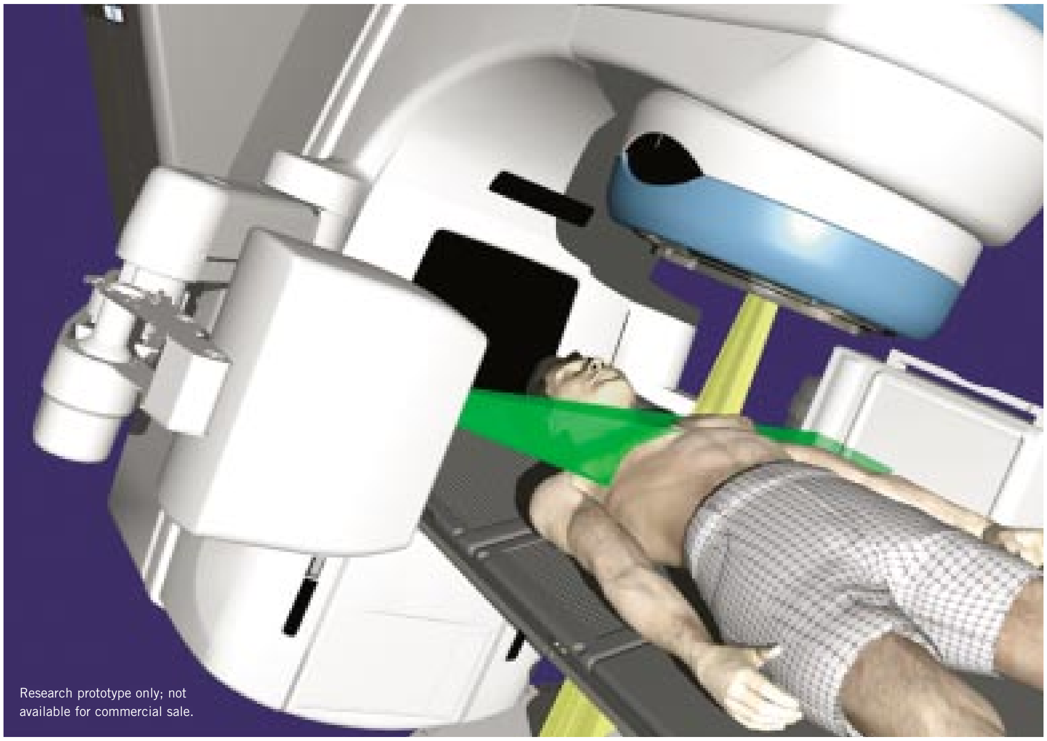
As we move into the new millennium, humans for the first time ever have the technology at hand with which they can confront their ancient enemy and bring it under manageable control. The idea of cancer being transformed from a life-threatening condition to a manageable disease is no longer wildly speculative science fiction but is tantalizingly close to becoming scientific fact. ■



The Clinac® digital medical linear accelerator delivers the most advanced forms of radiotherapy, including IMRT, to eradicate tumors.

VIEWPOINT

The Radiation Oncology Department of the Future



"Image-guided radiotherapy will make it possible to treat a broader range of cancer cases."

Timothy E. Guertin

An artist's rendition of a medical linear accelerator with an on-board imaging system consisting of an X-ray tube and an amorphous silicon flat-panel image detector on a pair of robotic arms. Clinicians envision using on-board imaging to verify tumor position and adjust for movement during treatment.

With the advent of IMRT and other advanced forms of radiotherapy, imaging has moved to center stage in the field of radiation oncology. These new treatment approaches make it possible for doctors to plan and deliver radiation doses that are precisely tailored to each patient's anatomy and tumor. Consequently, clinicians need much more detailed information about the tumors being treated – information that we can get with the latest advances in imaging technology. Without images that can give doctors three-dimensional views of the tumor and the surrounding healthy tissues, these treatment approaches would not be possible.

DIAGNOSTIC IMAGING

Imaging plays a role at every step in the radiation oncology process, from earliest diagnosis to treatment verification. The radiation oncology department of the future will depend on diverse imaging modalities even more than it does today. Currently, for example, Computed Tomography (CT) and sometimes Magnetic Resonance (MR) imaging show the structure of a patient's internal anatomy and help the oncologist to determine the boundaries of a tumor. Very recently, however, doctors have begun to augment what they know about tumors using imaging techniques like Positron Emission Tomography (PET). PET imaging provides them with metabolic information about the location, size, and aggressiveness of the tumors they are treating. Better diagnostic imaging improves the utility of techniques like IMRT for delivering escalated doses of radiation to the most active parts of a tumor, as well as to any areas of early spread. In the future, we may see doctors using additional biological imaging techniques like Single Photon Emission Computer Tomography (SPECT) and Magnetic Resonance Spectroscopy (MRS) to learn even more about the nature of the tumors they are treating.

ON-BOARD IMAGING

Imaging is also increasingly playing a role in treatment delivery. Radiation oncologists use several forms of imaging to help them accurately target the tumor during treatment. Present-day tools include electronic portal imaging, a technology that uses the treatment beam to capture images of irradiated areas to make sure that beams are being delivered as planned. In the radiation oncology department of the future, medical linear accelerators will be equipped with on-board imaging — special X-ray systems that provide high-resolution images for verifying tumor position and tracking their motion during treatment. These new machines will use high-energy megavoltage beams to treat and kill tumors, and low-energy kilovoltage beams to acquire clear images that can be used to guide the treatment beam. In this scenario, doctors will need software that adjusts radiation therapy in a real-time response to tumor motion caused by a patient's breathing. This software will interpret the images coming from the on-board imaging system and coordinate the treatment delivery device so that it follows the tumor as it moves.

These developments, taken together, have the potential to simultaneously achieve unparalleled tumor control and spare the maximum amount of healthy tissue, opening the possibility of using higher doses within fewer treatment sessions. At Varian Medical Systems, we are actively developing an integrated suite of products that transform the radiation oncology department into an image-guided treatment center. Image-guided radiotherapy will offer us improved precision, and that will make it possible for radiation oncologists to treat a broader range of cancer cases. ■

By Timothy E. Guertin,
President, Oncology Systems

Digital X-Ray Imaging

LOOKING

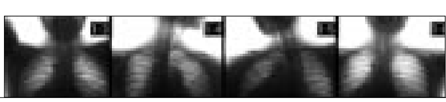
Digital technology has revolutionized our lives. We are collecting, storing, analyzing, and using more and more information at a faster and faster pace. X-ray imaging is no exception, whether it is for medical diagnosis, security screening, or industrial inspection. The benefits of digital X-ray imaging are clear. Doctors are already using it to see "real-time" movies of their patients' anatomy and physiology. They can watch blood flowing through vessels and into organs or monitor the gastrointestinal tract to diagnose conditions that require treatment. Better still, doctors are using this imaging capability during treatment to see exactly where to target cancerous tumors with radiotherapy beams or where to place the instruments and devices that will cure their patients.

The value of this real-time X-ray vision goes beyond medicine to many other scenarios, including industrial inspections in which technicians take instant snapshots of the internal structures of objects such as electronic circuits and mechanical parts.

While progress has been rapid in recent years, companies like Varian Medical Systems are now using solid-state digital technology in the form of amorphous silicon flat-panel X-ray detectors to achieve even more dramatic improvements that will extend the utility of digital X-ray imaging systems. These panels obtain instant high-resolution "still" X-ray images (radiographs) as well as "live," or moving, X-ray images (fluoroscopy) for display on computer monitors or storage in electronic archives.

Today, most medical centers are still hampered by a continuing reliance on film for obtaining, displaying, and storing radiographic X-ray images. In the digital age, this technological relic of the analog age is viewed as inefficient; it requires processing chemicals, storage space, and perhaps most important – time. Other centers are digitizing X-ray images using computed radiography, which requires several time-consuming steps before an image can be viewed. Furthermore, many centers rely entirely on separate systems for obtaining fluoroscopic images.

Companies like Varian Medical Systems are using solid state digital technology to achieve even more dramatic improvements that will extend the utility of digital X-ray imaging systems.



Hospitals have been generating live fluoroscopic images for years, using X-ray systems equipped with image-intensifier tubes. This now-common approach, which has been evolving since the first image intensifiers were introduced in the 1960s, has resulted in an annual multi-million dollar image-intensifier tube industry. The technology has some drawbacks, however. Image-intensifier tubes generate circular images that suffer from a loss of resolution at their periphery. Furthermore, the up-to-100-pound heft and barrel-shaped bulkiness of these tubes require large supports that are cumbersome to work around when doctors are treating patients. This can be particularly difficult in trauma centers, for instance, or in surgery, where doctors need very close access to their patients and the ability to maneuver around them.

By comparison, flat-panel imagers are 90 percent smaller and weigh 60 percent less than image-intensifier tubes. These new imagers cover the same anatomical area as image-intensifier tubes, but present a uniform, undistorted, high-resolution image throughout a rectangular field of view with superior contrast resolution. Flat-panel imagers exhibit smaller objects in greater detail than is possible with image intensifiers.

HOW FLAT-PANEL X-RAY IMAGERS WORK

Varian first introduced its flat-panel detectors to the medical world in 1998 with its VIP-9 system, making use of technology developed a few years earlier by Xerox Corporation. In this approach, the flat-panel detector consists of a sheet of glass covered with a layer of silicon that is in an amorphous, or filmlike, state. If your eyes could magnify this layer of silicon film a thousand times, you'd see that it has been imprinted with millions of transistors

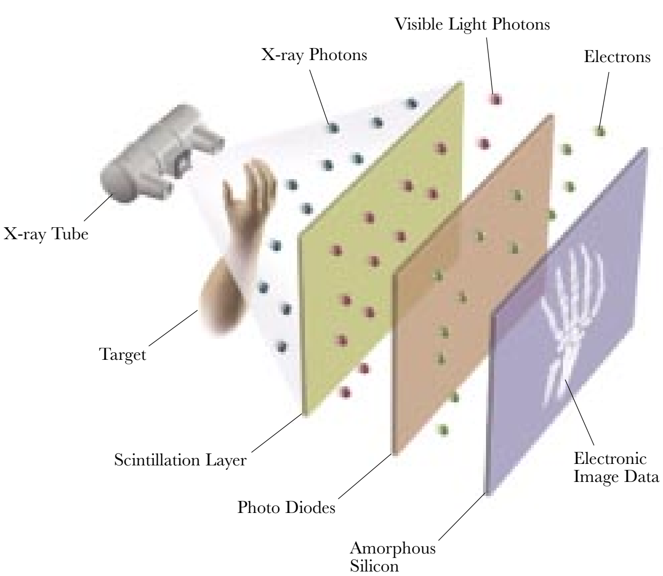
INTO THE FUTURE

PHOTOGRAPH BY JIM KARAGEORGE

Flat panels present a uniform, undistorted, high-resolution image throughout the rectangular field of view. With superior contrast resolution, they show smaller objects in greater detail than is possible with image intensifiers.

arranged in a highly ordered array, like the grid on a sheet of graph paper.

Each of these thin-film transistors (TFTs) is attached to a light-absorbing photodiode making up an individual pixel (picture element). Photons striking the photodiode are converted into carriers of an electrical charge, either negatively charged electrons, or positively charged holes (vacant energy spaces that act as if they were positively charged electrons). Since the number of charge carriers produced will vary with the intensity of incoming light photons, an electrical pattern is created that can be swiftly read and interpreted by a computer to produce a digital image.



With indirect digital X-ray imaging, an X-ray tube sends a beam of X-ray photons through a target. X-ray photons not absorbed by the target strike a layer of scintillating material that converts them into visible light photons. These photons then strike an array of photodiodes which converts them into electrons that can activate the pixels in a layer of amorphous silicon. The activated pixels generate electronic data that a computer can convert into a high-quality image of the target, which is then displayed on a computer monitor.

Although silicon has outstanding electronic properties, it is not a particularly good absorber of X-ray photons. For this reason, Varian, like some other flat-panel detector manufacturers, takes an indirect approach to creating electrical charge carriers. X rays first impinge upon scintillators made from either gadolinium oxysulfide or cesium-iodide. The scintillators absorb the X rays and convert them into visible light photons that then pass onto the photodiode array. Because cesium-iodide is such an excellent absorber of X rays, and converts them to visible light photons at energies that amorphous silicon is best able to convert to charge carriers, the combination of these two materials has the highest-rated Detective Quantum Efficiency (DQE) in use today. DQE is the yardstick by which the performance of photoconductors is measured. A high DQE rating means that superior images can be obtained with low dosages of X rays.

REAL-TIME IMAGING

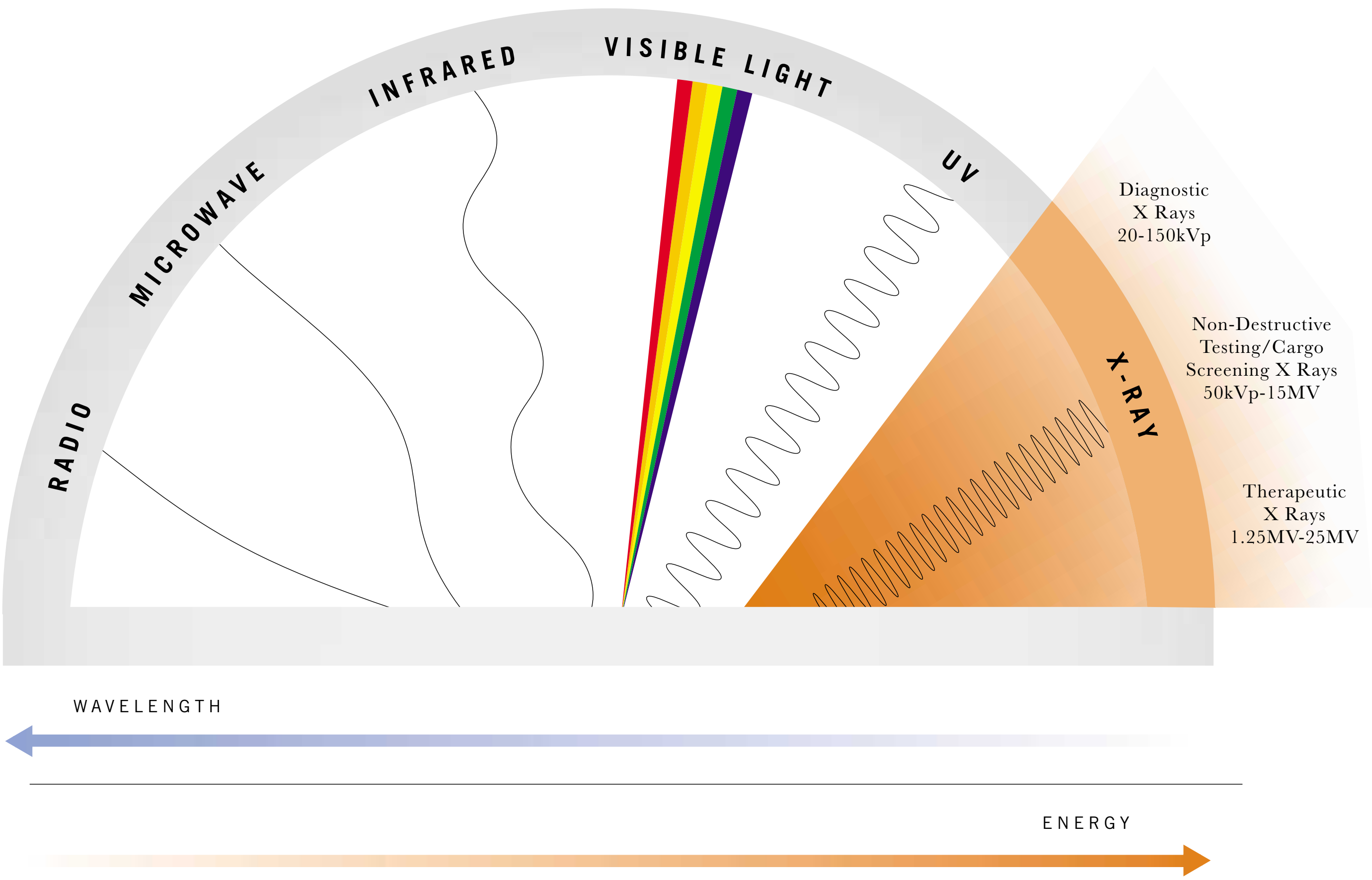
Varian's PaxScan® flat-panel detectors can acquire high-resolution radiographs at up to seven frames per second (FPS) and moving fluoroscopic images at up to 30 FPS. The PaxScan® 4030A also has been incorporated into Varian's radiotherapy products, including its Acuity™ and PortalVision™ systems (see IMRT: Targeting Cancer on page 4) that enable radiation oncology teams to properly position patients, target tumors, and verify treatment accuracy. Acuity's flat-panel imager, for example, can be used during brachytherapy procedures to image cancer patients, develop treatment plans, and precisely place radioactive isotopes within tumors.

As a new technology, the flat-panel imagers remain relatively expensive compared to the more traditional X-ray imaging systems. However, the technology can be expected to become more cost-competitive as more users move to take advantage of the substantial cost and time savings offered by digital X-ray imaging.

Varian's engineers have been working with several imaging equipment manufacturers to incorporate flat-panel detectors into a variety of different imaging systems. The PaxScan panel has already been incorporated into commercially available systems for gastrointestinal and vascular diagnostic procedures. Varian's flat-panel detectors are also being investigated for use in orthodontic applications. It is hoped that they will play a role during surgery by generating images that can help to guide doctors as they work. The flat-panel imagers also have potential as a noninvasive means of evaluating the structural integrity of bridges, rocket motors, and shipping containers, as well as the quality of multilayer microchips.

New market opportunities for flat-panel detectors have grown significantly in the past year, according to Chuck Blouir, marketing manager for Varian's imaging products. "We are still finding new applications for our digital flat-panel technology in medical, industrial, and homeland security markets where speed, image quality, and cost-efficiency are essential. I fully expect this to become the new standard in X-ray imaging." ■

The Electromagnetic Spectrum



We "see" images through light – the radiation emitted by electrons when they lose energy. This radiation is carried in massless particles called photons, and travels in waves that move through a vacuum at a constant speed of 186,282 miles per second. Scientists speak about the dual nature of light because it behaves both as a stream of photon particles and as the rippling motion of pure energy waves through space. Although most of us think of light in terms of what we see with our eyes, scientists consider light in a broader sense, as electromagnetic radiation.

Electromagnetic radiation is categorized either according to the energy of its photons, or by the frequency or length of its waves. This spectrum of electromagnetic radiation extends from radio waves, with energies of less than a billionth of an electron volt per photon and wavelengths measuring more than 10,000 kilometers (6,220 miles), to gamma rays, with energies topping a billion electron volts per photon and wavelengths of less than 10 trillionths of a meter. Visible light, the electromagnetic radiation that can be seen with our eyes, constitutes less than a millionth of one percent of the electromagnetic spectrum.

Depending upon the energy and wavelength of the incoming electromagnetic radiation, matter can either be transparent, or it can absorb or reflect light back. The surface of the human body absorbs and reradiates photons at energies ranging between 1.61 and 3.18 electron volts. This is the visible light region of the electromagnetic spectrum and explains why we can see people but cannot see beneath their skin. To look beneath the skin at the body's internal structure you need photons at energies high enough to penetrate tissue and bone. Photons at energies between 20 thousand and 150 electron volts are ideal for diagnostic imaging purposes. These photons are X rays.

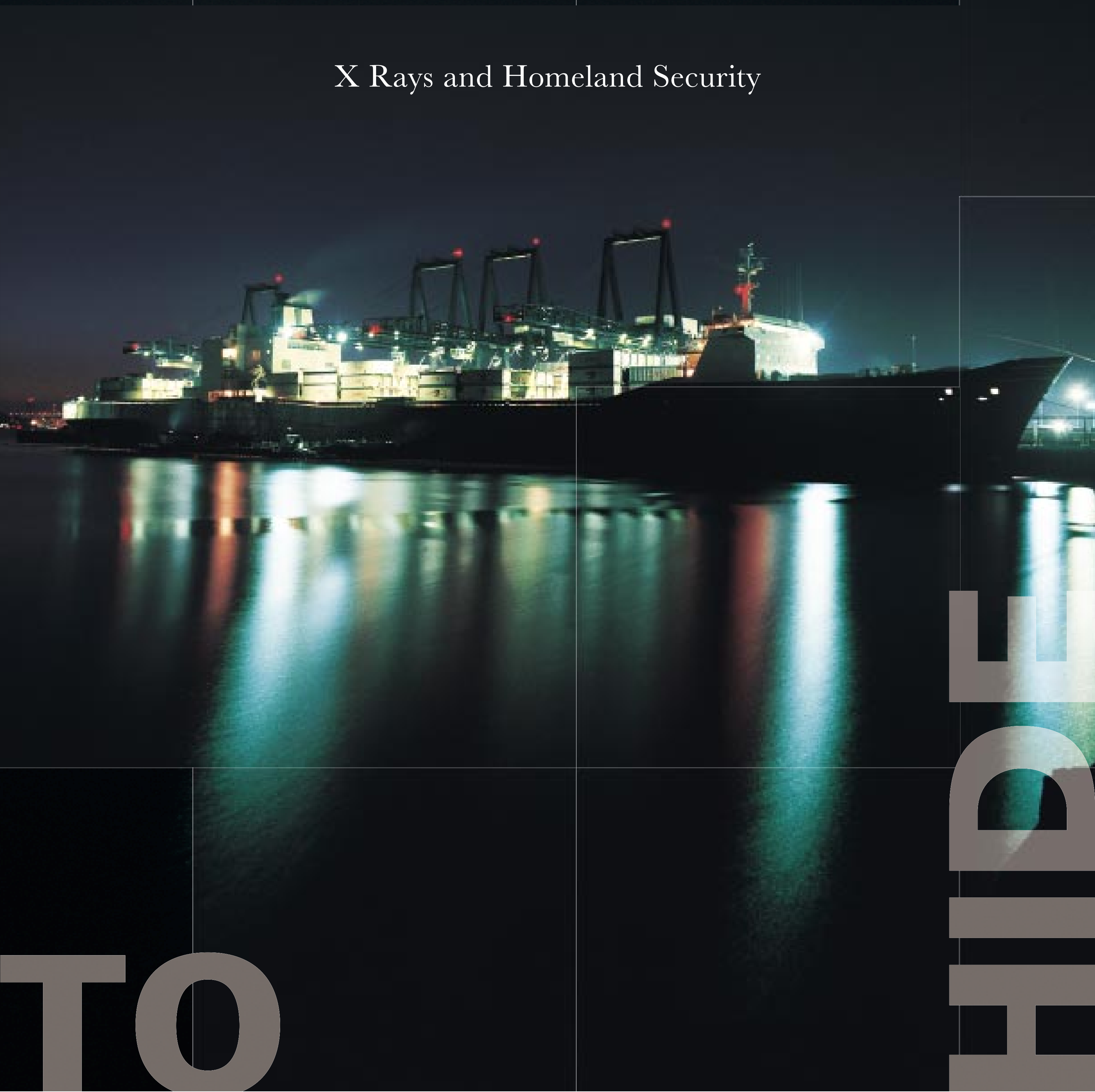
Diagnostic imaging depends not only upon the ability of photons to penetrate deep below the skin but also upon their ability to "see," or resolve, small details. This is a function of wavelength. For example, visible light waves, ranging in wavelengths from 700 nanometers (red) to 400 nanometers (violet), are simply too large to ever resolve images of structures the size of a typical protein molecule. No matter how high the magnification, visible light waves would pass over such molecules unaffected. It would be like trying to determine the size and shape of a tennis ball by observing its impact on the movement of ocean waves.

X rays have wavelengths several thousand times shorter, some even less than an angstrom, which is the unit of scale for measuring atoms. This makes X-ray photons ideal for imaging the structures of atoms common in the human body: hydrogen, carbon, oxygen, and calcium. X rays are also ideal for imaging nitrogen, which is a key component, along with hydrogen, carbon, and oxygen, of most chemical explosives. ■

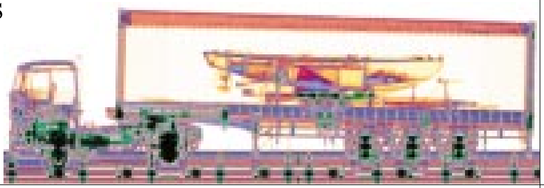
ILLUSTRATION BY ANDRÉ SEIBEL

NO WHERE TO HIDE

X Rays and Homeland Security



Since the tragic events of September 11, 2001, anyone who has been to an airport is aware that security efforts in the U.S. have been greatly intensified. However, according to many experts, terrorist threats to homeland security are equally likely to come by way of the sea. The U.S. Customs Service reports that some 6 million cargo containers arrive through U.S. seaports every year. Ninety percent of the trade goods brought into the U.S. each year – some 2 billion metric tons worth – enter through the country's 361 seaports. Presently, less than 2 percent of these containers are ever opened and inspected by Customs Service officials.



HEIMANN SYSTEMS X-RAY IMAGE

These trailer-sized, steel-walled cargo containers are typically sealed in foreign ports and not opened again until delivered by trucks to points all across the United States. It's not hard to imagine these containers being used for smuggling contraband – even a weapon of mass destruction. To physically open each container and extract and inspect the contents by hand would be too time-consuming and unrealistic. Clearly, what's needed is some means of searching the containers quickly and thoroughly without disrupting the flow of goods. An X-ray imaging system like Varian Medical Systems' Linatron® linear accelerator is an excellent candidate for the job. It can generate steel-piercing X rays that "see" through container walls and allow contraband nowhere to hide.

"The challenge is to provide customs officials with a solution that lets them look inside these containers quickly and efficiently. You need to generate enough energy to penetrate up to 440 mm (17 inches) of solid steel and produce high-quality images that show even small objects in fine detail," says Lester Boeh, vice president for Varian's Security and Inspection Group. "The Linatron meets those specifications. It has already been incorporated into cargo screening systems all over the world, but there are comparatively few in the U.S. The impact of September 11 could change all that for the U.S. and many nations engaged in international trade."

Varian's Linatron, which generates high-energy X-ray beams, has already been incorporated into cargo inspection systems in countries like Australia, Belgium, China, France, Germany, Ghana, Indonesia, Israel, Japan, Korea, Mexico, Saudi Arabia, Taiwan, Turkey, and the U.K. Japan operates multiple units at its six busiest ports; the U.K. at more than a dozen. Eurotunnel uses the technology to scan freight cars that pass between France and the U.K.

IMAGING THE CONTENTS OF A CARGO CONTAINER

The Linatron has been incorporated into fixed-site and mobile cargo scanning systems built by companies like ARACOR, Heimann Systems, L3, and RapiScan. These systems work like a giant airport baggage screening system. They use the high-energy X rays generated by the Linatron to send a beam of photons through a cargo container. The photons are absorbed and scattered in varying amounts by the materials in their path, depending on their densities. On the far side of the cargo container, a detector array collects and records the photons that make it through unabsorbed, generating an electronic signal that is translated into an image. The image, which shows the container's contents, can be viewed on a monitor. A Linatron-based cargo screening system can scan a full container in less than three minutes. Fixed-site systems are built into garage-like facilities, and trucks carrying cargo containers are moved through these facilities the way cars are moved through a carwash. The truck passes between the Linatron X-ray beam and the photon detector. Electronic images are captured and transmitted to a computer monitor at an operator's station.

For customers who need to move a cargo inspection system from site to site, mobile systems can be mounted on trucks.

PHOTOGRAPH BY TOM TRACY

New Looks for Airport Security

The need for improved security extends beyond cargo screening to a whole new set of security needs at airports. For years, carry-on bags have been screened, but checked luggage has been loaded onto airplanes without screening.

As of the end of 2002, however, the U.S. Federalization Security Act is requiring that all checked bags be screened by devices that can detect explosives.

Screening luggage for explosives poses unique challenges. Current screening systems for carry-on bags are not sensitive enough to do the job. These systems use stationary low energy X-ray tubes and line-by-line scanning to show two-dimensional shapes. They detect a knife within a pile of clothes, for example.

Detecting explosives, however, is harder; it requires the ability to distinguish materials of different densities as well as their shapes. And since an immense number of bags pass through the nation's airports in a single day, they must work quickly.

To tackle the job, the security industry has turned to CT scanning, which uses higher energy metal/ceramic X-ray tubes that spin around the luggage at two revolutions per second. They can detect and differentiate between the densities of scanned materials. They operate within explosive detection systems (EDS) that generate three-dimensional color-coded images highlighting suspicious items. EDS tubes represent some of the latest advances in X-ray tube technology.

X rays are a form of high energy light with very short wavelengths that make it possible for them to pass through solid objects. They are created by accelerating electrons to a very high speed and driving them into a metal target. The resulting subatomic collisions release energy in the form of X rays (1%) and heat (99%).

In an X-ray tube, electrical energy is applied to a filament, heating it up to white-hot temperatures so that it 'boils off' electrons. To accelerate these electrons, the tube is equipped with a cathode (a negative electrode) and an anode (a positive electrode). The application of a high voltage across the positive and negative electrodes creates a differential that causes the electrons to speed towards the anode at a very high velocity. This assembly is housed within a vacuum, which eliminates resistance so that the electrons can attain higher speeds by accelerating more rapidly.

The cathode incorporates a focusing cup to concentrate the electron stream and its kinetic energy onto a small focal spot, or target, within the anode. This target is usually made of tungsten or some other metal that can withstand very high temperatures.

The collision of electrons with the tungsten unleashes X rays that are channeled out of the tube through a small window or aperture. The velocity achieved by the electrons before they strike the anode is directly proportional to the amount and penetration power of the resulting X rays.

EDS series tubes operate at very high electrical voltages — between two and four times the voltage used in systems for screening carry-on luggage. This results in the higher contrast resolution needed for differentiating between materials and detecting explosives.

Varian's new line of EDS X-ray tubes are engineered to meet the specifications for CT based explosive detection systems that are now being installed at more than 400 U.S. airports. ■

INVISION TECHNOLOGIES X-RAY IMAGE

Similarly, it is also necessary to scan air cargo. Each year, more than 30,000 tons of air freight are transported in cargo and commercial aircraft in the U.S. and virtually none of it is ever inspected. The Linatron M is an ideal solution to this problem and is already working in airports outside the U.S.

PENETRATION, CONTRAST, RESOLUTION

Three basic physics criteria are used to measure the effectiveness of any imaging system: penetration, contrast, and resolution. All three are related to the level of energy – and hence the number of photons – sent through whatever is being scanned. A Linatron-based screening system generates higher energy X rays than competing gamma-based systems.

Penetration is probably foremost of the three criteria for cargo screening. The inspection obviously fails if the imaging photons lack the energy to punch through a container's thick steel walls. The key to penetration is photon energy – the more energetic, the deeper the photons penetrate into a material. Steel is the bar by which the penetration capabilities of an imaging technique are measured. Varian's Linatron can generate X rays at energies of 9 million electron volts (MeV). That's enough power to pass through 440 millimeters (17 inches) of solid steel and still provide enough energy to produce a high-contrast image – a critical issue for scanning big trucks and containers.

Says Boeh, "Without full penetration of a cargo container and its contents, too much can be missed."

Contrast sensitivity, the second important criterion for cargo screening, is extremely important for distinguishing between items inside a container. Imaging experts say that the higher the contrast sensitivity, the greater the chances for detecting contraband. Linatron-based systems have proven to be ten times more contrast sensitive than other systems.

"The objective of nonintrusive screening is to image the contents of a cargo container with enough clarity to make a decision about the contents," says Jim Johnson, general manager for Varian Industrial Products.

The third criterion, resolution, is a measurement of the ability to see spatial details in an image. If you are looking for hundreds of pounds of drugs, just knowing there's something large and unexpected inside the container is enough. However, if you're looking for nuclear weapons components, which can be surprisingly small, you want the best resolution you can get. While resolution depends to a large degree on the quality of the detector that is collecting the imaging photons, the more photons that penetrate the cargo's interior, the better your chances are of obtaining high resolution. Again, the advantage falls squarely to linac-generated X rays.

In addition to the three main criteria, several other factors involved in imaging give linac-generated high-energy X rays a distinct technological advantage for use in cargo screening. Varian's Linatrons can also provide dual views by sending in two perpendicular beams to help overcome the problem of a lighter material being shadowed behind a denser material. And thanks to the high energy and photon output of the Linatron, images can be obtained very quickly – an important consideration for a busy port.

"Before September 11, the U.S. Customs Service was mostly interested in screening cargo containers to find illegal drugs. Now their primary concern is finding weapons of mass destruction," Boeh explains. "For this task, there does not seem to be any competitive technology on the horizon better than high-energy X rays."

Numerous customs services, both in Europe and Asia, have installed cargo-screening systems that use Varian Linatrons to generate X rays. They are successfully finding illegal drugs, weapons, and other contraband. According to Boeh, many of these governments have found that the ability to verify manifests, find deliberate falsifications, and levy taxes on the undeclared contents generates enough revenue to pay for the inspection systems.

NON-DESTRUCTIVE TESTING

Varian's Linatron technology is also useful in other forms of non-destructive testing. Highway engineers use a portable version called the Linatron MP to test the structural integrity of large steel and concrete structures like bridges and overpasses. A major manufacturer of jet engines is using the Linatron M with a Varian flat-panel image detector to inspect turbine blades.

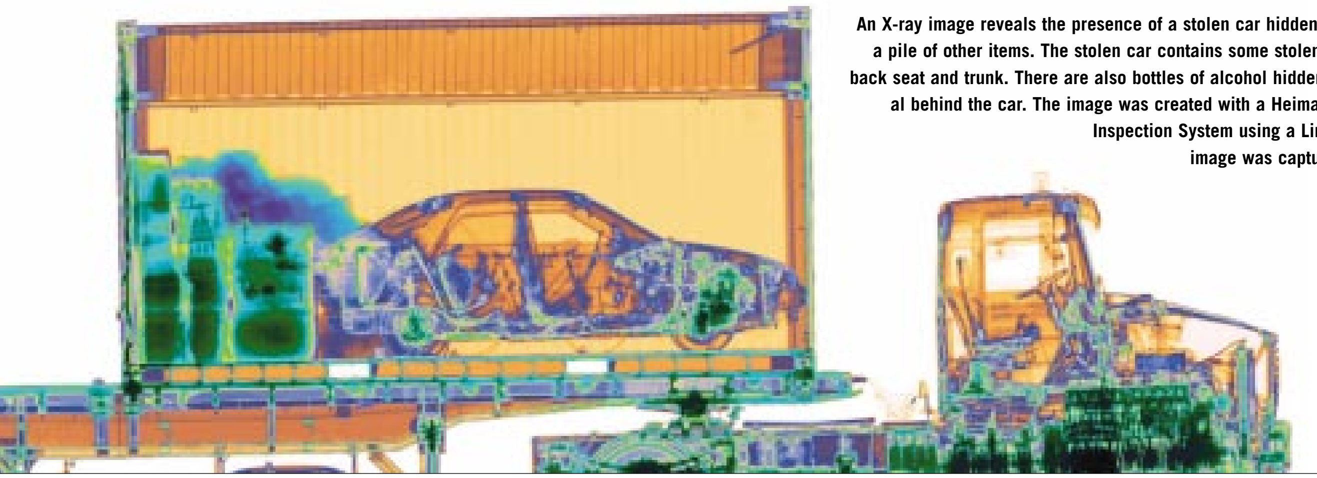
"They bought the Linatron to replace a kilovoltage (kV) imaging system," says Boeh. "They needed a system that could penetrate the larger cross-section of the new blades. Using the previous kV system was taking them 30 minutes to scan a turbine blade for structural flaws. With the Linatron, they have reduced this to about 30 seconds. In addition, we were able to design a compact shielding package so that the system fit into their existing facility."

Varian's Linatron has also been used to inspect large castings, rocket motors, and pressure vessels – large metal containers that carry pressurized contents. The technology enables engineers to find tiny cracks and flaws. "These are not things that you want to see fail," says Johnson.

STERILIZATION

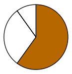
The Linatron technology has additional applications in sterilization. It is being used in medical settings to irradiate and sterilize medical products. A system in Hawaii is used to treat papayas, which are subject to a federal fruit-fly quarantine and cannot be distributed on the U.S. mainland without treatment. Unlike other solutions that Hawaiian growers had tried, including the use of chemicals and heat, the Linatron solution does not adversely impact the appearance or nutritional value of the fruit, or damage the environment, according to the grower, Hawaii Pride LLC. Food irradiation can be used to instantly eliminate the threat of harmful food-borne pathogens such as E. coli, listeria, and salmonella in meat and poultry, as well as fruits and vegetables, without changing their texture or taste.

"The Linatron enables us to harness and focus energy, and put it to work in a number of different ways," says Boeh. "High energy X rays are very useful for inspection and for sterilization. There are a lot of as-yet-untapped potential applications for this technology." ■



An X-ray image reveals the presence of a stolen car hidden inside a truck behind a pile of other items. The stolen car contains some stolen television sets in the back seat and trunk. There are also bottles of alcohol hidden in a stack of material behind the car. The image was created with a Heimann Cargo Vision X-ray Inspection System using a Linatron®. This customs image was captured at an undisclosed port in Africa.

ONCOLOGY SYSTEMS



Varian Oncology Systems is the world's leading supplier of radiotherapy systems for treating cancer. Its integrated medical systems include linear

accelerators and the broadest range of accessories and interconnected software tools for planning and delivering the most sophisticated radiation treatments available to cancer patients. Oncology Systems works closely with health care professionals in community clinics, hospitals, and universities around the world to improve cancer outcomes. Thousands of patients are treated daily on Varian systems. The business unit also supplies linear accelerators and components for industrial inspection, cargo screening, and sterilization.

2002 HIGHLIGHTS Oncology Systems again set records for annual net orders, sales, and operating earnings. It expanded its share of the worldwide radiation oncology market and became a leader in the treatment planning software market. The business also introduced the Acuity™ imaging system, a new product that for the first time integrates planning, simulation, and verification for treating cancer with radiation. The Acuity system pairs an X-ray tube and an amorphous silicon flat panel from Varian's X-Ray Products business to generate the high-resolution images needed for ultra-precise radiotherapy, including SmartBeam™ IMRT. As of the end of the fiscal year, Varian had equipped 840 radiation oncology clinics for SmartBeam IMRT and the number of clinics treating patients with SmartBeam IMRT had jumped to 188 – more than double the number that were offering this treatment last year.

OUTLOOK A record backlog and continuing growth in net orders point to the potential of another year of strong growth for Oncology Systems. Growth will continue to be driven by demand for IMRT-ready systems. More than 90 percent of respondents to a recent survey of radiation oncology centers indicated that they are either offering or planning to offer patients IMRT within the next three years. Product development initiatives will focus on software upgrades that streamline all forms of radiotherapy, including IMRT, and on new "on-board" imaging capabilities that will continue to enhance the precision of radiotherapy.

The new Acuity imaging system for treatment planning, simulation, and verification.

PRODUCTS AND SERVICES

Oncology systems:

- Clinac® medical linear accelerators
- Millennium™ MLC multileaf collimators
- Exact™ treatment couches
- Acuity™ treatment planning/simulation/verification systems
- CadPlan PLUS™/ Helios™ / Eclipse™ treatment planning software
- Vision™ radiotherapy image management software
- PortalVision™ imaging systems
- VARiS® clinical/data management software
- RPM™ respiratory gating systems
- Customer service and product support

Industrial inspection and security systems

- Linatron® linear accelerators

FACILITIES

- Baden, Switzerland
- Buc, France
- Crawley, England
- Helsinki, Finland
- Las Vegas, Nevada
- Milpitas, California
- Palo Alto, California (headquarters)
- Tokyo, Japan
- Zug, Switzerland

ONCOLOGY SYSTEMS

(Dollars in Millions)	**02**	01	00
Net Orders	**$825**	$699	$597
Sales – as Reported	**$725**	$614	$534
Sales – Pro Forma(1)	**n/a**	n/a	$522
Pretax Earnings – as Reported	**$159**	$113	$ 93
Pretax Earnings – Pro Forma(1)	**n/a**	n/a	$ 88
Pretax Earnings as % of Sales – as Reported	**22.0%**	18.5%	17.5%
Pretax Earnings as % of Sales – Pro Forma(1)	**n/a**	n/a	16.8%
Backlog – as Reported	**$650**	$550	$424
Backlog – Pro Forma(1)	**n/a**	n/a	$464
Capital Expenditures	**$ 14**	$ 8	$ 8
Depreciation & Amortization	**$ 8**	$ 10	$ 9

(1) FY00 is presented on a pro forma basis (assuming SAB 101 was applied retroactive to prior periods) for comparison purposes.

X-RAY PRODUCTS

Varian X-Ray Products is the world's premier independent supplier of X-ray generating tubes, serving manufacturers of imaging equipment for medical

diagnostics and industrial inspection as well as distributors of replacement tubes. This business provides the industry's broadest selection of X-ray tubes expressly designed for the most advanced diagnostic and inspection applications, including CT scanning, radiography, mammography, and baggage screening. X-Ray Products develops and manufactures tubes to meet evolving requirements for high-resolution imaging, faster patient throughput, longer tube life, smaller dimensions, and greater cost efficiency. X-Ray Products also supplies a new line of amorphous silicon flat-panel image detectors for medical and industrial applications.

PaxScan® 4030A flat-panel imager captures "live" X-ray images for fluoroscopy **(see story on page 14).**

2002 HIGHLIGHTS X-Ray Products created several new business opportunities during the year. The group entered the security market, developing and securing orders from two customers for a new line of baggage screening tubes in record time. Engineers also developed a new cost-competitive replacement tube for a line of CT scanners. The business secured new supply agreements with two major customers. It increased sales of flat-panel imagers and initiated production of a new PaxScan® 4030A imager for gastrointestinal diagnosis and digital subtraction angiography. A major equipment manufacturer has begun distributing a diagnostic imaging system utilizing this flat-panel technology in Japan. The business also improved product quality and factory efficiency, and established a new X-ray tube reload operation outside of Düsseldorf, Germany.

OUTLOOK The X-Ray Products unit will continue strengthening the business through the development and deployment of leading technology for high-power tubes and cost effective replacement tubes for the aftermarket. Through acquisitions and cooperative arrangements, the unit will continue to expand distribution of replacement X-ray tubes in Europe and Asia. The business is continuing work on the commercialization of amorphous silicon flat-panel imagers for fluoroscopic applications, and has supplied products to several equipment manufacturers who are considering incorporating this technology into their imaging systems.

PRODUCTS AND SERVICES

X-ray tubes for:

- All major segments of the CT scanning market
- Radiographic and fluoroscopic imaging
- Mammography
- Angiographic imaging
- Scientific instrumentation
- Airport baggage screening systems

A new X-ray tube for use in airport explosive detection systems (EDS). **See story on page 20.**

PaxScan® amorphous silicon flat-panel image detectors for:

- Industrial inspection
- Medical diagnostic subsystems

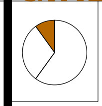
FACILITIES

- Charleston, South Carolina
- Salt Lake City, Utah (headquarters)
- Willich, Germany

X-RAY PRODUCTS

(Dollars in Millions)	**02**	01	00
Net Orders	**$123**	$134	$147
Sales – as Reported	**$122**	$139	$136
Pretax Earnings	**$ 12**	$ 18	$ 18
Pretax Earnings as % of Sales	**10.2%**	13.0%	13.1%
Backlog	**$ 36**	$ 36	$ 40
Capital Expenditures	**$ 4**	$ 4	$ 6
Depreciation & Amortization	**$ 7**	$ 7	$ 7

GINZTON TECHNOLOGY CENTER



The Ginzton Technology Center serves as Varian Medical Systems' research and development organization. The Center's mandate is to create market growth opportunities for Varian Medical Systems by developing technologies that eclipse current capabilities in radiation therapy and X-ray imaging and/or lead to entirely new businesses. An important repository of scientific and engineering expertise, the Center conducts research in support of product development for the company's business units, as well as contract research for other medical institutions.

This group passed several milestones in key research projects. It demonstrated the feasibility of acquiring 3D images using cone beam CT scanning on the Clinac linear accelerators and Acuity systems. It also advanced dynamic tracking and image-guided motion management technologies and algorithms that enhance the accuracy and precision of radiotherapy. Another project validated the use of implanted, radio-opaque marker seeds for targeting prostate tumors. Researchers also devised a means for achieving respiration-synchronized 4D CT & PET image acquisition and supported the development of radiation-activated drug delivery systems.

The Center, which is headquartered in Mountain View, California, also acts as one of the company's financial segments, where results for contract research and for the BrachyTherapy business are reported.

BRACHYTHERAPY

The BrachyTherapy business supplies products for treating cancer patients by placing tiny radiation sources within tumors. A market leader, this business develops, manufactures, supplies, and services devices and software for planning and delivering all forms of brachytherapy.

2002 HIGHLIGHTS The BrachyTherapy business increased sales and net orders, and completed the acquisition of the GammaMed® line of afterloaders and accessories for high-dose-rate brachytherapy. This acquisition positioned Varian for growth in high-dose-rate brachytherapy with the broadest range of products, pricing, and support. The business also introduced a new version of the VariSeed™ brachytherapy product, which enables doctors to improve treatment precision through intraoperative planning.

OUTLOOK The BrachyTherapy business is seeking to become a $30 million annual enterprise by offering a wider range of products and services to an expanded customer base. Brachytherapy has proven its value in the treatment of cervical cancers, and hundreds of thousands of American men have been treated for early-stage prostate cancer, with excellent results. The market is expected to continue growing, as clinicians research the use of brachytherapy for treating cancer in an increasingly diverse range of disease sites.

The GammaMedPlus 3/24 remote afterloader for HDR brachytherapy.

BRACHYTHERAPY PRODUCTS AND SERVICES:

- GammaMedPlus™ and VariSource™ high-dose-rate brachytherapy delivery systems
- VariSeed™ brachytherapy treatment planning software for prostate seed implants
- BrachyVision™ treatment planning software for high- and low-dose-rate brachytherapy

FACILITIES

- Charlottesville, Virginia
- Crawley, England
- Haan, Germany
- Mountain View, California (headquarters)

GINZTON TECHNOLOGY CENTER AND BRACHYTHERAPY BUSINESS

(Dollars in Millions)	02	01	00
Net Orders	**$26**	$25	$18
Sales – as Reported	**$26**	$21	$20
Sales – Pro Forma(1)	**n/a**	n/a	$19
Pretax Losses – as Reported	**$ (2)**	$ (3)	$ (5)
Pretax Losses – Pro Forma(1)	**n/a**	n/a	$ (5)
Backlog – as Reported	**$12**	$12	$ 8
Backlog – Pro Forma(1)	**n/a**	n/a	$ 9
Capital Expenditures	**$ 1**	$ –	$ 1
Depreciation & Amortization	**$ 1**	$ 2	$ 2

(1) FY00 is presented on a pro forma basis (assuming SAB 101 was applied retroactive to prior periods) for comparison purposes.

CONSOLIDATED STATEMENT OF EARNINGS

(Amounts in thousands, except per share amounts)	Fiscal Years 2002	2001[1]	2000
Sales	**$873,092**	$773,643	$689,700
Cost of sales	**533,777**	486,610	432,603
Gross profit	**339,315**	287,033	257,097
Operating Expenses:			
Research and development	**48,442**	43,596	42,083
Selling, general and administrative	**146,088**	133,981	125,107
Reorganization (income) expense	**(192)**	(435)	227
Acquisition-related expenses	**–**	–	1,977
Total operating expenses	**194,338**	177,142	169,394
Operating earnings	**144,977**	109,891	87,703
Interest income	**5,768**	6,281	2,333
Interest expense	**(4,486)**	(4,132)	(5,161)
Other	**–**	(5,000)[2]	–
Earnings from operations before taxes	**146,259**	107,040	84,875
Taxes on earnings	**52,650**	39,070	31,826
Earnings before cumulative effect of changes in accounting principles	**93,609**	67,970	53,049
Cumulative effect of changes in accounting principles – net of taxes	**–**	(13,720)	–
Net earnings	**$ 93,609**	$ 54,250	$ 53,049
Net earnings per share – Basic:[3]			
Earnings before cumulative effect of changes in accounting principles	**$ 1.38**	$ 1.03	$ 0.85
Cumulative effect of changes in accounting principles	**–**	(0.21)	–
Net earnings per share – Basic	**$ 1.38**	$ 0.82	$ 0.85
Net earnings per share – Diluted:[3]			
Earnings before cumulative effect of changes in accounting principles	**$ 1.33**	$ 0.99	$ 0.82
Cumulative effect of changes in accounting principles	**–**	(0.20)	–
Net earnings per share – Diluted	**$ 1.33**	$ 0.79	$ 0.82
Shares used in the calculation of net earnings per share:			
Weighted average shares outstanding – Basic	**67,664**	65,877	62,207
Weighted average shares outstanding – Diluted	**70,239**	68,457	64,863

[1] During fiscal year 2001, the Company adopted Securities and Exchange Commission's Staff Accounting Bulletin No. 1 (SAB 101) "Revenue Recognition in Financial Statements" and Statement of Financial Accounting Standards No. 133, "Accounting for Derivative Instruments and Hedging Activities." The cumulative effect of changes in accounting principles reflects the net effect of prior years of the Company's adoption of these accounting changes as of the beginning of fiscal year 2001.

[2] During fiscal year 2001, the Company wrote off its $5 million investment in the dpiX consortium.

[3] The results for fiscal year 2001 and 2000 have been restated for the two-for-one stock split (effected in the form of a stock dividend) paid on January 15, 2002.

CONSOLIDATED BALANCE SHEETS

(Dollars in thousands, except par values)	Fiscal Year-End 2002	2001
Assets		
Current Assets		
Cash and cash equivalents	$ 160,285	$ 218,961
Short-term marketable securities	41,035	–
Accounts receivable, net	237,345	227,794
Inventories	123,815	111,777
Other current assets	88,879	60,971
Total current assets	651,359	619,503
Property, plant and equipment	226,324	209,105
Accumulated depreciation and amortization	(144,184)	(133,279)
Net property, plant and equipment	82,140	75,826
Long-term marketable securities	97,529	–
Goodwill	59,996	49,870
Other assets	19,253	14,000
Total assets	$ 910,277	$ 759,199
Liabilities and Stockholders' Equity		
Current liabilities		
Notes payable	$ 58	$ 174
Accounts payable	45,776	44,839
Accrued expenses	199,836	149,424
Product warranty	30,725	23,975
Advance payments from customers	81,688	66,942
Total current liabilities	358,083	285,354
Long-term accrued expenses and other	20,891	20,949
Long-term debt	58,500	58,500
Total liabilities	437,474	364,803
Commitments and contingencies		
Stockholders' equity:		
Preferred stock		
Authorized 1,000,000 shares, par value $1 per share, issued and outstanding none	–	–
Common stock[(1)]		
Authorized 99,000,000 shares, par value $1 per share, issued and outstanding 67,790,000 shares at September 27, 2002 and 67,359,000[(1)] shares at September 28, 2001	67,790	67,359
Capital in excess of par value[(1)]	118,278	92,160
Deferred stock compensation	(3,190)	(4,247)
Accumulated other comprehensive loss	(2,530)	–
Retained earnings	292,455	239,124
Total stockholders' equity	472,803	394,396
Total liabilities and stockholders' equity	$ 910,277	$ 759,199

[(1)] Fiscal year 2001 has been restated for the two-for-one stock split (effected in the form of a stock dividend) paid on January 15, 2002.

CONSOLIDATED STATEMENTS OF CASH FLOWS

(Dollars in thousands)	Fiscal Years 2002	2001	2000
Operating Activities			
Net cash provided by operating activities	**$ 156,037**	$ 118,436	$ 83,839
Investing Activities			
Purchase of marketable securities	**(139,110)**	–	–
Purchase of property, plant and equipment	**(25,907)**	(16,537)	(19,234)
Proceeds from sale of property, plant and equipment	**437**	52	1,786
Purchase of businesses, net of cash acquired	**(14,086)**	571	–
Increase in cash surrender value of life insurance	**(2,799)**	(3,121)	–
Other, net	**(385)**	228	(4,124)
Net cash used in investing activities	**(181,850)**	(18,807)	(21,572)
Financing Activities			
Net repayments on short-term obligations	**(116)**	(442)	(34,971)
Proceeds from common stock issued to employees	**23,960**	42,487	23,730
Repurchase of common stock	**(55,092)**	(4,301)	–
Net cash provided by (used in) financing activities	**(31,248)**	37,744	(11,241)
Effects of exchange rate changes on cash	**(1,615)**	(1,733)	7,169
Net increase (decrease) in cash and cash equivalents	**(58,676)**	135,640	58,195
Cash and cash equivalents at beginning of fiscal year	**218,961**	83,321	25,126
Cash and cash equivalents at end of fiscal year	**$ 160,285**	$ 218,961	$ 83,321
Detail of Net Cash Provided by Operating Activities:			
Net earnings	**$ 93,609**	$ 54,250	$ 53,049
Adjustments to reconcile net earnings to net cash provided by operating activities:			
Depreciation	**19,090**	19,309	17,794
Allowances for doubtful accounts	**1,539**	1,697	1,142
Loss from sale of assets	**237**	739	73
Amortization of intangibles	**759**	3,573	4,162
Amortization of premium/discount on marketable securities, net	**546**	–	–
Amortization of deferred stock compensation	**1,057**	994	–
Deferred taxes	**(15,681)**	(13,547)	(1,062)
Non-cash stock-based compensation	**–**	53	190
Cumulative effect of changes in accounting principles	**–**	13,720	–
Net change in fair value of derivatives and underlying commitments	**138**	2,658	–
Other	**(460)**	6,550	514
Changes in assets and liabilities:			
Accounts receivable	**(2,179)**	2,891	(8,802)
Inventories	**(10,172)**	(11,447)	(14,158)
Other current assets	**(4,592)**	2,017	1,811
Accounts payable	**(257)**	2,829	3,121
Accrued expenses	**35,845**	(7,260)	12,192
Product warranty	**7,154**	4,892	2,000
Advance payments from customers	**13,997**	6,940	5,938
Long-term accrued expenses and other	**(1,996)**	(2,976)	(2,095)
Tax benefits from employee stock option exercises	**17,403**	30,554	7,970
Net cash provided by operating activities	**$ 156,037**	$ 118,436	$ 83,839

OFFICERS AND DIRECTORS

OFFICERS

Richard M. Levy, Ph.D.*
President and Chief
Executive Officer

Elisha W. Finney*
Vice President, Finance
Chief Financial Officer

John C. Ford, Ph.D
Vice President,
Senior Vice President,
Oncology Systems

Timothy E. Guertin*
Executive Vice President,
President, Oncology Systems

Robert H. Kluge*
Vice President,
President, X-Ray Products

Keith E. Krugman
Vice President,
Vice President, Operations and
Worldwide Customer Support,
Oncology Systems

John E. McCarthy
Vice President,
Human Resources

Mark R. Mohler
Corporate Treasurer

Joseph B. Phair*
Vice President,
Administration,
General Counsel and
Secretary

Crisanto C. Raimundo*
Vice President,
Corporate Controller

George A. Zdasiuk, Ph.D.
Vice President,
Ginzton Technology Center

* Executive Officers

BOARD OF DIRECTORS

Richard W. Vieser
Chairman of the Board,
Varian Medical Systems, Inc.,
Chairman, CEO, and
President (Retired)
Lear Siegler, Inc.

John Seely Brown, Ph.D.
Former Chief Scientist,
Xerox Corporation;
Director Emeritus,
Xerox PARC

Samuel Hellman, M.D.
A.N. Pritzker Distinguished
Service Professor,
Department of Radiation
and Cellular Oncology,
University of Chicago

Terry R. Lautenbach
Senior Vice President
(Retired), International
Business Machines
Corporation

Richard M. Levy, Ph.D.
President and Chief
Executive Officer,
Varian Medical Systems, Inc.

David W. Martin, Jr., M.D.
Chief Executive Officer,
Eos Biotechnology, Inc.

Burton Richter, Ph.D.
Paul Pigott Professor in
Physical Sciences,
Stanford University;
Director Emeritus, Stanford
Linear Accelerator Center

STOCKHOLDER INFORMATION

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Varian Medical Systems, Inc.
3100 Hansen Way
Palo Alto, CA 94304-1038
650.493.4000

Stockholder Relations
Copies of Varian Medical Systems' Annual Report on Form 10-K filed with the Securities and Exchange Commission and other current financial information are available without charge by contacting Stockholder Relations, Varian Medical Systems, Inc., 3100 Hansen Way, M/S E-210, Palo Alto, CA 94304-1038, 650.424.5855

To obtain information over the Internet, type www.varian.com at the URL prompt.

Listings
Varian Medical Systems' common stock is listed on the New York and Pacific Stock Exchanges. The symbol Is VAR.

Transfer Agent and Registrar
EquiService Trust Company, N.A.
PO Box 2500
Jersey City, NJ 07303-2500
1.800.756.8200
Hearing impaired 201.222.4955
www.equiserve.com

Stockholders' Meeting
The annual meeting of stockholders will be held on February 13, 2003 at 1:00 p.m. at Sheraton Palo Alto, 625 El Camino Real, Palo Alto, California

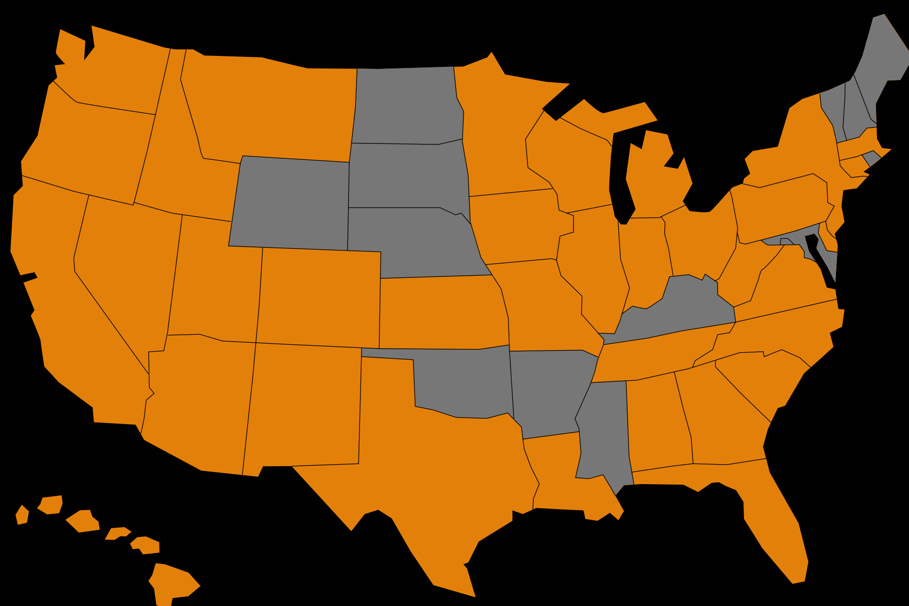
Stockholders of Record
There were 3,966 stockholders of record of the Company's common stock on November 20, 2002.

DESIGN: BROOM & BROOM, INC. SAN FRANCISCO

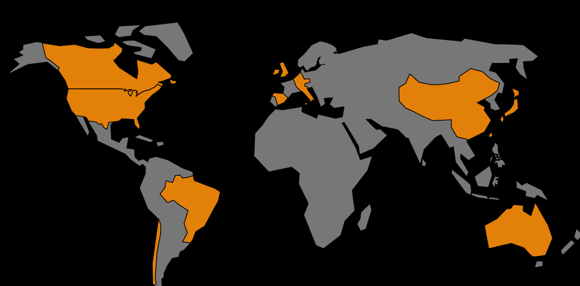
Doctors around the world have begun using SmartBeam™ IMRT from Varian Medical Systems to treat cancer patients. This advanced technique, which focuses radiotherapy on tumors while sparing surrounding healthy tissue, is being used to treat breast, gynecological, head and neck, lung, pancreas, prostate and many other types of cancer. For many, it offers new hope in the fight against cancer.

SMARTBEAM IMRT TREATMENT CENTERS

■ States and Countries with Smartbeam IMRT Treatment Centers



For the nearest U.S. facility offering SmartBeam IMRT, visit:
http://www.varian.com/USsites



For a list of worldwide SmartBeam IMRT locations outside the U.S., visit:
http://www.varian.com/worldsites

To access a sampling of medical journal articles about IMRT, visit:
http://www.varian.com/papers