CONVERGENCE

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Newsletter of the CENTER FOR OPTICS MANUFACTURING

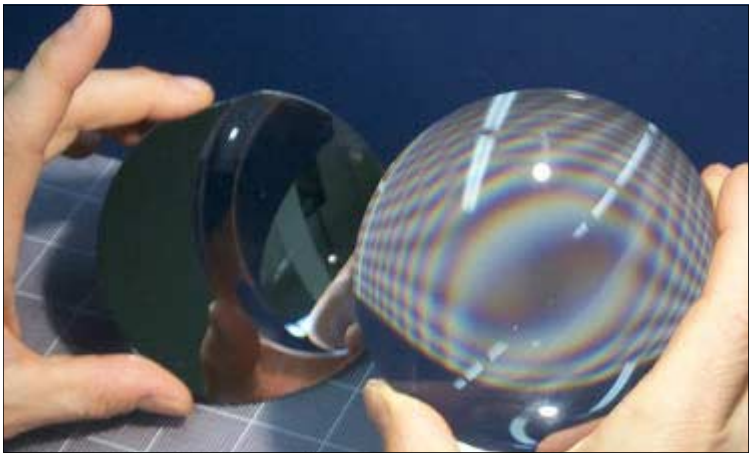
Take-Home Demos to Excite Young People about Careers in Technology

Dr. Stephen D. Jacobs

Center for Optics Manufacturing and Laboratory for Laser Energetics, University of Rochester

Problem: Every year the Exploring Division of the Boy Scouts of America in Rochester, NY conducts a career interest survey in area high schools. Students are given 100 career choices and asked to rank those most interesting to them. In 1999, of the 25,000 students responding, 1500 chose "engineering" as their career choice, making it #4 in the ranking behind teacher/professor (#3-1600 votes), doctor/surgeon (#2-1800 votes), and U. S. military (#1-1900 votes). In the previous three years that this survey was conducted, "engineering" ranked either #3 or #2. Why is it, then, that we hear about a reduction in enrollment of engineering majors in 2 year and 4 year college programs? Why are almost 2000 technical, entry-level jobs going unfilled in the local Rochester area? I don't claim to have the answer, but I have been told by some primary and secondary school educators that it can be hard to keep students on technology tracks because of the "difficulty of math," or the "early morning/late afternoon science lab."

The Education Committee / Rochester Section / Optical Society of America (OSA) has developed a K-10 presentation which, in some small way, tries to get children excited about technology through light and color. Our expectation is that the momentum imparted by this excitement can propel more students through the curriculum challenges leading to careers in technology. We have taken our presentation into the schools throughout the Rochester area, and it works (see insert). This short article tells you about our "optics suitcase." We invite you to pack your own career experiences in our suitcase, and take a career awareness trip to your child's school.



The school presentation begins with a silicon wafer and a silica lens.

Using Local Connections

Arranging a trip into the schools can be a formidable task, so we identified local programs that already do this and seek volunteers. Through the Rochester Area Career Education Collaborative (a program of the Industrial Management Council and the Monroe County schools) we gained

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access to 30 teachers and guidance counselors during a program visit to the Center for Optics Manufacturing (COM) last summer (reported in the Ceramic Bulletin, pp. 21-22, Oct. '99, and in Optics & Photonics News (OPN), p. 6, Nov. '99). From some lessons learned in that exchange, we contacted the Career Awareness Exploring Program (CAE) of the Boy Scouts of America in Rochester and volunteered to give presentations as part of their contracted and ongoing outreach program with Monroe County schools. To date, coupled with help from the Rochester Section membership and COM's students and staff, we have participated in, or arranged for, education outreach presentations as follows:

Date	Organization and Site	# attendees/ages
07/29/99	RACEC-"Manufacturing Matters! Worksite Visit," COM U of R, Rochester, NY	30 teachers / guidance counselors
09/30/99	OSA Annual Meeting/Educator's Day, Santa Clara , CA	15 educators
11/03/99	U of R undergraduate chapter of OSA, U of R, Rochester, NY	7 undergraduates
11/30/99	CAE-James Madison School of Excellence, Rochester, NY	50 eighth graders
01/05/00	CAE-The School Without Walls, Rochester, NY	30 tenth graders in chemistry
01/22/00	"Science Technology Hunt," *Science in Action Badge Workshop*, U of R, Rochester, NY	40 fourth - sixth grade girl scouts
01/26/00	Jefferson Road Elementary School, Pittsford, NY	40 kindergarten children
02/04/00	OSA Leadership Conference, Washington, DC	30 optics professionals
03/03/00	CAE-Martha Brown Middle School, Fairport, NY	40 sixth graders
03/17/00	CAE-Nathaniel Rochester Community School, Rochester, NY	22 eighth graders
03/27/00	"Technology Careers based on 2 year Degrees," RACEC Training Center	9 technology teachers for sixth through tenth grades
04/13/00	Park Road Elementary School, Pittsford, NY	25 second graders
04/13/00	Presentation to Ceramics Association of New York (CANY), and the School of Ceramics Engineering and Materials Science, Alfred University	17 people from industry

Key to the Presentation: The Take Home Demo

With a half dozen props, viewgraphs, and access to an overhead projector, our presentation takes from 30 to 60 minutes. The centerpiece is a "theme packet," or take home demo, given to each student (hence the need for a suitcase) at strategic points in the presentation. We have created three theme packets at a cost of ~$1.00 each, which explore color in white light through diffraction, transmission, and reflection. The packets offer the speaker a means for capturing attention and stimulating interaction while describing his or her career. Accompanied by a one-page color flyer (see insert) describing the goals of the presentation, we encourage each student to take the demos home for parents, siblings and friends. Since I have had the pleasure of giving many of the presentations, let me describe how it went for a class of 20 sixth graders on March 3, 2000.

CAE-Martha Brown Middle School, Fairport, NY

I extract from the suitcase and hold up a silicon wafer and a silica lens, asking the students for identification (answer: a mirror- that's what the wafer looks like- and a lens). Using a viewgraph of the periodic table of the elements (which they had never seen before), we discuss the chemical differences between these two objects and what I do in my career: find new uses for new optical materials. I talk about where I work.

The teacher, Ms. Boynton, then distributes the first packet, the Rainbow Peephole®. This consists of a grating, an atomic force microscope picture of the phase relief (with a scale compared to a human hair), and a mini flashlight. I show the students how to shine the enclosed mini flashlight at each other while holding the grating up to one eye. What each sees is a pattern of eight color images surrounding the white light bulb. Between the "oohs" and "aahs," I ask "so where does the color come from?" They have no idea. We discuss the colors in light revealed by the pattern on the plastic peephole.

While Ms Boynton hands out the "Magic Stripes" packet, we talk about the wave nature of light. I go through numerous hand gestures to convey the idea of polarization (not too successful - three Seniors in a Mechanical Engineering design class at the U of R are working this semester on a battery operated, wave/polarization demo for me to use in the future). The "Magic Stripes" packet contains two plastic polarizers and a plastic sheet covered with stripes of wrapping tape. I remove two large, plastic polarizer sheets from my suitcase and place them before my face, oriented so I can see the students. I ask them to do the same with their two pieces. Between the "oohs" and "aahs," I continue to explain polarized light and transmission or extinction between polarizers. Ms. Boynton turns off the room

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lights, and I place the polarizer sheets on the OH projector in a crossed configuration, separating them by plastic cups at the corners. I throw plastic silverware between the polarizers and the room erupts. This is their favorite demo. I won't finish this part of my story, but the trick is to see if their parents can figure out how to "see" the stripes in the third piece of plastic.

As Ms. Boynton hands out the final packet, the "Magic Patch Trick," I take off my glasses and cover my face with a black sheet of liquid crystal "paper." As my thermal image emerges, and between the "oohs" and "aahs," I ask them "where does the color come from?" By now they might have some pretty good guesses. I try to discuss color in reflection from liquid crystals, using a viewgraph that treats the liquid crystal molecules as loose springs (reflecting red light), or tight springs (reflecting blue light). But my explanations are irrelevant. All they want to do is test each other with their patches, to see who, by virtue of an inability to color the patch, is a vampire - the living dead!

Much planning and hard work have been devoted to this educational outreach activity. Over 500 theme packets and one-page flyers have been distributed. With a recent grant from the OSA National and additional financial support from the Rochester Section of OSA and COM, this effort will continue. I acknowledge many individuals for their contributions: Leslie Gregg (COM) for theme packet design, manufacture, and packaging; COM graphic designer Rebecca Coppens for design and preparation of the flyers; U of R undergraduates Susan Brandt, Rosa Lee(*), Kerry Johnson(*), Jacob Hesterman, and Caleb Farny for cutting, pasting, and bagging packets and giving (*) demos; Wayne Knox (Lucent Technologies) for introducing me to the Rainbow Peephole®; Eileen Korenic (University of Wisconsin, River Falls) for coining the term "theme packet"; OSA President Erich Ippen for suggesting the term "Optics Suitcase" in his page 3 column leading off the March 2000 issue of OPN; Theresa Macon / Courtnee Young for incorporating us into the Rochester Otetiana Council Explorer CAE program; and Kathleen Raniewicz / Eileen Hartmann for inviting us into RACEC.

For more information on this exciting program, or for a sample exploring kit, please contact Dr. Stephen Jacobs at the University of Rochester, Center for Optics Manufacturing (COM), phone 716-275-1093, fax 716-275-7225, email: sjac@LLE.rochester.edu.

ATTENTION APOMA MEMBERS!!!

MIL-PRF-13830B (not 2), "Optical Components for Fire Control Instruments: General Specification Governing the Manufacture, Assembly, and Inspection of," has been reactivated for either new or existing design acquisition effective January 7, 2000. For a copy of this standard, please visit the DODISS website:

http://www.dtic.mil/stinet/str/dodiss4_fields.html

At the search window, insert 13830B into the 'DODISS ID Number:' field.

UP TO DATE WITH PRECITECH, INC.

Precitech, Inc. an ultra-precision machine tool builder, has announced the completion of their new facility in Keene, New Hampshire. The new 60,000 sq. ft. facility is a state-of-the-art, temperature-controlled building that is now home to the company's entire operation, including corporate offices. This new facility will allow for the company's expansion and for more efficient manufacturing of Precitech's quality ultra-precision machine tool product line.

For further information, please contact David William Davis (phone 603-357-2511, fax 603-355-3282, or e-mail: ddavis@precitech.com). Additional information about Precitech can be found on their website at: ***http://www.precitech.com***.

New Machines, Tools and Processes for Modern Optics Manufacturing (with Labs)

COM's annual summer school, "New Machines, Tools and Processes for Modern Optics Manufacturing," will be offered from June 12-15, 2000 in Rochester, New York. The course is organized into 21 talks and tutorials providing an overview of emerging technologies that will shape the way optics are manufactured into the next century.

Guest speakers join the Center for Optics Manufacturing/University of Rochester professors and engineers to present the most recent manufacturing technology advances in deterministic processing and flexible automation for producing spherical, aspheric, and conformal optics (see machine photos opposite). The program is very interactive, providing two full afternoons of laboratory work on computer integrated manufacturing of aspheres, programming a CNC machine for complex shapes, on-machine probes, magnetorheological finishing, and modern optics metrology.

The cost for the 4 day course is $1,000; more information may be obtained by contacting Gayle Thompson at the Institute of Optics (phone 716-275-0056, fax 716-244-4936, E-mail: GAYLE@OPTICS.ROCHESTER.EDU). A full course listing will be mailed to all APOMA members in early April '00.

AGENDA

Monday, June 12

• COM Introduction and Next Generation Optics Issues	Harvey Pollicove (UR/COM)
• Deterministic Microgrinding of Spheres, Aspheres, and Conformal Optics	Jeff Ruckman (UR/COM)
• Chemical Effects in Classical Optics Fabrication	Michael Cumbo (OCLI)
• Survey of Commercial Systems for Optics Manufacturing	Arne Lindquist (Schneider)
• Interferometric Form Metrology for Precision Machined Surfaces	Andrew Kulawiec (Tropel Corp.)
• Single Point Diamond Turning	John Schaefer (Raytheon Elcan Texas)
• *Open House at Schneider Optical Machinery*	

Tuesday, June 13

• What Mechanics and Materials Science Can Do for Optics Manufacturing	John Lambropoulos (UR/ME)
• How Diamond Tools Work Glass	Paul Funkenbusch (UR/ME)
• Vibration Analysis of CNC Machines for Optics Manufacturing	Sheryl Gracewski (UR/ME)
• CNC Generating Lab	
• Materials Science/Classical Optics Fabrication Lab	

Wednesday, June 14

• Magnetorheological Finishing (MRF)	Don Golini (QED Technologies)
• Optical Polishing Pitch and Pitch Laps	Birgit Gillman (Zygo Corp.)
• Diffractive and Micro-Optics Fabrication and Applications	Mike Morris (Rochester Photonics Corp.)
• Modern Optics Metrology Lab	Maria Robinson (Zygo Corp.)
• Magnetorheological Finishing Lab	
• *Open House at QED Technologies*	

Thursday, June 15

• Glass, Glass Making and Future Directions	Alex Marker (Schott Glass Technologies)
• Dwell Maps and Tool Paths for Deterministic Sub-aperture Polishing	Greg Forbes (Macquarie University)
• Manufacturability of Precision Polymer Optics	John Schoen (Opkor, Inc.)
• Efficient Glass Grinding Coolants and Bound Abrasive Polishers	Birgit Gillman (Zygo Corp.)
• Ion Beam Processing of Optics	Axel Schindler (University of Leipzig)

Job Postings

COMPANY: **Tropel Corporation**
60 O'Connor Road
Fairport, NY 14450
Attn: Mary Ruggieri
Fax: 716-377-6332
E-mail: mruggieri@tropel.com

Title: Optical Technicians (Entry Level; Experienced)
Description: In the Final Test Group, technicians would use optical aligning techniques, interferometry, and computer aided analysis to optimize optical systems. In the Final Assembly Group, the positions would precision mount/cement opto-mechanical subsystems as well as clean/assemble components/systems.
Experience: AAS degree in Optics or equivalent.

Title: Manufacturing Process Engineers
Description: Support both the Optical Fabrication Group and the Final Assembly and Test Groups. Position requirements include working with technicians and fabricators to improve current methods and develop new processes; taking a leading role in integrating prototype products/processes into production.
Experience: BS in Optical or Manufacturing Engineering, and 5-10 years experience.

Title: Optical Fabricators and Test Technicians (Entry Level; Experienced)
Description: In the Optical Fabrication Group, fabricator responsibilities include: lens polishing, complex blocking, grinding. Test technicians handle precision optical components; repair/modify optical test equipment; perform component interferometric testing.
Experience: AAS degree in Optics or equivalent.

Title: Optical Technician
Description: In the Optical Fabrication Group, responsibilities include asphere, sphere, and flat polishing, using the MRF (Magnetorheological Finishing) System.
Experience: 4-6 years optical background; working knowledge of CNC; use of Microsoft Office; availability of two shifts.

Title: Quality Control Inspector
Description: Lead department activities in support of internal and vendor quality control for metal fabrication. Coordinate instrument calibration processes between manufacturing groups. Manage metrology support plant wide.
Experience: Precision management techniques required. Familiarity with Taylor Hobson Pneumo Centric, Zeiss Profiler, Air Bearing Roundness Checkers, and Zeiss Scanning Coordinate Measurement Machines is a plus. ISO 9001 and communications skills a must. BS degree, plus 5 years experience or equivalent work/class knowledge with 15 years experience.

Please send resumes to address above.

COM Summer School '00 course features breakthrough technologies for the commercial manufacture of aspheric and conformal optics.

Nanotech™ 500 FG
DARPA Freeform Conformal Microgrinder by
Moore Nanotechnology Systems, LLC

Q22™
Magnetorheological Finishing (MRF) Machine
by QED Technologies, LLC

2000 Industry Events

Representatives from COM will be attending the following optics industry events. Stop and see us at:

AeroSense 2000, Orlando, FL
April 24-28, 2000

EM Window Symposium, Colorado Springs, CO
April 25-27, 2000

CLEO 2000, San Francisco, CA
May 9-11, 2000

COM Summer School 2000, Rochester, NY
June 12-15, 2000

OSA Optical Fabrication & Testing 2000,
Quebec City, CANADA
June 18-22, 2000

Newsletter Mailing List Update

Please let us know of any address corrections, additions, or deletions by completing this form. Mail or fax to Michele Richard at the Center, fax 716-275-7225.

Name: _____

Title: _____

Company: _____

Address: _____

City, State, Zip: _____

Phone: _____

Fax: _____

E-Mail: _____

Center for Optics Manufacturing
University of Rochester
240 East River Road
Rochester, NY 14623-1212

Stop by and visit COM on the web!
www.opticam.rochester.edu

Career Awareness Exploring
Fairport Martha Brown Middle School
6th Grade - Jerrilyn Boynton
March 3, 2000

Topic: Careers in Optical Engineering

Presenter: Stephen D. Jacobs
U of R
Center for Optics Manufacturing
Laboratory for Laser Energetics
The Institute of Optics

Outline

- optics is colorful
- optics is exploring *mysterious* materials
- many job opportunities will exist based upon course work in science, technology and math
- teamwork and good writing/speaking a must

polariscope reveals color in white light

liquid crystals sense temperature with color

rainbow peephole - diffractive color

Optical Society of America
Rochester Section

Career Awareness Exploring

March 4, 2000

Dear Mr. Jacobs,

Thank you very much for taking the time to come and talk to my classes about your fascinating career. The students really enjoyed it.

We hope to have you come again.

Sincerely,

Jennifer Rapston

March 6, 2000

Dear Mr. Jacobs,

Thankyou for coming and teaching us about where colors come from. When I went home, I showed a couple people in my family the things you gave us. They thought they were really cool. I liked it when you put the plastic cups and forks between the two sheets of black paper. The lesson was very cool.

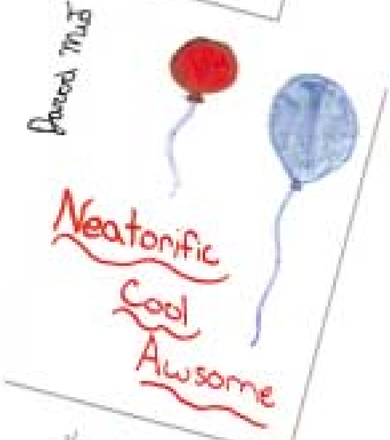
Sincerely,

Rachel Mattei

Dear Mr. Jacobs, 3-6-00

Thank you for giving your time to come and speak to our class about your job. I think you have a really cool job. I'll keep it in mind till I'm older. Thank you for the kits you gave us, that was awfully nice. I really liked the flashlight one. I hope you had a good time coming into our class.

Created by Briana King



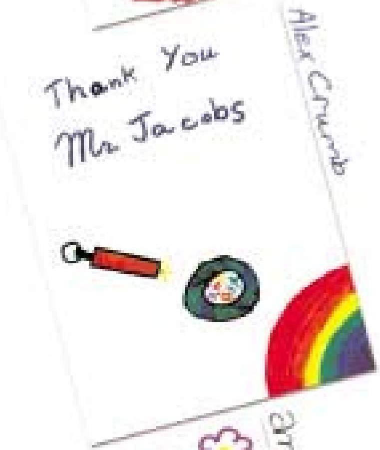
3/6/00

Dear Mr. Steve Jacobs,

Thank you for coming in and teaching us about colors and light. I liked it when you took the two black sheets of plastic and put them on the projector and put plastic silverware under it. Thanks again!

Sincerely,

Jeff Matysek



3/6/00

Dear Mr. Jacobs

Thank you very much for coming into our class and showing the fun of your work. I am very interested in some of the stuff you do at work like traveling and being paid to learn.

Sincerely,

Mario Ponezio

March 6, 2000

Dear Mr. Jacobs,

I really enjoyed your presentation. I also liked that you gave out kits because it makes it easier to understand when it's hand on. Your presentation was interesting. Science optics is confusing but you made it much easier to understand. Thanks alot!

Sincerely,

Jess Rose