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Brian Culshaw explores the notion of the academic entrepreneur.

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PRESIDENT’S LETTER

I’d also like to thank all the SPIE members and volunteers in Europe who participated in the various working groups that helped develop the Photonics21 agenda and on other plans for photonics development.

SPIE has worked for many years in Europe (and all around the world) to promote optics and photonics. In the last several years this has accelerated, especially in Europe. With local people in different regions taking a strong role in SPIE activities and lobbying locally for photonics and optics technology development, our activities are more effective.

Of course finding the money to implement plans such as Photonics21 is always a challenge. It is interesting that similar monetary challenges are being faced on both sides of the Atlantic.

In the United States we have discussion of American competitiveness and strong endorsement by many senators and representatives, but we still have questions about the actual appropriation of the money. In Europe we have the announcement of Photonics21, but we still have issues about actual funding levels. It seems this is a common challenge.

Endorsing an ideal is much easier than coming up with the money. SPIE will continue to support these types of initiatives through many activities, and along with that, SPIE members on both sides of the Atlantic need to continue to be strong voices for economic support of optics and photonics technology development.

Paul McManamon
2006 SPIE President

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Photonics21 Meets SPIE

SPIE members contribute to this vital European initiative promoting optics- and photonics-based technologies.

Attending Photonics Europe and the Defense and Security Symposium (DSS), both held in April, made for a busy month for myself and SPIE.

DSS was bustling. I ran into Steve Jamison from BAE Systems (Lexington, MA), who said, “I called my subcontract guy and told him to get down here since many of our current suppliers and other potential suppliers are all in one location.”

This is a perfect example of the kind of service SPIE provides—connecting the people and technologies of the optics and photonics community.

At Photonics Europe an initiative was featured that is also set to benefit the greater optics and photonics community. At the event, Viviane Reding, European Commissioner for Information Society and Media, accepted the first draft of the Strategic Research Agenda in Photonics.

The agenda is part of Photonics21, an industry-focused initiative promoting the need for an aggressive and rapid commercialization of optics- and photonics-based technologies over the next five years in Europe.

It was exciting to have Reding accept the draft agenda at Photonics Europe. This is a testament to the central role Photonics Europe has achieved as an event in such a short time.

To learn more about Photonics21, turn to page 18 where Hugo Thienpont, SPIE board member and member of the Photonics21 board of stakeholders, explains the Photonics21 agenda and its intended effects on the European and worldwide optics and photonics communities.

I am proud that SPIE members have contributed to Photonics21—members such as Thienpont and Malgorzata Kujawinska, SPIE immediate past president and a vice president of Photonics21—and I thank them.

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Viviane Reding cuts the ceremonial ribbon to open the Photonics Europe Exhibition.

Paul McManamon
2006 SPIE President
The non-profit One Laptop per Child with Nicholas Negroponte at the helm aims to put laptops in the hands of millions of children worldwide.

In January 2005, MIT Media Lab chairman Nicholas Negroponte announced a bold project: laptops produced for $100 each and sold to governments of technologically underdeveloped countries that would distribute them en masse to their countries’ children.

By November 2005, the One Laptop per Child (OLPC) nonprofit was in full swing, and a prototype was unveiled by Negroponte and Kofi Annan at the World Summit on the Information Society in Tunis, Tunisia.

Now, well over a year after the project’s genesis, the group still has a number of challenges to overcome for an anticipated 2007 launch, but recent developments have happened swiftly. Just this May, in fact, the first working prototype of the laptop debuted at the OLPC’s Seven Countries Task Force Meeting.

The machine’s specs are simple. It features a dual-mode display with backlit color and frontlit black and white. The Linux-based laptop won’t have a hard disk but will have a 500 MHz processor and 128MB DRAM, with 500MB flash memory, and four USB ports. Wireless broadband will allow the computers to work as a mesh network and create an ad hoc, local area network. Though original designs featured a hand crank, testing proved this a poor power supply.

“Human power remains very important to the $100 laptop,” explains Negroponte, who has left the MIT Media Lab to commit full-time to the OLPC. “What has happened is that it has moved off the laptop and onto the AC adapter. There are several reasons for this move, which probably should have happened much sooner. One is that the previous scheme introduced too many extraneous forces into the laptop itself, putting it needlessly at risk. It is also the case that, when cranking with one hand, the other hand had to spend as much or more force keeping the laptop from twisting. With human power on the AC adapter these go away. Furthermore, using your foot becomes viable, as is getting your baby brother to do it for you.”

“We will have one of three human-powered options for the machine available on the power brick—a crank, a foot treadle, or a pulley system,” says Walter Bender, OLPC president of software and content.

Hardware, software, distribution, and education challenges remain for the project, however.

“Immediate challenges always loom greatest, but are probably the easiest,” says Negroponte. “Making a $100 laptop felt hard. Making a 1W laptop is harder. Distributing 100 million is yet harder. Dealing with the educational issues will be yet harder again. Right now, making a dual-mode display is the most consuming aspect of the project.”

Though the $100 laptop is a bit of a misnomer—initial computers are expected to cost around $135—the more units that are sold, the more the price will come down.

“The current plan is that Phase One is seven large and diverse countries, each big enough...
to absorb 1 million units into their system and budget. That gives scale and gets the price down for Phase Two countries to enjoy the ride thereafter. The seven anticipated launch countries are Brazil, Argentina, Egypt, Nigeria, Thailand, India, and China. We are in discussions with each and at various stages in the agreement.” He anticipates that at least five countries will commit by September.

The organization hopes to ship between five and 10 million laptops next year, according to Bender. The OLPC acknowledges that the project doesn’t end with the creation and distribution of the hardware. A large portion of the work on the laptops revolves around the development of open source software, which is being worked on with Red Hat, and the educational implications of the machines.

Negroponte stresses that the laptops are not gadgets but learning tools for both group and independent study, which brings its own set of challenges.

“The still bigger challenge is building a learning culture around the machine,” says Bender. “There is not a one-size-fits-all solution—conditions vary too much from place to place. There is a one-size-fits-all epistemology, however: you learn through doing. The initial experience with the machine for both students and teachers will be one of create and share.”

“Considerable work has been and will be devoted to teachers,” says Negroponte. “Not so much to have them learn what and how to teach the kids, but more in terms of their own self-confidence and comfort. Experience to date, at a scale of about 50,000 machines, has been in Maine. Many teachers in Maine—in 2002—were apprehensive. Those same teachers today are nearly euphoric, in part because teaching has become so much more fun. Students are more engaged.”

The OLPC is working with a number of partners on the $100 laptops. Quanta Computer Inc. in Taiwan is the original design manufacturer of the laptop, and Red Hat is the group’s partner in software development. The OLPC also relies on donations from sponsor organizations, each of which have donated $2 million. These sponsors include Google, AMD, Red Hat, Brightstar Corporation, News Corporation, Nortel Networks, and Canonical Ltd.

For more information on the OLPC and the $100 laptops, see the organization’s website at laptop.org.

—Erin M. Schadt, Managing Editor
Crystal Clear

Yehoshua Kalisky talks about his new book, which aims to help new engineers better understand solid-state lasers.

By Gregory J. Quarles

One of the toughest challenges facing faculty in physics and engineering departments today is how best to educate students who seek a breadth of information in the field of solid-state lasers.

Several renowned texts address strictly the engineering principles of lasers, or the theoretical and experimental aspects of photophysical processes, but few tutorial texts have been specifically directed toward advanced undergraduate- or graduate-level courses encompassing many of the complexities required to understand, design, and advance both the physics and engineering of solid-state lasers.

Based strongly upon his well-received short courses offered throughout the past decade at the SPIE Photonics West and Photonics Europe symposia, The Physics and Engineering of Solid State Lasers (SPIE Press 2006) by Yehoshua Kalisky, of the Chemistry Division of the Negev Nuclear Research Center in Israel, presents an overview of many of the greatest breakthroughs in solid-state lasers during the past two decades.

Kalisky’s text starts with a historical overview of the evolution of solid-state laser materials and associated technology, and moves into the basic elements of laser resonators. While this is typical for most books addressing solid-state lasers, it is here within the first three chapters that Kalisky provides readers with an integration of principles and technologies for which most readers have previously had to rely upon multiple treatises for similar information.

He very succinctly addresses a multitude of topics that are necessary for those entering the field of solid-state lasers who desire a more complete understanding of the complexities required to design not only the laser resonator but also the materials and transitions required for specific applications.

“My biggest challenge was to integrate several key processes developed independently in other texts so that the desired audience of students in both the sciences and engineering fields could see the relationships between photochemistry, nonradiative processes, energy transfer, and laser physics. The goal was to bring photophysical processes to the forefront, as some previous texts have taken these for granted,” explains Kalisky.

Why should the interrelationship of these areas be so critical to the modern laser engineer? Kalisky stresses from his experience that “it is quite important for laser engineers to have a foundation to be able to predict performance capabilities of new laser materials based upon an understanding of the thermal properties and overall efficiencies observed in similar hosts and with previously characterized transitions.”

This breadth in the evaluation of complex laser materials is examined in a very understandable manner throughout Chapter 8: Lasing Efficiency and Sensitization. Here, Kalisky uses as a working example chromium-sensitized garnets that incorporate thulium and holmium ions as the activation pair to emit in the 2-µm region of the infrared.

He very skillfully examines energy transfer, thermal effects, concentration-dependant effects, and the laser performance impact of host and sensitizer/activator ion selection, which will assist in providing the novice laser engineer with a comprehendible overview of these complexities that define whether a laser material will have the capability of being both efficient and feasible.

A strength of this tutorial is that it reviews several recent developments and advances in solid-state lasers and novel materials that were not of interest or mature enough when other texts in the field were published. These topics include an extensive chapter on ytterbium-activated solid-state lasers.

The review of the evolution of the ytterbium lasers illustrates the materials development path to reach acceptance and maturity in the field. As with many solid-state lasers, a 10- to 15-year full
maturity cycle can be clearly seen through the research outlined in this chapter. After examining the optical properties and thermal considerations of these ytterbium-doped lasers, Kalisky summarizes the various excitation techniques, such as the thin-disk laser concept, face-pumping, and various waveguide designs.

When asked about such revolutionary technologies witnessed during this past decade, Kalisky remarked that he believes the three leading technologies are “the demonstration of multi-kilowatt lasers based upon ytterbium, thin-disk technology, the evolution of high-power fiber lasers based upon breakthroughs in glass and diode technologies, and finally, the exploitation of polycrystalline materials currently under investigation for ultrafast and high-energy laser platforms.”

Kalisky went on to expound that “by applying the energy gap laws, an understanding of phonon interactions, and the various photophysical laws examined in the text, one is able to apply this understanding to other growing fields such as high-power fiber lasers and materials engineering, such as with the rare-earth activated orthovanadates.”

Another strength of The Physics and Engineering of Solid State Lasers is that it provides not only a strong selection of seminal references, but it also provides readers with extensive tables that highlight and compare the pertinent physical and optical properties of a variety of mature and new solid-state laser material. Many of the engineers and scientists utilizing this text will find these tabulations invaluable resources as they attempt to model and design future laser systems.

In fact, these parameters evolve directly from the source of the strength of this tutorial: the integration of both the theoretical and practical engineering aspects of solid-state lasers based upon photophysical processes.

“...the goal was to bring photophysical processes to the forefront, as some previous texts have taken these for granted.”
Five Ways to Improve Your Presentations Now

Enhance your next scientific presentation with these helpful hints.

By Michael Alley

1. Focus on the essence of your work.
   
   If you try to present everything you’ve done in your research, you may very well end up communicating nothing. Rather than overwhelming your audience with every detail in the paper, focus on the essence of your work. The best conference presentations consist of a single storyline with one or two main assertions that are well supported. If you’re worried that the audience will ask about specific procedures or derivations, then simply include those details in back-up slides you can access during the Q&A period. In a PowerPoint slideshow, you can quickly jump to a particular slide by punching in the slide number.

2. Reveal your passion for the subject.
   
   The best speakers in science and engineering were passionate about their work: Linus Pauling, Gertrude Cori, Richard Feynman. And with good reason—if you don’t show that you care about your subject, little hope exists that your audience will either, especially if your audience has listened to a slate of other presentations. Not every excellent speaker reveals his or her passion with the same intensity of a Pauling. For instance, Jane Goodall presents her work in a soothing voice. Still, Goodall is an engaging speaker, and it is her earnestness that makes her so.

3. Channel your nervous energy in a positive direction.
   
   Many speakers mistakenly allow their nervousness to pull down their presentations. In the days before your presentation, whenever you feel nervous, shift your focus to the audience. What do they know about your topic? What biases might they have against your results? Thinking about your audience will serve your presentation—thinking about your nervousness will not. To combat nervousness on the day of the presentation, arrive early to the room, make sure the equipment is working, and then go out to meet your audience. Find out why they came to your session. If appropriate, during the presentation, mention one or two audience members. Thinking so much about your audience will displace the nervous feelings about yourself. Finally, if you begin the presentation and your nervous energy starts to seep out into shaking hands and dancing feet, try scrunching your toes. Doing so will allow you to release your excess energy without distracting your audience.

4. Begin each slide with a succinct sentence.
   
   If slides are the appropriate medium for your presentation’s content, then rise above the mind-numbing defaults of PowerPoint. The single most important default to challenge is the one calling for a short phrase headline. My own research shows that audiences understand and retain significantly more information when the headline of each slide is a one- or two-line sentence, starting in the upper left corner, that states the main assertion of the slide. If you cannot come up with a headline, then cut the slide. Most conference presentations have too many slides, which leads to a frenetic pace. In conference presentations, aim for 1.5 to 2 minutes per slide.

5. Make connections, not bullets.
   
   Bullet lists do not show connections between details, and showing connections in your evidence is critical to making your presentation persuasive. Instead of writing a boring bullet list on each slide, create a visual representation of the supporting details. That representation might be a photograph, a diagram, a linked series of images, or text blocks connected by arrows. Many excellent examples and templates for such slides can be found at the site “Design of Presentation Slides” (writing.eng.vt.edu/slides.html) hosted by Virginia Tech.
In Memoriam: Yuri Denisyuk 1927–2006

Holography pioneer Yuri Denisyuk died peacefully on 14 May in St. Petersburg, Russia. The loss to the optics community of this brilliant, humble, and generous man is immeasurable. Coming as it does less than six months after the death of his friend and colleague Emmett Leith, Denisyuk’s death marks the end of an era.

The two beloved founders of modern holography are gone, and somehow the field they created and nurtured for more than 40 years must determine how it can honor them by continuing to thrive.

Professor, academician, and friend to all in his field, Denisyuk was best known for the Denisyuk hologram—the holograms that produce the wonderful, often colored 3-D images hovering just behind the plane of the hologram. His other contributions to the field of coherent optics and holography were also of great importance. During the last years of his life, he turned his attention to optical logic, high-density data storage, and nonlinear optics where he also made significant contributions.

Denisyuk began experiments in interference photography in 1958 and published his work in 1962 in the Soviet Union. But his research was not well received until the work of Leith and Juris Upatnieks began to generate excitement in the late 1960s. In 1970 Denisyuk was awarded the Lenin Prize and was elected a member of the Soviet Academy of Sciences. Denisyuk and Leith received the first Dennis Gabor Award from SPIE in 1983.

SPIE will honor Denisyuk and Leith with a special conference as part of the Optics & Photonics symposium this August in San Diego, CA. For more information about the special event, visit spie.org/events/op.

—Vladimir Markov, MetroLaser (Irvine, CA), and H. John Caulfield, Diversified Research Corporation (Cornersville, TN)
Lighting is poised to be the next great solid-state frontier. The technology is already making inroads in the markets for architectural lighting, signage, and specialty residential and retail applications.

According to Robert Steele, director of optoelectronics programs at Strategies Unlimited (Mountain View, CA), the overall lighting market for LEDs in 2005 was an estimated $250 million. Hard numbers aren’t yet available, but he projects the market to reach roughly $1 billion by 2010, with steady year-over-year growth rates of 30 to 40% annually. “It’s still small but it’s emerging,” he says. “There’s a huge amount of activity.”

One of the strengths of LED lighting is reliability, making the industrial market a natural target of opportunity. In an industrial setting, replacing burned out bulbs doesn’t just incur parts costs but also production downtime costs. Given the industrial setting’s voracious appetite for lumens, however, LED lighting is going to have to meet some pretty strict performance standards.

**Industrial Strength**

LEDs generate white light through a mix of red, green, and blue output or by downconversion via phosphors. In theory, the technology offers high efficiency; the reality is lagging a bit.

According to “Solid-State Lighting Research and Development Portfolio,” a U.S. Department of Energy (DoE) roadmap compiled in conjunction with a panel of industry experts, current white-light LEDs can produce from 20 to 45 lm with a luminous efficiency of 20 lm/W or 45 lm/W, respectively. In contrast, a typical fluorescent bulb produces 5300 lm at a luminous efficiency of 83 lm/W, and a high-intensity discharge bulb produces 24 klm at a luminous efficiency of 80 lm/W. Clearly, LEDs are at an enormous disadvantage in terms of overall output, despite boasting lifetimes a factor of two or more higher than the other technologies.

Industry doesn’t care as much about lifetime if it can’t get the light it needs for an assembly line or a high bay, though. “For these particular applications, I think the requirement is still tens of thousands of lumens,” says Srinath Aanegola, director for white LED technology at GELcore (Valley View, OH), and a member of the technical committee for the DoE report. “Whether solid-state lighting will be the right choice is still a question mark.”
Power On

Of course, the aforementioned DoE roadmap carries two important milestones: reaching an efficiency of better than 100 lm/W by 2010 and reaching a value of $3/klm by 2015 (compared to $0.6/klm for fluorescents). Companies like Nichia (Tokyo, Japan) have reported reaching 100 lm/W for small white-light LEDs, but efficiencies typically drop by 50% when devices are scaled up to the large chips and color temperatures appropriate for industrial applications.

Past the magic 100 lm/W barrier, a whole host of interesting things happen. LEDs will provide better luminous efficiency and lifetime than any lighting alternative, on a competitive cost basis.

“In an industrial or a commercial setting, people pay attention to life cycle costs,” says Steele. “If you’re saving on labor and saving on electricity, you’re willing to pay more up front.”

With this efficiency comes the opportunity to achieve high-lumen output. Consider a white-light LED that produces 1000 lm at 100 lm/W. “Because I have more efficiency, can I drive it at 30 W and get three times the light output, make this a 3 klm source?” Aanegola asks. “I think that’s what most people will try to do because what is going to drive penetration is how many lumens you’re getting for every dollar you spend.”

Of course, this approach raises the pesky issue of thermal management. Incandescent and fluorescent bulbs dissipate heat radiatively; LEDs are limited to conduction and convection. Moreover, incandescents generate and release most of their heat through the front of the bulb, which is available to the open air; LEDs generate most of their heat at the back, where they would presumably be plugged into a fixture. When you’re talking about 4 or 5 W, it’s not such a challenge. When you’re talking about dissipating the tens or even hundreds of watts that could be generated by an industrial fixture, however, conductive and convective cooling are simply not feasible. Not only are there safety issues, there’s the nasty little fact that elevated heat slashes device lifetime, which is a key part of the LED lighting value proposition.

“Then you’ve got to maybe change the shape, the fixture, and include active cooling techniques so you’re not impacting lifetime, which is a key requirement,” says Aanegola. But he’s quick to point out that adding a thermoelectric cooler or a fan, say, in turn adds cost or failure points.

In the case of office lighting, for example, which would face far lower output requirements, cooling via heatsinks presents less of a challenge, says Kathryn Conway, LED Consulting (Nassau, NY). “Because they have to have a lot of surface area, they can be made in decorative shapes so it doesn’t really detract. It can be made kind of aesthetically pleasing.”

Fitting the Niche

If LED lighting for general industrial illumination has yet to take off, the technology is still moving along one niche at a time. “You have to find where LEDs will bring some value that you can’t get with other light sources,” Steele says. LED reliability, for example, has gained the technology a strong foothold in machine vision. “If the lamp on your machine vision system fails and you’ve got to shut the production line down for even 10 minutes to change it, that could be thousands of dollars of lost production time.”

Conway recently scouted the Light+Building show (Frankfurt, Germany; 23–27 April) and discovered new trends in industrial lighting, including office-type fixtures that feature LEDs on the edges, mixing their output with that of other sources. “They’re using the molded plastic that is there to reinforce the fixture for the industrial environment, but with the color LEDs, they’re able to get kind of a cool decorative effect because the light travels on the edges of the reinforcing element. What they’re doing with the color is adding some interest to it.”

She also saw demonstrations of LED footpath systems, for example, to mark a pathway or illuminate a perforated steel element such as an electrical-cord cover. LEDs also showed up in handheld inspection devices.

As to applications beyond the niches, they still await the crossing of the 100 lm/W bar. “The earliest I could see LEDs enter the mainstream of manufacturing environment would be probably be around 2012, when we would have at least 100 lm/W and preferably maybe 150 lm/W. Then things change dramatically,” says David Pelka, president of Tailored Optics Inc. (Los Angeles, CA). For now, the industry just keeps moving. “There’s been a lot of progress,” says Steele. “The best white LEDs are now three times as efficient as incandescent and getting pretty close to compact fluorescents. After that, they’ll be hitting the efficiency of linear fluorescents, and I think that’s going to have an impact.”

—Kristin Lewotsky is a freelance technology writer based in Amherst, NH.

Learn more about the latest breakthroughs in LEDs at the Illumination Engineering conference at Optics & Photonics this August in San Diego, CA. Find out more at spie.org/events/op.

Lighting Up the Future

If what Kathryn Conway, principal of LED Consulting (Nassau, NY) saw at the Light+Building show (Frankfurt, Germany; 23–27 April) is anything to go by, the future looks bright for solid-state lighting in general. “What’s really obvious is that every major manufacturer feels the obligation to show some LED products,” she says. The show had more than 300 exhibitors from around the globe in the area of LED lighting.

Of course, true market penetration by LEDs has always hovered somewhere in the tantalizingly close future. That may be changing, according to Conway. “For years, people have been saying in five to 10 years we’ll see LEDs, five to 10 years, but I think this is the year we’ll mark as the beginning of the real adoption of white LEDs,” she says. In part, she points to the critical mass of manufacturers now participating in the sector through technology licensing. R&D efforts driven by demand in the display and automotive industries have also provided a push.

Don’t look for LEDs to be at your local hardware store tomorrow, but an increasing number of niche applications, white-light LEDs make sense, for example in cove lighting and certain types of retail lighting.

In addition, manufacturers such as Color Kinetics are showing white-light LEDs that can be adjusted in color tone from warm white to cool white. Applications include retail, high-end residential and even entertainment venues such as museums. “Last year they had prototypes,” she says. “This year, they’re real.”

—K.L.
The somewhat abstract concept that academics should “take their ideas to market” has been with us for a very long time. Historically, though, mutterings in the common room have disparaged the (usually) senior academic trotting the world to his planning consultancies in Tokyo, London, Cape Town, and New York. How can such philandering possibly benefit the academic credibility of our august institution? Indeed, why are such miscreants never discreetly asked to resign from their positions?

Similar gossip survives to this day. However, in the UK at least, the encouragement to do the deed as well as publish the paper has never been stronger. Universities gain local credibility through reporting that members of their staff have successfully made this or that high-technology concept into a marketable product. The university “contracts office” has evolved from a quirky curiosity into a (usually) professional support body linking academia to sources of finance and industrial exploitation opportunities.

Institutional philosophy may have changed but the academics themselves retain many of their stereotypical attributes: dreamy and unmanageable—herding cats is the phrase often used—they are anathema to conventional business. Spin-offs, indeed the whole SME (small- and medium-sized enterprise) culture, though, shouldn’t be confused with the conventional business infrastructure embraced by the corporate multinational.

A Different Breed
Why should academics get involved with industry? The vast majority enjoy tenure; the prospects of a reasonably secure pension; the
freedom within very broad limits to do as they please especially in the research context; and an idealistic, genteel lifestyle, intruded upon only by the frenetic excesses of research assessment exercises and quality assurance agencies. The motivation then is certainly not basic survival. Neither is it the desire to accumulate a fortune. Academics are notoriously disinterested in large sums of cash, provided of course that the wine cellar is well stocked.

Engineering academics, though, are a somewhat different breed—scientists who when young tinkered with construction sets and so like to see ideas turned into reality. After all, in academia the definition of reality is the published paper. The grown-up construction kid often wishes to see more.

I, personally, started all this to see things happen. We would find things out in the lab, publish the paper, and be left with this lingering thought that really this might be useful somewhere.

Taking this precious thought to the corporate multinational is almost certainly doomed to failure. The staid corporate servants will convincingly argue that they have already had a magical product on the market for the last 15 years doing exactly what you claim your nebulous thought might be able to do. Though we did discover that the users of this magical product may well beg to differ.

In time, the inevitable conclusion is the only way to push your baby is to push the pram yourself. Consequently, the thought of a company vehicle through which to make things happen eventually consolidates into some form or other of actual entity.

There are other motivations as well, though these tend to appear in hindsight. The spin-off can, and often does, offer a different type of opportunity for the right type of emerging graduate student and that in itself can be exciting and rewarding. Furthermore, the direct experience of actually making things happen is splendidly effective at bringing the dreamy and unmanageable academic rapidly down to earth. The apparently simple step of putting the lab demonstration into a box and shipping it out of the door raises a whole raft of absolutely essential and frequently very demanding technical issues which are all too rapidly trivialized by those who have but observed the process from afar.

**Birth of a Spin-off**

In the late 1980s a few of us at Strathclyde, in collaboration with a local company and our regional development agency, set up Gallex with essentially these ends in view. We got investment, hired a managing director, and took management advice (after all, we are academics and don’t know how to manage). Two years later, Gallex was bankrupt. In the UK there is a government enquiry into corporate bankruptcies. The result was that our professional managing director was banned from being a company director for several years. For us, the trouble with Gallex was that it never felt right. But the experience of bankruptcy is frowned upon in European cultures far more than the U.S. Lots of musing later and along came the conclusion that we should trust our instincts. Perhaps intuition is really quite a good thing after all.

We regrouped, and early in 1994, two of the academics from the original Gallex team, another academic from a neighboring university, and the former chairman of a company with whom we at Strathclyde had done some successful technology transfer, got together and out came OptoSci Limited. OptoSci was founded with the same objective, namely to take things from the lab into reality.

We had by this time learnt that there are two basic models for a spin-off company. The first is to take an initial modest investment, including that from the founders, and earn your keep. Remember too that in Europe there is no equivalent of the rather splendid U.S.-based SBIR scheme (that is, the Small Business Innovation Research program). This simply contravenes the EU equivalent of anti-trust legislation, so earning and simultaneously developing new products within an SME presents a challenge.

Of course this challenge can be met by persuading the venture capitalists or possibly the business angels (many of whom respond to the name “Lucifer”) into the fold. This gives up control, though, and intuitively—based on the Gallex experience—control of one’s own destiny is, at least in the early stages, a critical prerequisite. Consequently we went for the modest investment-and-earn model for OptoSci. A direct result of this is that growth is probably more modest but total collapse is less likely.

The key to earning your keep is a readily developed, at reasonable cost, easily marketed product which can earn sufficient profit to be able to plough useful amounts with matching government funding into development programs. In our case we opted initially toward laboratory instrumentation for the undergraduate teaching market. OptoSci’s resulting range of photonic educator kits is unique in addressing highly technical concepts within a reasonable cost envelope, with the benefit of both excellent supporting documentation and significant student exposure prior to market release.

Additionally, the founders are predominantly academics, so they know how academics tick and how the funding cycles in academic institutions
work so that we can time offers to potential customers with the tantalizing prospect of money to spend. This, we later learned, is called “marketing.” Of course the market is limited and also needs very much to be multinational to become viable. We then had to learn about foreign agents, letters of credits, and the whims of exchange rates.

The model has served us well, and in effect, the education market has helped us to provide matching funding for government initiatives, targeting more speculative product. In particular we have begun to address gas sensing using fiber-optic systems and have now installed systems, some of which have been operating for several years, in very challenging environments, particularly for the detection and accurate measurement of methane gas concentrations.

We have continued along the modest investment and earn model, though, despite the temptations at the beginning of the millennium when photonic technology was the venture capitalist’s ideal. Thankfully we resisted the temptation and have survived. The model has its frustrations, however, of which the demands on company staff are undoubtedly the greatest. The need to survive is paramount. This is true of any company, large or small, so longer term prospects often incur frustrating delays. We do retain that ever-precious control, and with the company being consistently profitable for several years, we strengthen our position should investment be required in the future.

What of the future? Educational equipment is a stable product and has been augmented in recent years by a range of instrumentation products and OEM units. The large systems for safety monitoring initially focusing on methane appear particularly promising and we are currently working on expanding the market address. However, we really don’t know how things will actually turn out, so flexibility and agility coupled to sound, even parsimonious financial control and carefully considered forecasting, are always on the agenda.

Lessons Learnt
And what have we learnt? Taking ideas from the academic paper to a real product has made far more to it than we first thought. In particular we found the need to devote far more effort to persuading people to buy our product than we did to developing it. The illusion that “it is technically excellent” so it would sell itself soon vaporized. For many high-technology companies, certification of product (administration and form filling—anathema to academics) is absolutely essential, and the whole issue of putting

the idea into the right kind of box which survives in the right kind of environment, under demanding conditions, is extremely important. The glue that holds together critical assembly is probably the most closely guarded secret of the entire process.

People too are critical. The SME community is small. Everyone interacts daily. Staff motivation and staff selection are therefore vital elements. Thus far we have largely employed people whom we have known, either personally or through reliable reputation. There is a need for the more nebulous benefits too. Share options for key staff (even though we may never sell the company) give an essential sense of belonging. Most of all, though, all concerned need to trust these nebulous feelings and instincts and have faith in intuitive reactions. We may need to justify logically later, but if it doesn’t feel right, don’t do it till it does. The SME, though, can very productively employ eccentrics and unusual characters, making the best of technical excellence and working with the non-conformism. Paradoxically perhaps the SME can have overtones of the academic environment which often stimulate it, so perhaps it isn’t so alien after all.

Instinct and Persistence
None of us involved with OptoSci has made a fortune and it is unlikely that we will. Would we go through the same exercise again? I am sure the answer would be most definitely in the affirmative. Indeed, in my own case, a little while ago Solus Sensors appeared, this time based in Wales and so hardly a campus company. But again this is targeted at taking a particular sensing system, well proven in the laboratory, and turning it into a useful product. We have already done some preliminary assessments in collaboration with a potential customer. I have no doubt the story will continue.

So is the academic entrepreneur an oxymoron? We know for sure that our business has survived over a decade, in itself a tangible measure of success. We have had the satisfaction of really turning our eccentric research into quality product. We have learnt of the intangibles which never appear in the books, courses, and consultants’ reports. We have valued, and will continue to value, the immense contribution from energetic, capable, and dedicated staff.

Perhaps most of all, we’ve learnt that instinct and persistence is a powerful combination. All the academics involved would, I’m sure, repeat the exercise with the added benefit of a more mature judgment on the process. And, we also know that our institutions perceive sufficient value in such initiatives to be willing partners.
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Since 1955, SPIE—The International Society for Optical Engineering, has become the largest international force for the exchange, collection, and dissemination of knowledge in optics, photonics, and imaging.
By Hugo Thienpont and Ronan Burgess

Photonics21 brings together the key stakeholders in Europe in the area of photonics. Its purpose is to stimulate greater and more effective investment in research and development, to accelerate innovation, and to eliminate barriers to the deployment and growth of new photonic technologies.

Photonics21 is one of several European Technology Platforms (ETPs) that have been set up and led by European industry to address technology areas considered to be key to future economic growth in Europe. Photonic technologies are driving innovation in a broad range of areas from telecommunications to manufacturing and lighting to medical and environmental.

In order to remain competitive, European industry needs to better exploit the capabilities of high technologies. Investment in research needs to be increased, and there needs to be better coordination between privately and publicly funded research, and between European and national research. In particular, the fragmentation of Europe's photonics research and development effort needs to be addressed.

The Photonics21 platform therefore brings together the key players from the entire photonics sector and includes industrialists, researchers, academics, and policy makers. The European Commission has actively encouraged the formation of such technology platforms, in that they can help to better align European research priorities with the needs of industry.

Photonics21 has its origins in early 2005 with the publication of "Photonics for the 21st Century," which set out a vision for photonics. The first task for Photonics21 was to draw together the main stakeholders in the sector and to define a strategic research agenda, presenting the medium- to long-term objectives for photonics. This was completed in March 2006 and the strategic research agenda was officially presented to Viviane Reding, European Commissioner for Information Society and Media, by Alexander von Witzleben, president of Photonics21, during the Photonics Europe 2006 symposium.

In the next few months, the platform will produce a deployment strategy that defines how its members will mobilize the human and financial resources needed.

The ambitious goals of the Photonics21 platform will not be achieved overnight, and its members will need to remain committed to these goals for the long haul. However, it is clear that the importance of photonics is already being recognized more widely, and that technological advance is entering the "century of the photon."
form calls for its acceleration.

Alexander von Witzleben, Photonics21 president, presented the first draft of the strategic research agenda to Viviane Reding at Photonics Europe in April.

Learn more about Photonics21 at www.photonics21.org. There you can read about recent developments or download the strategic research agenda titled Towards a Bright Future for Europe.

Active Participants

Through SPIE Europe (based in Cardiff, UK), SPIE leadership and members have been active participants in the formation and implementation of the Photonics21 strategic agenda for photonics research and development.

“Photonics21 is an exciting proactive step by the broad photonics community in Europe,” says Eugene Arthurs, SPIE Executive Director. “It was striking to see industry leaders, academic researchers, and those from many research institutes come together in Brussels last December to assess Europe’s opportunities in photonics, and subsequently to quickly craft the technology platform document. The document has already helped funding decision makers in the EU glimpse the enormous potential for photonics in Europe, and recognize some of the inertial forces. SPIE Europe will continue to work in support of the technology across Europe.”

Read more about SPIE’s involvement with Photonics21 at spie.org/Announcements/epe.html.
Solar energy is set to pull in the crowds this August in San Diego.

The SPIE Optics & Photonics 2006 symposium, colocated with SPIE’s 51st Annual Meeting, is the largest technical event in its field. From 13 through 17 August, more than 6500 people will converge in San Diego, CA, to explore and discuss the latest developments in optics and photonics.


Of all the technologies featured at Optics & Photonics, a great focus this year is on solar energy.

“Solar energy is very important. I mean, look at the price of gasoline and the rising cost,” says Zakya Kafafi, head of the Organic Optoelectronics section at the U.S. Naval Research Lab. (Washington, DC) and chair of the Organic Photonics and Electronics program at Optics & Photonics. “The world today uses about 13 terawatts of power. People expect by the mid-century this is going to be more than double, and by the end of the century more than triple, so there’s a strong need for a good source of carbon-free, renewable energy.”

Martha Symko-Davies, senior project leader at the National Renewable Energy Lab. (NREL; Golden, CO), and chair of the High and Low Concentration for Solar Electric Applications conference, expects to see a variety of topics covered under the solar energy umbrella.

“I think that it’s an open, technology-neutral place right now,” says Symko-Davies. “I think we’ll see some downflux in the future, but right now, everybody’s pushing for their own technology.”

The solar energy plenary session presentations this year include “The Promise of Concentrator Photovoltaics Using High-Efficiency Multijunction Solar Cells” by Raed A. Sherif from Spectrolab Inc. (Sylmar, CA), “The Sustainable Hydrogen Economy” by John A. Turner, NREL, and “Chemical Conversion of Solar Energy and Photocatalysis” by Akira Fujishima, Kanagawa Academy of Science and Technology (Kawasaki, Japan).

But solar energy isn’t the only technology getting attention.

James Grote of the Air Force Research Lab. (Wright Patterson AFB, OH) and Nanotechnology program chair, along with Kafafi will co-chair a joint organic and nanophotonics plenary session. The session aims to showcase the best of both programs.

“It started out as a workshop,” explains Grote. “We’ve made it into a plenary to kick off all the other conferences, and it highlights different areas, so people get an idea from the plenaries what might be talked about at other conferences.”

At the plenary session “there are two very prominent women scientists that are going to talk,” says Kafafi. “Zhenan Bao from Stanford University [Stanford, CA] will talk about organic ‘plastic’ electronics, and Naomi Halas from Rice University [Houston, TX] is going to be talking about hybridizing plasmonics.”

Another event is a symposium-wide plenary
A special panel/workshop hybrid titled “Atmospheric and Environmental Remote Sensing Data Processing and Utilization: Perspective on Calibration/Validation Initiatives and Strategies" will consist of four, 30-minute lectures about the importance of applying sufficient resources, current initiatives, and issues in achieving optimal and accurate validation. Joseph Tansock, Utah State University (Logan, UT), will moderate.

There are also several non-conference-related events taking place.

The SPIE Annual General Meeting will take place from 6 to 7 p.m. on 15 August. SPIE President Paul McManamon will announce the 2006 election results and speak about the state of the Society. This meeting is also an open forum for members to share their thoughts or concerns with SPIE officers.

Mary Lou Jepsen, CTO of One Laptop per Child (Boston, MA), is this year’s banquet speaker. One Laptop per Child is a non-profit group created by faculty members of the MIT Media Lab to design and manufacture $100 laptops for children in developing countries (see related article, page 6).

There are a number of events aimed at students, and Grote encourages students to take advantage of the offerings, such as the Lunch with the Experts, scheduled from 12:30 to 1:30 p.m., 14 August.

The two-day SPIEWorks career fair, held 10 a.m. to 5 p.m., 15 and 16 August, is an opportunity for students and professionals alike to meet with recruiters from hiring companies, as well as network with technical staff and human resource recruiters.

More than 50 professional development courses will also be offered at Optics & Photonics, including “How to Start a Small High Tech Business Almost Anywhere” by Eric Udd, president of Columbia Gorge Research (Fairview, OR), “Book Publishing for Engineers and Scientists” by Tim Lamkins, SPIE Press acquisitions editor, and “The Craft of Scientific Presentations: A Workshop on Technical Presentations” by Cody Curtis and Kathryn Krages, instructors at the Oregon Health and Science University (Beaverton, OR).

“I think it’s good for people not to stick to conferences in the fields with which they’re familiar. They should venture to unknown territories and listen to talks in other areas,” says Kafafi. “SPIE provides a very good channel for exactly that by having interesting workshops and tutorials, and broad-spectrum plenary sessions. Attendees will benefit by learning about other technologies, and possibly integrate some of them with their present work.”

Another good place to explore the new up-and-coming technology is at the Optics & Photonics Exhibition, 15–17 August. More than 250 exhibiting companies will be present to reveal the latest trends and commercial developments in optical engineering, materials and devices, remote sensing, nanotechnology, signal and image processing, and x-ray optical technologies, among others.

This symposium is a can’t miss event for the optics and photonics community. To read the program, visit spie.org/events/op.

—Beth Huetter, Staff Editor

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Small Concerns

Kristen Kulinowski, director of the International Council on Nanotechnology (ICON) at Rice University (Houston, TX) will give the plenary presentation “Nanotechnology: Managing Potential Risks in a Climate of Uncertainty” on Sunday, 13 August.

ICON is a multi-stakeholder initiative that comprises industry, academia, government, and non-government organizations interested in understanding and minimizing the risks associated with nanotechnology. ICON works with these different organizations to assess practices and safety standards at companies that work in nanomaterials.

“The companies that we interact with are very interested in understanding what are the best ways to handle nanomaterials in the workplace,” says Kulinowski.

“No company wants to spend millions of dollars on R&D only to find out these materials are going to pose an unacceptable risk to human health or the environment.”

With recent attention regarding the safety of nanomaterials, she says, “It’s an excellent time to be having a discussion with the research community about the promise of nanotechnology and how to secure a bright future that is untainted by environmental contamination, by human health hazard, by ecotoxicology. By keeping the dialogue going and opening the door to a variety of different factors in society, including the nanotech critics, I believe that we’ll get there.”

—B.H.
Gold Medal Performance

SPIE Fellow Duncan Moore is this year’s recipient of the Gold Medal of the Society—the highest honor given by SPIE.

From associate director for technology in the White House Office of Science and Technology Policy to founder of Gradient Lens Corporation to president of the Optical Society of America (OSA), Duncan Moore has had a varied and amazing career in optics. A career being honored this year with the Gold Medal of the Society, the highest honor bestowed by SPIE.

Currently Moore is the Rudolf and Hilda Kingslake Professor of Optical Engineering at the University of Rochester (U of R; Rochester, NY) Institute of Optics and professor of entrepreneurship in the U of R's Simon Graduate School of Business. In his own words, “Optics has been very, very good to me.”

Duncan Moore in his lab at the University of Rochester’s Institute of Optics.

Moore’s interest in space and optics continued to grow, and he began college hoping for a career in astronomy, specifically in astronomical instrumentation. This plan, however, changed as the result of a summer job he held at Itek in Lexington, MA.

There he shared an office with Robert Fischer—now a former president of SPIE and current president of OPTICS I (Westlake Village, CA)—and Tom Sloan—who would go on to own Southern Optical. Moore worked with a number of people at Itek who were either already big names in the field or who would go on to be.

“They kept talking about this place called U of R, and so I learned from all these guys about the optics degree here. I came to U of R in 1969 with the intention of being here for one year, and I’ve been here almost continuously since then. I got here, and I had fantastic faculty members. I had people like Brian Thompson, Rudolf Kingslake, Phil Baumeister, and Bob Hopkins. I got here and thought, ‘wow, this is incredible.’ ”

While at U of R, Moore began his career of innovative research, especially in the area of gradient optical systems. For his master's thesis, he designed the first lenses with either an axial or a radial gradient using aberration theory. For his PhD thesis, he developed the first raytrace algorithm that would allow both gradient index, or GRIN, materials and discrete surfaces.

Moore’s many other research accomplishments include: co-writing the first computer program to optimize lenses with GRIN materials, building the first interferometer to measure the GRIN profile, and fabricating the first axial gradient lens ever.

He's fostered even more breakthroughs as advisor to dozens of master’s and doctoral candidates over the years. A number of these students have gone on to successful careers in optics. Just one example is Susan Houde-Walter, 2005 OSA president, whom Moore advised for both her master's and doctoral theses.

“I think one of the things that kept me in the field is that working with young, smart students is really very rewarding,” he says.

Student and professor are certainly not the only roles he’s had in his career. In 1980, he founded the Gradient Lens Corporation. A successful company now, Moore says getting to that point was a long road. “We worked off
In the Lab
Duncan Moore keeps busy with a number of cutting-edge research projects. Here are three he’s currently working on with teams at the University of Rochester.

Human Eye Gradient Lens
Moore is studying how the human eye’s lens shape accommodates as people’s vision changes over time. “I’m trying to understand the visual process of how the gradient interacts with the visual system. It becomes important because people are looking at the possibility of lens implants that will allow them to accommodate after 45 years of age, and we’d like to understand how humans do that.”

Insect Eye Sensors
In another eye-related project, Moore and team are working on ways to make affordable insect-type visual systems. “You can envision having one eye here in the middle of my office and one down the corridor, so the one in my office starts turning on lasers in all different directions until it actually hits the one that’s down the corridor. Then when the one in the corridor receives the signal, it turns on the laser and sends the laser beam back, and you open up a channel between the two.”

Solar Cell Arrays
In conjunction with the University of Delaware, Moore is researching arrays of lenses that would allow people to charge their laptops using solar power. “The idea is you open up your laptop and out of the back of the screen is something that’s up to 10-mm thick that folds out and chases the sun.”

SBIRs, we worked off contract research, and then we introduced the Hawkeye Botoscope at a trade show in 1996. Not until then did we have a successful commercial product. Finding a market niche for a new technology can take a real long time.”

White House Bound
Another sector Moore has made his mark in is government. On a sabbatical from U of R in 1993–94, he was the American Physical Society Congressional Science Fellow in Senator John D. Rockefeller’s office.

A few years later, after presidential nomination and Senate confirmation, Moore served for three years as the associate director for technology in the White House Office of Science and Technology Policy. Among many initiatives, he says, “we were working on the whole issue of what we call the society-driven science and technology agenda. That is, how science and technology can work to improve the lives of the average American.”

One of the programs, called ElderTech, was aimed at utilizing science to allow older people to live independently longer. Though the program never blossomed into a full-blown initiative, Moore is currently working on a related subject as part of a program at the Stanford Center for Longevity.

“I’m working on the geopolitical issues of aging right now, and working with other universities around the country and around the world.” For more on this topic, see an exclusive article online at spie.org/SPIEProfessional.

During 1990–91, he chaired the Hubble Space Telescope Independent Optical Review Panel, which determined the optical adjustment needed for the then-ailing Hubble.

Moore has also served as the president and CEO of the Infotonics Technology Center, which fosters R&D collaboration among photonics industry, universities, and government.

While he’s a member of many technical societies, Moore is an SPIE Fellow and an OSA Fellow, and has contributed enormously to both organizations including serving as president of the OSA in 1996.

Considering all of Moore’s accomplishments, Dennis Hall, associate provost for research and graduate education at Vanderbilt University (Nashville, TN), points out perhaps the most important aspect of Moore’s career, “A common thread that runs through everything Duncan touches is how deeply he cares about the welfare of everyone with whom he comes into contact—I think this is the focus of everything he does.”
2006 SPIE Award Recipients

Each year SPIE recognizes outstanding achievements through its awards program. The Awards Committee is pleased to announce the 2006 SPIE award recipients.

Gold Medal of the Society
Duncan T. Moore
The Gold Medal is the highest honor that the Society bestows. It is awarded annually in recognition of outstanding engineering or scientific accomplishments in optics, electro-optics, or photographic technologies or applications. To receive the award, the recipient must have made an exceptional contribution to the advancement of relevant technology.

This year the Gold Medal is presented to Duncan T. Moore, University of Rochester, USA, for his numerous contributions and innovative research in optical engineering as well as his significant contributions in the field of gradient index systems.

Read a profile of Moore in this issue of SPIE Professional, page 22.

George W. Goddard Award
Martin C. Weisskopf
The George W. Goddard Award is given annually in recognition of exceptional achievement in optical or photonic instrumentation for aerospace, atmospheric science, or astronomy. The award is for the invention and development of a new technique, photonic instrumentation, instrument, or system.

Martin C. Weisskopf, NASA Marshall Space Flight Center, USA, is the 2006 George W. Goddard Award recipient for his vital contributions to the Chandra X-ray Observatory.

A. E. Conrady Award
Virendra N. Mahajan
The A.E. Conrady Award is given annually in recognition of exceptional contributions in design, construction, and testing of optical systems and instrumentation. The recognition of this award is based on developments of new equipment, techniques, and applications for designing, testing, analyzing, and/or evaluating optical systems, components, and theories.

Virendra N. Mahajan, Aerospace Corporation, USA, is this year’s A.E. Conrady Award recipient for his innovative contributions to optical imaging and aberrations.

Harold E. Edgerton Award
Takeharu Goji Etoh
The Harold E. Edgerton Award recognizes outstanding contributions to optical or photonic techniques in the application and understanding of high-speed physical phenomena. The development of new technologies and the new application of existing technologies are considered in the determination of the award.

Takeharu Goji Etoh, Kinki University, Japan, is the 2006 Harold E. Edgerton award recipient for his significant contributions to the development and reduction to practice of the ultra-high-speed digital camera.
Rudolf Kingslake Medal and Prize

The Rudolf Kingslake Medal and Prize is awarded annually by the Kingslake Award Committee to recognize the most noteworthy original paper to appear in SPIE’s journal *Optical Engineering* on the theoretical or experimental aspects of optical engineering. The 2005 Rudolf Kingslake Medal and Prize will be announced at the Optics & Photonics symposium and in the October issue of SPIE Professional.

President’s Award

The President’s Award, a discretionary award plaque, may be given to an individual who, in the opinion of the President and the Board of Directors, has rendered a unique and meritorious service of outstanding benefit to the Society. The President’s Award will be announced at the Optics & Photonics symposium and in the October issue of SPIE Professional.

SPIE Educator Award

James M. Palmer

The SPIE Educator Award is given in recognition of outstanding contributions to optics education by an SPIE instructor or an educator in the field.

James M. Palmer, University of Arizona, USA, is the 2006 SPIE Educator Award recipient for his substantial and sustained contributions to education in the critical area of radiometry.

Frits Zernike Award

Timothy A. Brunner

The Frits Zernike Award for Microlithography is given for outstanding accomplishments in microlithographic technology, especially those furthering the development of semiconductor lithographic imaging solutions.

Timothy A. Brunner, IBM Thomas J. Watson Research Ctr., USA, is the recipient of the 2006 Frits Zernike Award for Microlithography for significant achievements to the fields of microlithography and optical lithography.

Dennis Gabor Award

Demetri Psaltis

The Dennis Gabor Award is presented annually in recognition of outstanding inventive accomplishments in electro-optical systems, especially those that further the development of holographic imaging and metrology applications.

Demetri Psaltis, California Institute of Technology, USA, is the recipient of the 2006 Dennis Gabor Award for his outstanding contributions and novel applications of holography in information processing.

G. G. Stokes Award

Kazuhiko Oka

The G.G. Stokes Award is given for exceptional contribution to the field of optical polarization. It may be presented for a specific achievement, development, or invention of significant importance to optical science and society, and may be given for lifetime achievement.

Kazuhiko Oka, Hokkaido University, Japan, is the 2006 G. G. Stokes Award recipient for his revolutionary techniques in polarization research and accomplishments in encoding Stokes parameters on spectral and spatial frequencies.

SPIE Technology Achievement Award

Jean-Louis de Bougrenet de la ToCNaye

The SPIE Technology Achievement Award recognizes outstanding accomplishments in optical, electro-optical, or photonic engineering technology. The recipient shall have contributed significantly to the advancement of these technologies with a specific demonstration of optical technology in a new system or application and its reduction to practice.

This year the SPIE Technology Achievement Award is presented to Jean-Louis de Bougrenet de la ToCNaye, GET-Ecole Nationale Supérieure des Télécommunications Bretagne, France, for his pioneering contributions to liquid crystal technology in telecommunications systems and in optics.
SPIE Elects 33 New Fellows

SPIE will honor 33 new Fellows of the Society this year. Fellows are members of distinction who have made significant scientific and technical contributions in the multidisciplinary fields of optics, photonics, and imaging. They are honored for their technical achievement, for their service to the general optics community, and to SPIE in particular. “The annual recognition of Fellows provides an opportunity for us to acknowledge outstanding members for their service to the general optics community,” says SPIE President Paul McManamon.

David L. Andrews
University of East Anglia, United Kingdom, for specific achievements in light-harvesting materials.

Maria L. Calvo
Complutense University of Madrid, Spain, for specific achievements in optical waveguide theory, holography, and service to the international optics community.

G. Groot
Lambda Research Corporation, USA, for specific achievements in optical software design.

John H. Bruning
Coming Tropel Corporation, USA, for specific achievements in phase measuring interferometry and short wavelength technology.

Casimer M. DeCusatis
IBM Corporation, USA, for specific achievements in the design, packaging, testing, and deployment of optical fiber data communication networks.

Kevin G. Harding
GE Global Research Center, USA, for specific achievements in optical metrology and optical inspection.

Arnold Burger
Fisk University, USA, for the development of new photonic devices for detecting and imaging visible light, x-rays, and gamma rays.

Victor L. Gamiz
Air Force Research Laboratory, USA, for specific achievements in unconventional imaging using diversity of light, promoting research in optical polarization for military applications, and promoting international optical research in Russia.

Daniel J. C. Herr
Semiconductor Research Corporation, USA, for the development and commercialization of two early families of chemically amplified resists and critical patterning and control challenges in the deep nanodomain.
Anil K. Jain
Michigan State University, USA, for specific achievements in pattern recognition and biometric authentication.

Chennupati Jagadish
Australian National University, Australia, for pioneering contributions to semiconductor optoelectronic devices, photonic integrated circuits, and nanophotonics.

Charles Joenathan
Rose-Hulman Institute of Technology, USA, for specific achievements in speckle metrology, unique applications of holographic optical elements, and optics education.

Tribikram Kundu
University of Arizona, USA, for specific achievements in non-destructive evaluation and health monitoring of engineering and biological materials and structures.

Eric G. Johnson
University of Central Florida, USA, for specific achievements in micro-optics and nano-optics.

Phillip A. Laplante
The Pennsylvania State University, USA, for specific achievements in real-time image processing.

James R. Janesick
Sarnoff Corporation, USA, for groundbreaking contributions to the development of high-performance scientific charge-coupled devices.

Mahendra P. Kothiyal
Indian Institute of Technology Madras, India, for specific achievements in applied optics.

Cheng-Chung Lee
National Central University, Taiwan, for specific achievements in thin-film coating.

Alex K.-Y. Jen
University of Washington, USA, for specific achievements in organic and polymeric functional materials research and nanotechnology for photonics applications.

Muradin A. Kumakhov
Institute for Roentgen Optics, Russia, for specific achievements in x-ray and neutron capillary and polycapillary optics theory and applications.

Jongmin Lee
Gwangju Institute of Science and Technology, Korea, for specific achievements in laser spectroscopy and high-power lasers.

Now It’s Your Turn
Nominate an SPIE member you think deserves the distinction of Fellow. Nominations for the 2007 class of Fellows will be accepted through 1 October 2006. More information and nomination forms are available at spie.org/Fellows.
Longxia Li
Yin nel Tech Inc., USA, for specific achievements in the growth of compound semiconductors, particularly cadmium zinc telluride and mercury cadmium telluride, for infrared, x-ray, and gamma detection applications.

Joanna Schmit
Veeco Instruments Inc., USA, for innovative contributions in the areas of optical metrology and interferometric fringe pattern analysis.

Kurtis J. Thome
University of Arizona, USA, for specific achievements in remote sensing.

Chris A. Mack
KLA-Tencor Corporation, USA, for specific achievements in optical lithography.

Vladimir M. Shalaev
Purdue University, USA, for specific achievements in plasmonic nanophotonics and optical sensors.

Mary G. Turner
Engineering Synthesis Design Inc., USA, for specific achievements in computer-aided optical design training.

Fernando Mendoza Santoyo
Centro de Investigaciones en Óptica, Mexico, for specific achievements in optical metrology.

Tomasz Szoplik
Warsaw University, Poland, for specific achievements in applied optics and optoelectronics, in particular holography, anamorphic Fourier optics, morphological optical-digital processing, photonic crystal fibers, and metamaterials.

James C. Wiltse
Georgia Institute of Technology, USA, for specific achievements in the theory and application of large-aperture Fresnel zone plates at terahertz- and millimeter-wave frequencies.

Dan V. Nicolau
Liverpool University, United Kingdom, and Monash University, Australia, for specific achievements in bionanotechnology.

Hugo Thienpont
Vrije Universiteit Brussel, Belgium, for specific achievements in photonic interconnects, micro-optics, optical fiber sensors, and VCSELs.

Xiaocong Yuan
Nanyang Technological University, Singapore, for specific achievements in the development of micro-optics for discrete and integrated elements.
Top Scholarships Go to Chau, Mohanty

Kenneth Chau Receives SPIE D. J. Lovell Scholarship

Kenneth Chau, a graduate student at the University of Alberta’s Department of Electrical and Computer Engineering (Edmonton, Alberta, Canada), is this year’s recipient of the D. J. Lovell Scholarship, the largest SPIE scholarship, worth $11,000.

Graduating with a doctorate in 2007, he also tutors, is the Electrical and Computer Engineering (ECE) Department representative of the Graduate Student Association, founding member of the university’s SPIE student chapter, and vice president academic of the ECE Graduate Student Association (ECEGSA), through which he planned and coordinated a conference for ECEGSA students. In addition, he has published nine journal papers as of this summer, with 16 other conference papers or presentations under his belt.

“I enjoyed science growing up,” says Chau. “I pursued a doctorate because I was curious about how things work. To me it seemed like a natural progression. I love the research and attacking different problems.”

As an undergraduate, Chau worked on preventing micro-cracks in the process of micromachining glass and developed detectors for wax formation in oil pipelines. Currently, he is researching terahertz electromagnetic propagation in, and scattering from, mesoscopic, sub-wavelength-size materials.

“He is the first person who drew the analogy between photon propagation and electron transport in magnetic systems and managed to experimentally prove it,” says his graduate advisor, Abdul Elezzabi.

“Ken is in the top one or two students of the approximately 300 graduate students whom I have interacted with,” says Ying Yin Tsui, professor and associate chair of graduate studies at the University of Alberta.

Chau plans to use the scholarship money to attend more international conferences.

“In Canada, it’s sort of a one-shot deal,” Chau explains. “You have to apply and you get funding to only go to one conference [per year]. With this award, I can go to more conferences, which is great since here in Canada we’re a little bit isolated.”

Chau also received a $1500 SPIE scholarship award in 2004.

Khyati Mohanty Awarded Major SPIE Scholarship

Khyati Mohanty is a recent graduate of the Maharaja Sayjirao University of Baroda (Baroda, India) and is the 2006 recipient of the SPIE Scholarship in Optical Science and Engineering, worth $10,000. It is the second-largest scholarship given by the Society.

Though she majored in electrical engineering, Mohanty’s real passion is biomedical optics. Her interest began while she was still in high school.

“My fascination turned into summer training at Medtronic Inc. and Baroda Heart Research Institute on cardiac electrophysiology,” says Mohanty.

Her acute asthma unfortunately took a toll on her schooling, until biomedical optics stepped in.

“Dr. Nagpal, president of the Acupuncture Society of India (Jaipur, India), treated me with laser acupuncture treatment,” explains Mohanty. “It was a boon for me and now I am leading a normal healthy life with no problems.”

Since then she has flourished as a researcher.

“Students and faculty often remark that Khyati is blessed with considerable talent and uncanny skills,” says C. S. Narayanamurthy, professor of applied physics at M.S. University of Baroda. “In over 15 years of teaching, I haven’t known any other students with talent equivalent to Khyati.”

“Alongside her professional career,” says K. Divakar Rao of the Center for Advanced Technology (Indora, India), “the most impressive thing about her is that she constantly wishes to improve herself in terms of knowledge and skill.”

Being a woman researcher in India has also brought struggles.

“In giving opportunities such as remuneration for the work, equal chance, etc., a woman is second-preferred,” says Mohanty. “Additionally there was always uncertainty about whether I would be able to pursue my career after marriage. But I was lucky as I got a very understanding hubby who has been more of an inspiration to me.”

Mohanty will pursue her doctorate in biomedical optics in the United States. She will use the scholarship to pay for her schooling.

—Beth Huetter, Staff Editor
SPIE 2006 Scholarship and Grant Recipients

This year SPIE will award 129 SPIE scholarships and grants, for a total of $260,500, to SPIE student members and educational institutions.

The mission of the SPIE Scholarships and Grants Program is to recognize, assist, and encourage SPIE student members and academic organizations with outstanding potential for long-range contribution to the field of optics and photonics.

Award-winning applicants were evaluated and selected by the SPIE Scholarship Committee and approved in April by the SPIE Board of Directors’ Executive Committee.

Forty-two of the scholarships will be given to U.S. citizens (39%), and 66 to applicants from other countries (61%), including Afghanistan, Australia, Canada, China, Egypt, France, Germany, Greece, India, Iran, Ireland, Latvia, Mexico, Nigeria, Poland, Russia, Singapore, Thailand, Turkey, and the Ukraine. Of the 108 scholarships awarded, 27 will be given to women (25%).

Twelve grants are to U.S.-based institutions and nine to institutions in other countries, including Ireland, Russia, Ukraine, and the United Kingdom.

“To date, SPIE has distributed nearly $3 million dollars in individual scholarships and institutional grants. This ambitious effort reflects the Society’s commitment to education and to the next generation of optical scientists and engineers around the world,” says SPIE President Paul McManamon.

SPIE 2006 Scholarship Recipients

Recipients of SPIE Scholarships named in honor of meritorious individuals or programs are:

D. J. Lovell Scholarship: Kenneth J. Chau, Univ. of Alberta (Canada). The $11,000 D. J. Lovell Scholarship is the Society’s most prestigious scholarship. This scholarship is sponsored by SPIE with contributions from Labsphere Inc.

The second largest scholarship given by SPIE, the $10,000 SPIE Scholarship in Optical Science and Engineering, was awarded to Khyati S. Mohanty, Maharaja Sayajirao Univ. of Baroda (Baroda, India). Read more about Chau and Mohanty on page 29.

Laser Technology, Engineering and Applications Scholarship: Miguel A. Bandrés, California Institute of Technology (Pasadena, CA). This $4,000 scholarship is awarded in recognition of the student’s scholarly achievement in laser technology, engineering, or applications. This is sponsored by SPIE with contributions from the Forum for Military Applications of Directed Energy (F-MADE).

William H. Price Scholarship in Optical Engineering: Costin E. Curatu, Univ. of Central Florida (Orlando, FL). The $3,000 William H. Price Scholarship in Optical Engineering was established in 1985 to honor Bill Price, a well-respected member of the SPIE technical community. This scholarship is awarded to a full-time graduate or undergraduate student in the field of optical design and engineering.

BACUS Photomask Scholarship: Wojtek J. Poppe, Univ. of California, Berkeley. The $2,500 BACUS Scholarship is awarded to a full-time undergraduate or graduate student in the field of microlithography with an emphasis on optical tooling and/or semiconductor manufacturing technologies. This scholarship is sponsored by BACUS, SPIE’s Photomask International Technical Group.
Other SPIE Scholarship Recipients

Viswanathan Alagan, National Institute of Technology (India)
Felipe Alberdi, College of Optics & Photonics/Univ. of Central Florida
Kirk D. Anderson, Michigan Technological Univ.
Subashini Asokan, Rice Univ.
Joseph L. Baccanti, Indiana Univ. of Pennsylvania
Ivan Barrientos, Hickman High School
Rochester Institute of Technology
Gregor Knoener, Lomonosov Moscow State Univ. (Russia)
Liana V. Kuznetsova, Dr. of Chemistry, National Univ. of Technology/Institute (Ukraine)
Kumar Rajesh, Chernivtsi National Univ. (Ukraine)
Elena Krutkova, Lomonosov Moscow State Univ. (Russia)
Nataliya Polikarpova, Moscow Engineering Physics Institute (Russia)

2006 SPIE Grant Recipients

Chernivtsi National Univ. (Ukraine)
College of Charleston
Colorado School of Mines
Ivan Franko National Univ. of Lviv SPIE Student Chapter (Ukraine)
Great Lakes SPIE Regional Chapter and Great Lakes Student Chapters
Kharkov National Univ. (Ukraine)
Montclair State University
MV Lomonosov Moscow State Univ. (Russia)
New Mexico State Univ.
Rice Univ.
St. Petersburg State Polytechnic Univ. (Russia)
St. Petersburg State Univ. of ITMO (Russia)
Texas Christian Univ.
Three Rivers Community College
University College Dublin SPIE Student Chapter (Ireland)
University College London (UK)
University of Arizona, College of Optical Sciences
University of California/Tiruchirappalli (India)
University of Connecticut (U.S.)
University of Illinois at Urbana-Champaign
University of Kentucky
University of Leiden (Netherlands)
University of Lutsk (Ukraine)
University of Rochester, Institute of Optics
Washington Univ. School of Medicine

And the Winner Was . . .

Jennifer Kehlet Barton received the 1997 D. J. Lovell Scholarship as a PhD student in biomedical engineering at the University of Texas at Austin.

After graduating, she immediately interviewed for faculty positions, unsure whether she would be seriously considered without post-doctorate experience.

“I am certain that this prestigious scholarship helped convince the search committee that I was the most worthy candidate,” says Barton. She also believes it played a role in her secondary appointment at the UA Optical Sciences Center two years later.

Since then, she has become an associate professor at the University of Arizona (UA; Tucson, AZ), teaching bioinstrumentation and biophotonics, as well as signals and systems.

Her research focuses on developing miniature delivery systems for optical diagnostic techniques, particularly optical coherence tomography and fluorescence spectroscopy.

Her project group has used small, high-resolution endoscopes for time-serial visualization of epithelial cancer development and cell growth in bioreactors.
Hamamatsu CEO Receives Visionary Award

Hamamatsu Photonics K. K. CEO Teruo Hiruma is the 2006 recipient of the SPIE Visionary Award. Hiruma is honored for his visionary guidance of Hamamatsu Photonics K. K. to international recognition as a leading supplier of high-quality products, his work that has expanded the frontiers of photonics technology, and his advocacy for photonics research for the betterment of the human condition.

SPIE President Paul F. McManamon and Executive Director Eugene G. Arthurs recently returned from a trip to Japan, where they presented Hiruma with the award.

Arthurs says that for many years Hiruma has promoted photonics for addressing problems facing all of humanity, such as energy, environment, healthcare, and communications. “He has gone way beyond the immediate interests of his company which, consistent with his vision, is strong in these technical areas,” says Arthurs.

After graduating from Hamamatsu Technical College in 1947, Hiruma helped establish Hamamatsu Photonics K. K. where he has held a number of key positions. He was awarded a commendation by the Japanese Minister of the Science and Technology Agency for the development of a special image pick-up system for ultrafast (picosecond) phenomena in 1983.

Hiruma is just the second recipient of the SPIE Visionary Award. The first recipient was Nobel laureate Richard Smalley.

Barrett, Myers Receive Goodman Book Award


Given biennially with a $5000 prize, the award recognizes a recent and outstanding book in the field of optics and photonics that has contributed significantly to research, teaching, or the optics and photonics industry.

The Barrett and Myers work explores the basic theories behind imaging systems, including the principles, mathematics, and statistics needed to understand and evaluate these systems. The book provides a strong foundation for graduates and undergraduates and workers in the field of imaging science, from satellites to medicine and beyond.

The joint SPIE-OSA award committee describes the book as “a superb example of scientific and technical writing” and “likely to become the standard text for the next generations of students interested in image science.”

To be eligible for the award, books should be published recently, and should be “authored” technical books rather than handbooks, reviews, or compilations. Nominated books must be in print, readily available, and must be available in English.

The endowment for this award is a personal gift from Joseph W. and Hon Mai Goodman. Goodman says he hopes the award will encourage book writing by researchers and educators at all stages of their careers.
SPIE and the Optical Society of America (OSA) awarded their 2006–2007 Congressional Fellowship to Eleanore B. Edson. This jointly sponsored program places the recipient in the office of a U.S. senator, representative, or congressional committee. While participating in the creation and implementation of public policy, the fellow helps the government to effectively utilize scientific knowledge and forges relationships among the scientific, engineering, and public policy communities.

Edson, an ideal recipient of the fellowship, possesses extensive experience communicating technical knowledge about biomedical research, biotechnology, mental health, AIDS, and smallpox to non-scientists.

Earlier this year she served as the National Academies’ Christine Mirzayan Science and Technology Policy Graduate Fellow in Washington, DC, where she attended many congressional hearings about contemporary issues in science, and conducted primary research on sleep disorders and reusable ventilation masks for pandemic influenza.

Edson majored in biological sciences at Stanford University (Stanford, CA) and received her PhD in neurobiology from Harvard University (Cambridge, MA). Her dissertation researched the transfer of information through the mammalian visual system over its development. The two classes of proteins she studied are essential for preventing neurodegenerative diseases like Parkinson’s, Alzheimer’s, epilepsy, and schizophrenia.

In the future, Edson plans to research emerging biotechnology and participate in the development of legislation that both encourages and regulates advancing biotechnology. As the SPIE/OSA fellow, Edson will gain unique firsthand experience about how lawmakers balance such ethical considerations with the need for scientific innovation. Edson hopes to apply her new understanding of domestic and international scientific policy to future research and public policy work.

Edson’s term as congressional fellow runs from September 2006 through August 2007.
Yoseph Bar-Cohen Receives NASA Honor Award Medal

Yoseph Bar-Cohen of NASA’s Jet Propulsion Laboratory (JPL; Pasadena, CA) recently received the NASA Honor Award Medal for Exceptional Technology Achievement for his work and contributions to the field of electroactive polymer actuators, or artificial muscles.

Two notable discoveries of Bar-Cohen are leaky Lamb waves and polar backscattering phenomena in composite materials.

SPIE Fellow Bar-Cohen is the editor of two SPIE Press books: Electroactive Polymer (EAP) Actuators as Artificial Muscles: Reality, Potential, and Challenges and Biologically Inspired Intelligent Robots. He has also received two SPIE Smart Structures & Materials/NDE Symposium Lifetime Achievement Awards.

Vo-Dinh Named Director of Fitzpatrick Institute for Photonics

Tuan Vo-Dinh has been appointed director of the Fitzpatrick Institute of Photonics at Duke University’s Pratt School of Engineering (Durham, NC).

SPIE Fellow Vo-Dinh says he plans to build on the Fitzpatrick Institute faculty’s strengths—biophotonics, optical materials, and quantum information technology—as well as expand into new areas like nanophotonics. One of the institute’s goals is to emphasize translational research activities that put technology into the service of society.

“Photonics has been at the heart of the information technology revolution, and it can have similar impact in many critical areas such as medicine at the point-of-care, molecular manufacturing, national defense and global health,” says Vo-Dinh.

“We are very fortunate to have Tuan join us at Duke,” says dean of the Pratt School of Engineering and SPIE board of directors member Kristina Johnson. “He cares very deeply about people and in making a difference.”

Vo-Dinh was previously the director of the Center for Advanced Biomedical Photonics at the Oak Ridge National Laboratory (Oak Ridge, TN).

Vo-Dinh has won seven R&D 100 Awards, and holds more than 30 patents. He will chair this year’s SPIE Optics East Symposium.

Townes Awarded 2006 Vannevar Bush Award

The National Science Board has awarded Charles H. Townes a Vannevar Bush Award for his lifetime contributions to science and his long-standing statesmanship in science on behalf of the nation.

Townes is considered the father of quantum electronics, and shares a Nobel Prize in physics with Alexander M. Prokhorov and Nikolai Basov. Among many accomplishments, he invented the maser, was vice president and director of research of The Institute for Defense Analysis (1959–61), vice-chair of the Science Advisory Committee to the President of the United States, and chaired the Advisory Committee for the first human landing on the moon. Still active in his 90s, he has spent the past 39 years at the University of California, Berkeley.

The Science Board is a 24-member body of policy advisors to the president and Congress on matters of science and engineering research, and is the policy making and oversight body for the National Science Foundation.

Shoop Named U.S. Science Advisor

Colonel Barry L. Shoop was recently named science advisor to retired Army General Montgomery Meigs, director of the Joint Improvised Explosive Device Defeat Organization (JIEDDO) in Arlington, VA.

SPIE Fellow Shoop is currently the director of the Electrical Engineering Program at the U.S. Military Academy at West Point, NY, and will serve in the capacity of science advisor for one year.

The organization was originally established as a task force in 2003 but as U.S. service members have continued to fall to the simple but deadly devices, this has become a top Pentagon priority. The newly renamed Joint IED Defeat Organization now has over 300 employees and in excess of a $3 billion budget.

Shoop has served as chair of the Conference on Education and Training in Optics and Photonics.

Shoop would like the input of the technical community with IED detection and defeat. To volunteer, contact Shoop at Barry.Shoop@usma.edu.
Group Supports American Competitiveness Initiative

This March members of SPIE and the Optical Society of America joined nearly 300 scientists, engineers, and business leaders who made visits on Capitol Hill as part of the 11th annual Congressional Visits Days (CVD). The team met with 40 congressional offices to express the need for increased and balanced federal investment in research and development.

“Senior staff members in both the House and Senate were very receptive this year to our visits and advocacy for the appropriation of funds for Science, Technology, Engineering and Mathematics (STEM) education and research,” says participant Keri Then.

One of the issues the group advocated for was support of the President’s American Competitiveness Initiative (ACI), which was announced in the January 2006 State of the Union Address as an effort to encourage American innovation and strengthen the ability of the United States to compete in the global economy.

This ambitious strategy would commit $5.9 billion in FY 2007, and more than $136 billion over 10 years, to increase investments in research and development, strengthen education, and encourage entrepreneurship and innovation. The initiative includes specific support recommendations for the National Science Foundation, the Department of Energy Office of Science, the National Institute of Standards and Technology and the Department of Education.

“It has taken years of effort to bring this issue to the forefront,” says SPIE Washington, DC, Representative Robert Boege. “It is critical that Congress hears from the notoriously silent science and technology community on this issue.”

More information about the American Competitiveness Initiative can be found on the web at www.whitehouse.gov/infocus/technology. Position papers drafted for Congressional Visits Day 2006 can be viewed at spie.org/Announcements/CVD.

Fujimoto Elected to National Academy of Sciences

The U.S. National Academy of Sciences has elected James G. Fujimoto (Massachusetts Institute of Technology; Cambridge, MA) as part of its newest class of 72 members for his distinguished and continuing achievements in original research.

“Election to the Academy is considered one of the highest honors in American science and engineering,” says Ralph Cicerone, president of the Academy.

The total number of active members is now 2,013. The National Academy of Sciences is a private organization of scientists and engineers dedicated to the furtherance of science and its use for the general welfare.

Woodward Awarded for Her UK Work

Ruth Woodward was honored during the 2006 British Female Inventors & Innovators Awards with a Gold Award for her PhD research on imaging skin cancer.

Nominated in the category of Information Technology Electronics & Commerce (ITEC) Innovators, she was given the award for her endurance and determination while working on her PhD and turning this work into her own company, HT Consultants Ltd.

“Ruth Woodward sets a great example and role model,” says Elizabeth Pollitzer of ITSynergy (London, UK). “She has been promoting UK technology in a challenging and demanding environment, representing the UK industry at an international level, and has succeeded in doing so globally.”

Woodward was a session chair on Terahertz Spectroscopy at this year’s Photonics West, and is chair of the SPIE Standards Committee.
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spieworks.com
Healthy Competition

Students can cultivate creativity, commercialize a product idea, and learn essential leadership skills through entrepreneurial competitions.

Scientists and engineers with entrepreneurship skills are great assets to companies. “Companies that aren’t filled with entrepreneurs today won’t be around 50 years from now,” says Steven Nichols, associate vice president for research and advisor to the Idea to Product (I2P) competition at the University of Texas at Austin (UT Austin).

Needing business-savvy employees, interviewers frequently ask candidates to speak to their entrepreneurial qualifications. Honing your entrepreneurial abilities now will give you an important edge on your competition, especially if you are new to the job market.

But you don’t have to enroll in an MBA program to become a keen entrepreneur. Instead, you can participate in one of the many entrepreneurial competitions held around the world. You’ll learn valuable skills as you turn an idea into a marketable product or service. In addition, winners receive cash prizes to help finance the development and marketing of their ideas.

A Different Kind of Competition

If you have little or no formal entrepreneurial training, it is best to begin with a competition focused on education, like the Instituto Tecnológico de Monterrey’s Muestra Emprendedora.

Students at the institute begin by taking a required course in entrepreneurial development. After this course, they participate in Muestra Emprendedora, a fair designed to showcase innovative ideas. “At the fair, a committee chooses the best ideas based on their originality, feasibility, and the quality of their business plan,” says Carlos López Mariscal, a former participant and doctoral student studying optics at the institute.

After the competition, students understand tangible factors for success, like local markets and infrastructure, as well as intangible factors, like culture and communication. Mariscal reflects, “At Muestra Emprendedora, I learned that even the most simplistic systems have a long way to go before being fool-proof and marketable.”

Many students enter this competition multiple years in a row and some even receive credit to conduct research overseas. Past winners have received attention from international organizations like the United Nations. This publicity is essential for these young businesses and technologies to secure funding.

To prepare their students to succeed in the working world, the University of Texas at Austin competition offers another innovative model: providing funds for new companies and teaching students to be successful entrepreneurs.

“The main skills that are derived through technology innovation are creativity and leadership. But most engineering and science courses don’t develop these skills in students, and these are the skills that students most desperately need,” Nichols says.

In the first phase of I2P, participants develop a technology and identify a corresponding market. Past entries have included advancements in nanotechnology, computer science, biotechnology, pharmaceuticals, communications, and electromechanics. Some teams present original ideas developed while working on their degrees. Other teams choose to reapply and combine products or services already available but in need of improvement.

Working with successful entrepreneurs, lawyers, scientists, and technology experts, semifinalists refine their products and develop a timeline for implementing a product prototype. The finalists then deliver 10-minute business presentations to a panel of established local and international entrepreneurs who serve as competition judges.

The judges evaluate entries on market need, market opportunity, novelty, and innovation. Winning teams receive up to $9,000 in cash prizes.

“Companies that aren’t filled with entrepreneurs today won’t be around 50 years from now”

—Steven Nichols

Winners of the 2006 Idea to Product Competition with Steven Nichols (right) in Austin, TX.
I2P Winners Focus on Cancer Detection

“In the idea to Product competition, we learned to think like entrepreneurs,” says Mehul Sampat, an SPIE member studying biomedical engineering at UT Austin. Together, husband-and-wife team Mehul and Pallavi Sampat won $5,000 for developing and commercializing a new image-processing algorithm. Designed for computer-aided detection systems (CAD), their algorithm improves radiologists’ ability to detect architectural distortions accurately in mammograms.

An electrical engineering student, Pallavi Sampat conducted extensive market research for their product. “The workshops that I2P organizers conducted taught us about technology commercialization and what all is involved in the process of protecting intellectual property,” Mehul Sampat explains. “We explored the commercial world to discover the need and the market potential of our product. Discussions with our mentor helped us to distinguish between our primary customers (makers of CAD systems) and the end users (women who had a mammogram screening conducted).”

By participating in I2P, the Sampats learned how to make their innovative technology market-ready. Currently, they are collaborating with radiologists at the MD Anderson Cancer Research Center to further develop their algorithm.

Many teams from I2P have secured commercial licenses and formed new businesses. And, as a direct result of I2P, the University of Texas has received more than $1 million in research funding.

“Our program encourages students to work in interdisciplinary teams to identify and develop new technologies and to match those technologies to perceived social needs,” explains Nichols. “Because students work with those from other disciplines, it broadens their education and gives them a much better understanding of the skills that other disciplines bring to the table.”

One Team’s Success Story

Two former UT graduate students, Scott Evans and Donnie Vanelli, formed a partnership at Austin’s I2P that has lead to a burgeoning new business. By combining Evan’s talents in electrical engineering and Vanelli’s abilities as a mechanical engineer, they won $5,000 in prize money for their 3-D printing technology for silicon carbide parts. Vanelli and Evans also received additional funding from investors they met at I2P.

With the skills and financial support they received through I2P, Evans and Vanelli were able to launch Advanced Laser Materials Inc. They then licensed their technology and secured a grant for future research.

“I2P led me to the next stage of my education in entrepreneurship,” says Evans. After Evans graduated in 2005, he became the director of I2P and a lead researcher at UT Austin. “I also have gone on to consult for startups and to teach a graduate course in technology commercialization,” Evans says. Vanelli currently runs their company.

I2P Goes Globetrotting

Inspired by Austin’s I2P model, many universities—including Trinity College Dublin, National University of Singapore, Imperial College London, and Tsinghua University in China—have started their own local I2P competitions.

I2P International, an invitation-only competition, selects its teams from student entrepreneurs around the world, including the winners of local I2P competitions. “Last fall the international competition had representatives from 50 universities across five continents,” says Nichols who also advises I2P International. “It’s an interesting time for students to meet and compete against students from significantly different backgrounds.”

I2P International offers $26,000 to winners and invitations to Global Moot-Corp, a prestigious business plan competition that awards $100,000 each year.

You also might consider joining an interdisciplinary business plan competition like the University of Chicago’s New Venture Challenge (NVC). Similar to I2P, the objective of NVC “is to build a business plan around a product or service idea, vet the plan through a series of faculty panels and actual investor panels, and eventually provide seed funding for the best projects,” says Leo Irakliotis, associate chair of the Computer Science Department and director of the Computer Science Professional Programs.

And, unlike most business plan competitions that host day-long or weekend-long competitions, NVC is an interactive process that spans the academic year, including a course in entrepreneurial development. Over a period of nine months, students test out their ideas as they attend workshops and develop long-term mentor relationships.

“We emphasize how important networking and team management are not just in startups, but in almost any business venture,” says Ellen Rudnick, executive director of the University of Chicago’s Polsky Center for Entrepreneurship.

“Many of our teams include students and faculty from other local universities, alumni, experts, and advisors from the business world,” says Rudnick.

As a direct result of NVC, students have received more than $50 million in funding and secured patents. Many NVC participants have started successful new businesses, including:

• Sarvega, a high-tech infrastructure company that Intel bought last year;
• Medspeed, a medical laboratory logistical service;
• Noon Solar, a company that makes messenger bags and purses with solar panels that can recharge cell phones, PDAs, and other electronics; and
• Sun Phocus, winner of the 2006 MBA Jungle Competition for their electricity generating solar windows.

Each year NVC judges award $50,000 in cash prizes.

How to Get Involved

Though distance may prevent you from participating in Muestra Emprendedora, I2P, or NVC, many universities around the world invite science and engineering students to enter their entrepreneurial competitions. And with the growing number of interdisciplinary competitions, it is likely that you can find one close to home.

If there isn’t already an entrepreneurial competition at your school, consider beginning your own. With permission from the organizers of I2P, you can use their training materials, and UT faculty will even host workshops to make your local I2P a success. More information about I2P can be found at ideatoproduct.org. If you decide you want to begin your own branch, contact Steven Nichols at s.nichols@mail.utexas.edu or Scott Evans at scottevans@mail.utexas.edu.

—Jessica Locken, SPIE Staff Writer
Physics for Kids

About this time of year, kids are going on school breaks or holidays around the world. Pique your child’s or grandchild’s interest in science (or keep him or her from taking apart another clock as the case may be) with the help of these websites for kids on optics, physics, and engineering.

Top Notch Pick

Exploratorium
www.exploratorium.edu

This is a highly recommended site for all ages of kids and teens. Adults might just find themselves reading for hours, too. Dozens of experiments and an amazing amount of interesting information exploring many areas of science make this a site to bookmark. Especially interesting for teens is the Origins part of the site (www.exploratorium.edu/origins), which provides a huge amount of interactive information on the CERN, Hubble, Antarctica, Las Cuevas, Cold Spring, and Arecibo programs and efforts. The site is run by the Museum of Science, Art, and Human Perception, located in San Francisco, CA.

Sites for Ages 5 through 13

Zoom
pbskids.org/zoom

The website for an American television show of the same name, the site has science experiments, recipes, games, jokes, poems, and volunteer ideas, all sent in by viewers, offering a wealth of activities for kids ages 5 to 11 to do by themselves, with friends, or with parents.

Do Try This at Home

A great book of experiments for kids is available from SPIE Press: Light Action! Amazing Experiments with Optics is an illustrated book of home experiments involving optics and light for kids age 11 and older. The 200-page book contains a bevy of activities, which include how to: Bend light around corners; “Stop time” with a pair of sunglasses; Magnify pictures with an ice cube; and project a big-screen image from your small TV.

Just $12 for members and $15 for non-members, you can order the volume at bookstore.spie.org/PM150.

Optics for Kids
www.opticsforkids.com

Powered by the Optical Society of America (OSA), the site provides experiments and games for kids ages 5 through 10.

Engineering Interact
www.engineeringinteract.org

The aptly named site is chock full of interactive online games for 9- to 11-year-olds, based on the UK national curriculum, and developed by the University of Cambridge Department of Engineering.

Invention at Play
www.inventionatplay.org

Nicely designed, fun online activities for kids ages 9 through 11 are available in the site’s “Invention Playhouse,” along with stories about current and past inventors. Especially fun is the Tinker Ball “game” where kids can virtually assemble a Rube Goldberg-like contraption. The site is hosted by the Smithsonian National Museum of American History.

Physics Life
www.physics.org/Physics_Life

An interactive site run by Physics.org shows kids ages 9 through 11 how physics are a part of our everyday lives, with links to related subjects.

NASA Kids Site
www.nasa.gov/forkids

NASA has an extensive offering of activities, games, and learning for all ages, but especially ages 7 through 13. The site is naturally focused on outer space and NASA missions.

Discover Engineering
www.discoverengineering.org

The site provides links to many kids’ sites about engineering, and games and activities for 7- to 13-year-olds.

No Kids? No Problem.

If your kids are grown or you don’t have kids of your own, here are a few ways to encourage the next generation of engineers and scientists.

Local Science Fairs

Many schools have their own science fairs, and are usually looking for volunteers from the science and engineering communities. Give a local school a call and find out if they could use your help.

Engineers Week

Engineers Week is held each February, but the event’s site at www.eweek.org has resources to help you begin your own community’s Engineers Week outreach programs at any time. Engineers Week supports a variety of programs in conjunction with the event, including Introduce a Girl to Engineering, Discover “E,” and the Future City Competition™.

As part of the Discover “E” outreach program, you can visit local elementary, middle, and secondary schools and sponsor extracurricular activities, as well as work with community organizations to highlight engineering careers.

The Future City Competition™ offers engineers the opportunity to serve as volunteer mentors to help 12- and 13-year-olds in student teams design and build a future city, using SimCity software.

For more information on Engineers Week, visit their site at www.eweek.org.
SPIE 2006 Events Around the World

1. Optics & Photonics
   13–17 August 2006  San Diego, CA
   More than 5,000 participants and 250 exhibitors are expected at this symposium. See the special event preview on page 20 for more information.

2. Asia-Pacific Optical Communications (APOC)
   3–7 September 2006  Gwangju, South Korea
   APOC will address recent achievements and future trends in optical component and fiber-based devices, optical transmission and systems technologies, network architecture, management, and applications. APOC is collocated with Photonics Korea Exhibition.

3. Remote Sensing
   11–16 September 2006  Stockholm, Sweden
   This symposium encompasses everything from the earth to the sky, with conferences such as "Remote Sensing for Agriculture, Ecosystems, and Hydrology" and "Remote Sensing of Clouds and the Atmosphere." The prestigious event is an excellent opportunity to collaborate with new partners from other fields.

4. Optics/Photonics in Security and Defense
   11–16 September 2006  Stockholm, Sweden
   Colocated this year with Remote Sensing, this event focuses on international technical capabilities in security and defense with optics and photonics. Conference topics range from optics and photonics for counter-terrorism and crime-fighting to optically based biological and chemical detection for defense.

5. 26th Annual Symposium of Photomask Technology
   17–22 September 2006  Monterey, CA
   Photomask Technology is the most recognized international meeting for presenting innovations in mask-making technologies. This event attracts the people, institutions, and companies that drive this critical and influential industry.

6. Optical Imaging 2006
   25–27 September 2006  Bethesda, MD
   This workshop, Optical Imaging 2006: Fifth Inter-Institute Workshop on Optical Diagnostic Imaging from Bench to Bedside at NIH, includes invited oral presentations and contributed posters on the latest developments in imaging with the greatest potential for transferability to clinical and research utility.

7. Boulder Damage Symposium
   25–27 September 2006  Boulder, CO
   This symposium is the leading forum for the exchange of information on the physics and technology of materials for high-power and high-energy lasers.

8. Optics East
   1–4 October 2006  Boston, MA
   Optics East will host the researchers and the research behind many of the current breakthroughs in nanotechnology, biology, telecommunications, and environmental science. Featured topics encompass photonics for applications in industry, life sciences, and communications with a focus on optoelectronic components and systems for sensing applications. One hundred thirty exhibitors and 2,000 participants are expected from the local and the international optics and photonics community.

9. Asia-Pacific Remote Sensing
   13–17 November 2006  Goa, India
   The focus of the Fifth Asia-Pacific Remote Sensing Symposium is remote sensing for resource management and disaster warning and mitigation.

10. Smart Materials, Nano-, and Micro-Smart Systems
    10–13 December 2006  Adelaide, Australia
    This symposium provides the opportunity for networking with researchers and developers in smart materials and structures with special emphasis on packaging and integration of MEMS and NEMS for diverse application areas.

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