MODERN JEWELER

OCTOBER 2003
A CYGNUS PUBLICATION

A *NEW* DIAMOND AGE

CUTTING EDGE PEARLS

THE LANGUAGE OF DIAMONDS

Pearl World Prosperity

A New DIAMOND Age

A PHILADELPHIA SCIENTIST WORKING OUT OF HIS LIVING ROOM MAY HAVE UNEARTHED THE MYSTERY OF DIAMOND GRADING. AND CUTTING. AND PERHAPS EVEN SELLING. HOW IT PLAYS OUT WITH THE INDUSTRY COULD BE THE BIG STORY OF 2004.

DIAMOND SHOWING OFF BOTH BRILLIANCE AND FIRE IN NATURAL OUTDOOR SKY LIGHT. THIS INTERACTION OF THE DIAMOND REFLECTING AND REFRACTING THE SURROUNDING LIGHT TO THE VIEWER IS THE DIAMOND'S OPTICAL PERFORMANCE—WHICH COULD SOON BE CHARTED BY AN AUTOMATED PROCESS WITH FAST DEVELOPING SOFTWARE. PHOTO BY MICHAEL COWING, ACA GEMOLOGICAL LABORATORY.

BY IVAN SOLOTAROFF, SENIOR EDITOR

The offices of ImaGem look remarkably like the living rooms found in the many solid and sumptuous 100-year-old manses of Philadelphia's main line. Sometimes these rooms have been converted to an office suite by the dentist or doctor living there, as was the case of an optician (how prophetic) who raised a family in this house several decades back.

Over the past eight years, however, these two rooms have morphed into an office and laboratory that may well turn the diamond industry upside down. It is the domain of Dr. Lalit Aggarwal, a retired university professor who has lived with his family in this house since the late 1970s. And beginning last month, it became the "showroom" for the ImaGem GL3000 and GL250, patented devices visited by a handful of diamantaires (including several

"INSIDE, THERE IS A CROSS-TECHNOLOGY THAT ENABLE IMAGES THAT NO ONE ELSE CAN MAKE," SAYS DR. AGGARWAL, REFERRING TO THE GL3000 SOFTWARE.

DR. LALIT AGGARWAL, FOUNDER OF IMAGEM, INC. PHOTO BY CHARLOTTE DAVIS.

sightholders) who were the first outsiders to witness the world's first fully automated diamond and gemstone grading and analysis tool in action.

It will soon doubtless be a port of call for many others.

"This happens fairly quickly," Dr. Aggarwal tells me, placing a small diamond into a front panel of the GL3000. The predicate is clear: "So keep your eyes open." He directs the cursor of the monitor I sit in front of to the top left, inviting me to click. The machine, centerpiece of the largest of a half-dozen workstations here, sits beside a monitor and keyboard, looking like some oversize laser-jet printer. Below the desk is an impressive stack of microprocessors.

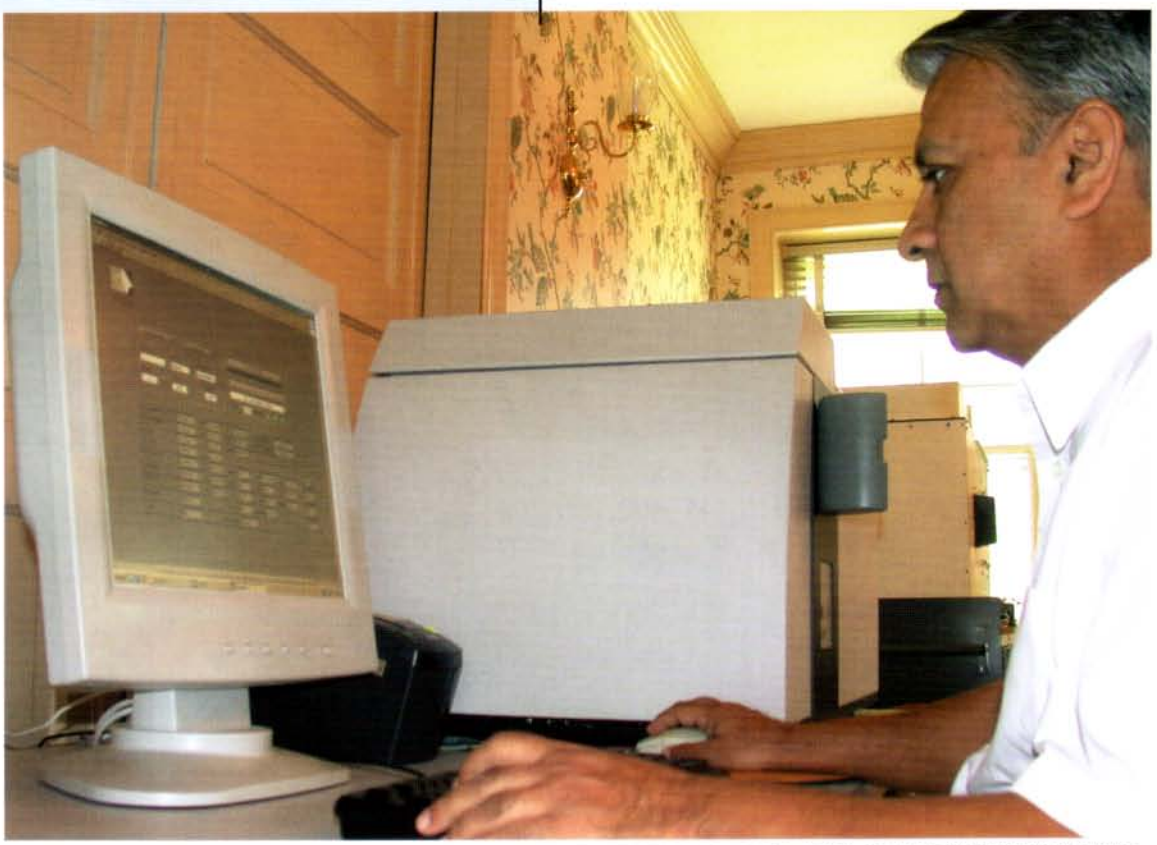
I click. A small automated three-prong "picker" grasps the diamond up and into the darkness of the machine as the panel door closes, and the show begins: a quick registering of numbers on a chart; a small window on the top right of the screen flickers with momentary images of the stone, popping light and patterns as it moves under illumination inside the machine. It would look like weird science to the uninitiated, but there are several machines out there already that swallow diamonds, spit out images, and fill out charts that measure and compare performance—"black boxes" that, like the GL3000, are actually off-white. Like the others, ImaGem's speed and alacrity are impressive, and, for anyone interested in non-static performance, beautiful to behold.

This one's different: In addition to providing numerical statistics of the "next new thing," (brilliance, fire, and scintillation), the GL3000 has also spat out those old war-horses, the 4C's, with a box on the right announcing GRADING DONE!—in less than three minutes. It's happened in extreme detail, too, and with some very *small* numbers: Angles and depths ciphered from 16 measurements, all actually *taken*, rather than averaged through the type of hypothesis used by Sarin-type machines. Weights and sizes have been measured to three places right of the decimal. Girdle perimeters have been fractioned down to plus-or-minus five microns, measured at 360 points on 180 images of the stone, represented in a graphic on a separate monitor.

The GL3000 is thus able to measure, and in essence to grade, an individual facet or junction not only for proportion and symmetry but also for overall impact on performance. With some adjustments, one might be able to see its application as a cutting tool, limited only by the cutter's requirements.

Fluorescence is expressed in frequency lengths, indicating not only degree but temperature and

A HANDFUL OF DIAMANTAIRES WERE THE FIRST OUTSIDERS TO WITNESS IMAGEM GL3000, THE WORLD'S FIRST FULLY AUTOMATED DIAMOND AND GEMSTONE GRADING AND ANALYSIS TOOL, IN ACTION.



IMAGEM'S LALIT AGGARWAL REVIEWS DIAMOND INFORMATION FROM THE COMPANY'S GL3000 TECHNOLOGY—WHICH CAN ANALYZE A DIAMOND IN MINUTES. PHOTO BY CHARLOTTE DAVIS.

color. Clarity is graded and mapped with the accepted green, red, and black lines, squiggles, circles, and dots—but to an almost baffling degree. This stone, a well-cut .614 carat VVS1, has yielded a map with dozens of tiny marks, a function of using pixels to measure flaws and inclusions microns large or deep.

And at the bottom of the chart is a grade I've never seen: I3. That's a color grade, not some hot-button clarity mark. In fact, this "I3" may be even more controversial.

"We found too much range in the existing perimeters," explains Tom Ferguson, ImaGem's CEO. Each color grade on the ImaGem document is thus parsed into one of three sub-gradations.

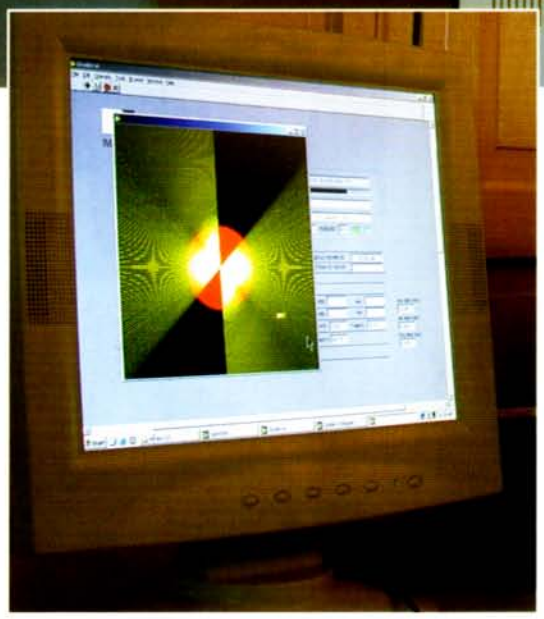
"For now," smiles Dr. Aggarwal. Whittling down to finer sub-grades, apparently, will present few problems for the GL3000.

THE PROBLEM SOLVER

Solving problems is a passion with Dr. Aggarwal. Holder of Wharton's first doctorate in peace science—the infant science of resolving crises without resort to warfare—as well as a masters in urban planning and architecture, he was known outside Drexel University, where he has taught for 20 years, principally for ImageStatistics, a trademarked data-analysis technique he applies to problems ranging from inventory control to information systems, evaluation of graphics, and decision-making aids. He came to the "problem" of diamond grading via a "60 Minutes" episode on Philadelphia's Sansom Street diamond market scandals. "I watched that program," he remembers cheerily, as though speaking of a newspaper chess problem that challenged his imagination a decade ago, "and thinking, 'I could solve this problem.'"

That game-like approach is no coincidence. Aggarwal, whose Ph.D. thesis was on the sort of game theories that absorbed John Nash, subject of "A Beautiful Mind," is a serene, incisive man who seems to see conflict not as an irrational threat but as an opportunity to usher in reasonable calm. It's the temperament of a highly principled man with confidence in his own judgment. Indeed, Aggarwal sees himself less as a problem-solver than as a man, "whose work is all about decision-making."

And as I'll learn today, the distinction is quite small. To paraphrase Thomas Edison's "Genius is 5 percent



IMAGEM'S GL3000: AUTOMATED DIAMOND GRADING FINDS ITS REALITY, AND WHAT A REALITY IT IS. PHOTOS BY CHARLOTTE DAVIS.

inspiration and 95 percent perspiration," the art of problem solving probably has less to do with Eureka's! than making the right choices to answer the myriad small and large questions that come up. When it comes to the application of a new technology to a business pursuit, that distinction is even more blurry.

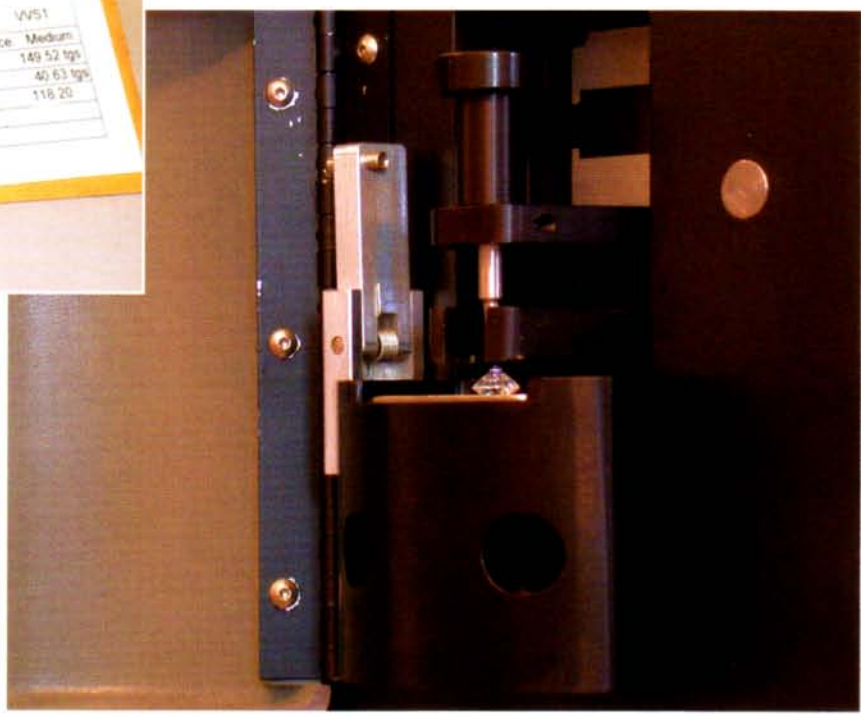
Aggarwal's two colleagues share that measured decisiveness in the face of applying insight to dollars and cents. ImaGem CEO Tom Ferguson is a former AT&T vice president of technology and a specialist in business development and intellectual property. Marketing director Ralph Day, a Harvard MBA, brings 30 years in advertising/marketing consumer goods.

Day came to Philadelphia via De Beers' long-time agency, NW Ayer, but has no background in diamonds. Nor do Aggarwal or Ferguson. The company has also worked with gemologists and appraisers, has diamond-specific patents granted and pending, and has recently added the veteran insider Cheryl Kremkow, of New York's Kremkow Consulting, to help tailor marketing and public relations to the very particular needs of the diamond industry.

"This is a tool that will enable both sides of a B2B transaction to have more information," says Kremkow. "This will allow better sorting, matching, setting tolerances, quality control, and precisely defining the parameters of your client's preferences. At the end of the day, you can better manage the enormous capital investment in the diamond pipeline. It's all about turning that inventory."

Still, this is unabashedly not an "industry" start-up, and the above character descriptions set the stage for a debate likely to be as heated as it will be comprehensive: Three outsiders presenting a measuring, quantifying, identifying, and data-communicating rubric to an industry never particularly known for its kindness to strangers, and which has struggled with commoditization and internecine squabbles about diamond appearance for decades, across the gamut from pure theory to profit margins.

ImaGem's machines do not test for synthetics and treatments (for now, at least), but there would seem to be no other hot-topic button ImaGem isn't threatening to push: branding, conflict, tightened supply chain, sweet-grading, cut controversy, not to mention valuation and added value, or the myriad fights that can accompany transactions. Or insurance claims (and costs): The data taken by the GL3000 may well prove a thoroughly foolproof fingerprinting. "Can I find a stone, fingerprint it with



STANDARDS TO LIVE BY: A REPORT OF DIAMOND GRADING COMPLETED AUTOMATICALLY AND WITHIN MINUTES FROM IMAGEM. PHOTOS BY CHARLOTTE DAVIS.

the GL3000, and then find another stone that would match the fingerprint?" asks Tom Ferguson. "I'd say almost impossible. Or more to the point: With distinctions this fine, what difference could it make if it's the same stone or not."

The issue of conflict diamonds also comes to mind, particularly given the machine's purported ability to quickly grade and identify large parcels.

FINDING A MARKET

And then, of course, there are the labs. If the machines are capable of one-tenth the repeatable accuracy ImaGem claims, where will it leave all those dark rooms through which a huge percentage of diamonds half-carat and above are, in essence, valued by highly trained but fallible humans? Will labs become ImaGem clients? Partners? Rivals?

Are they even the right market for ImaGem? Will this be a tool used less for grading than for sorting? Matching? Cutting? Fulfillment? Inventory control? Will it help e-commerce? End it? Will it help one brander and harm another? Will it enhance the Kimberley Process? And will it apply only to diamonds? Will it revivify the open-bourse system of trading? Will it put Rap to bed? Breed a super-Rap? What is too much information? And how much of these annoying rhetorical questions are too many?

SMALL NUMBERS: THE GL3000 GIVES WEIGHTS AND SIZES TAKEN TO THREE PLACES RIGHT OF THE DECIMAL. GIRDLE PERIMETERS ARE FRACTIONED DOWN TO PLUS OR MINUS FIVE MICRONS, MEASURED AT 360 POINTS ON 180 IMAGES OF THE STONE.

About two hour's worth, it turns out for Dr. Aggarwal. As one would expect, there's a veritable ghetto of unanswerable questions up and down the razor-thin line between the business and science of technology, where trade secrets and business plans dovetail into "intellectual property." And Dr. Aggarwal, a problem-solver and decision-maker, seems uncomfortable being in a de facto position where he's unable to fully answer many such questions. He's clearly thought deeply of them—enough to know how much or little to answer with—and, equally clearly, has come to some preliminary conclusions about many, though he's often unable to elaborate at this stage.

And while hardly uncomfortable with the eventual applications of his work and their effect—this is, after all, a man with three advanced degrees in fields emphasizing the human face of science—he does seem more at ease with questions of optics and tolerances and algorithms. Though we speak at length about the likely applications, I'm left largely with quotes that have an unseemly way of turning into blurred gibberish in the notebooks of left-brained people like myself.

As for the labs: He, Ferguson, and Day see the difficulties that may lie ahead. "But at the end of the day," he stresses, "this is only information, and a method for analyzing it. The best comparison may be to the labs doctors use. The labs return numbers for bloodwork, but it's still the doctors who diagnose and deal with patients. We're selling knowledge."

"Just because the GL3000 says '.3725' doesn't mean

you can't call it what you want," adds Ferguson. "Or that you're even obliged to have that number in your report. Or, for that matter, mean that your use of the word *ideal*, for example, is right or wrong. I've been in the business of intellectual property too long to cross that line."

"Which line?" I ask. There are so many flying around this room.

CLARIFICATIONS

This much is clear: ImaGem's near-term market (the machines will debut in early 2004), is "Initially, going to be probably for evaluating the lower grades," says Ralph Day. "SI to piqué goods. Early prospective clients will likely be large-scale manufacturers" of such goods: India, for example, where Dr. Aggarwal recently paid a visit. "But we anticipate serving the four principal centers, of India, Israel, Belgium, and our own backyard New York. And while only the market can decide this and many other issues, we see it primarily as a B2B tool, with both or perhaps one side of the deal as clients. The price is to be competitive."

"THE BEAUTY OF A DIAMOND," SAYS AGGARWAL, "IS EXTREMELY PERSONAL. A BRAND STANDS FOR THAT, AND THERE'S NO REASON WHY OBJECTIVE INFORMATION THAT CAN BE RELAYED ACCURATELY SHOULD DETRACT FROM SUCH A HIGHLY PERSONAL CHOICE."

"With the labs?" I interrupt.

"What whatever the application's competition might be," Ferguson says. "One reason for India is that it's a huge expense and inconvenience for manufacturers to have to ship diamonds out of the country and then wait for results."

"From labs?"

"Or from clients," says Ferguson. "All the logistics of returns and confusion that can happen with huge parcels. If each stone is identified as finely as we can make it, there are huge economies achievable."

"So will the machines be at some central facility of yours, or in the diamantaire's office?"

Dr. Aggarwal pauses to measure out the response. "We want to be as close to manufacturers, cutters, and dealers as needed to help facilitate the sale of diamonds. It is important to stress," he adds, "that we are not selling a machine [GL3000s and 250s will not be purchased or leased] but a service. It begins with a diamond entering the machine, which we have been beta-testing extensively since we incorporated in 1998, but this is not a technocentric method or company."

Though I'm offered a look inside the box, I haven't a clue what the GL3000's method is. Grades, I assume, are assigned by referring data to an existing database, as existing performance tools and colorimeters function. But Dr. Aggarwal isn't free to comment. "Lots of different things are taking place," he says, referring not only to the black box but also to the software. "Inside, there is a cross-technology that enables images that no one else can make: girdle images, for example. And there have been years spent on issues such as the type of light, how it's used, how performance is correlated with expert opinion." Though he interrupts himself shortly after, he does allow that imaging through zones, a kind of cross-sectioning of the diamond, helps the machine to isolate a certain facet and let the viewer, or cutter, see the effect it's having.

"Since this is a machine," I ask, "could it eventually be incorporated into some form of robotics, to help not only automate grading but production?"

Aggarwal smiles approvingly. I seem to be catching on a little.

"We do believe it will restructure the industry," says Ferguson. "I'd be foolish to tell you how it's all going to play out, and I think that's really up to the industry to decide."

But I ask, "Will this better benefit the commoditizers or the branders?" Why wouldn't quicker and more reliable detailing further reduce romance and add to specs for sales.

"The beauty of a diamond, of anything really," says Aggarwal, "is extremely personal, for one thing. A brand stands for that, and there's no reason why objective information that can be relayed accurately should detract from such a highly personal choice. It should, in fact, only help it."

"It hasn't always so far," I object.

"There's always a threshold of information," he says calmly, "that is worked through when one is able to get past the basic data, in this case, the 4C's. If I am a brander, or really anyone whose business is the beauty of diamonds, and I am able to objectively identify and then communicate to my clients my personal idea of beauty, or theirs, or perhaps to influence them that my personal idea should be theirs, then I have used data to get well past commoditization."

"So this machine is really an objective assessor of beauty?" I ask.

Aggarwal shakes his head slowly. Apparently I haven't really gotten it. "It's whatever you want to use it for," he says. ✦