



Of Petsval, Pitch, and Profit

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When the venerable Optical Society of America took it upon itself to sponsor a series of "Workshops on Optical Fabrication and Testing," I do not believe any of those involved knew what to expect. I gather that this departure from the esoteric intricacies of coherence theory, lens design, and quantum electronics and entry into the much more practical realm of abrasives, pitch, and production technology was in response to a vague realization that sooner or later most theories and/or system designs must be proven in the cold, cruel world.

This reduction to practice invariably requires hardware, which, to most of us, means lenses, prisms, and mirrors. Lenses, prisms, and mirrors are traditionally fabricated by opticians. Ergo, optical scientists and engineers need opticians. Opticians, in turn, depend on engineers and scientists to design the optics for them to build. The great expectation was that, somehow, a conference in which opticians and scientists talked with each other, discussed mutual problems, traded ideas, and generally were introduced to each other's *modi operandi* would lead to a more efficient use of both parties' resources.

This bit of unbridled idealism culminated in a series of workshops, which came to be known as "the road show," presented twelve times in the last two years in such hotbeds of optical activity as Hartford, Rochester, San Francisco, Chicago, Dallas, Tucson, Boston, and Los Angeles. When judged against our idealist goal, the road show was less than successful; it simply did not reach the working

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optician. The sessions tended to be populated by scientists, engineers, and miscellaneous management types, instrument and machine makers, company presidents, professors, production managers, assorted salespersons and marketers, with here and there an honest-to-goodness working optician. The net result was that, although the conferences stimulated many fruitful, spirited, and sometimes acrimonious discussions of subjects quite relevant to the design and manufacture of optics, far too few opticians heard or participated in them.

The scarcity of opticians was especially regrettable because many of the better papers were specifically directed toward those who work in optics daily. Judging from the comments and questions from the few opticians who did attend, many of these papers hit their mark and were of immediate interest. Papers by Wiktor Rupp of Itek and T. Izumitani of Hoya in which the fundamental mechanisms of material removal during grinding and polishing of glass were discussed were models of well conceived and meticulously executed empirical studies. These fine

reports provide anyone willing to make the effort to study them a sound basis from which to make significant reductions in the man-hours needed to produce precision optical surfaces. The series of talks on testing by Roland Shack from Arizona, Paul Forman from Zygo, and Peter Emmel from Tropol, taken as a whole, offers a very complete and thorough introduction to optical surface testing.

Frank Cooke's inimitable movie-lecture-storytelling session illustrated with the genuine article (usually next to impossible to produce), pulled like a rabbit out of a hat from the depths of Frank's well traveled suitcase, never failed to interest an appreciative audience. The one-and-only Frank Cooke is an impossible act to follow. It took the Optical Society's Jon Hagan almost a year to realize that no one in our industry was gutsy enough to do this and to solve the problem by scheduling Frank's talks in the evening.

Each session had its own atmosphere and special focus. In Hartford, the demise of Barnesite was the subject of the hour. "How are we to polish glass without Barnesite?" (With any number of other polishing compounds.)

The business difficulties, both real and imagined, facing the American optical industry were a recurrent theme of the first Rochester meeting. (Probably the situation was neither so good nor so bleak as some would have us believe.)

Ted Saito from Lawrence Livermore pulled together two fine sessions on single-point diamond machining of optical surfaces for the San Francisco meetings. (There is hope, but don't junk your polishing spindles just yet.)

It was infrared materials in Dallas, coating in Los Angeles, non-conventional production techniques in Boston.

Although the workshops may not have drawn many opticians, they

did indeed attract about 2,000 participants, a respectable number for such a specialized subject.

Who came and why? The attendees were those in industry, government, and academia who produced or used conventional optical components. This group was genuinely interested in assuring that there is a healthy commerce in optics in the United States. As a forum and a mechanism to initiate and nurture discussions on this subject, the road show was an outstanding success. The inner workings of the American optical industry, its strengths and weaknesses, the forefronts of new technology as well as innovative applications of older practice, who is doing what and how, were fairly thoroughly described. Each workshop was a miniature course in optical fabrication.

Hal Hansen of Rogers and Clarke and Bob Voras of Universal Shellac presented a sort of "Ev and Charlie Show" on high-speed production machinery that played the full two years. When, as often was the case, their exhortations were preceded or followed by Grit Tool's Harry Strauss, Jr.'s excellent survey of diamond-tool technology, this animated trio provided a concise, up-to-date and factual look into the advantages and limitations of current high-speed generation and polishing practice à la Loh, Bothner, R&C, Strasbaugh, *et al.* Phil Baumeister of Rochester, Dennis Tichen of OCLI, and Mike Shay of Evaporated Metal Films each described the spectral magic that can be worked, for a price, through the use of specialized dielectric coatings.

Representatives from each of the world's major optical glass makers, Schott, Corning, Hoya, Ohare, and Chance-Pilkington, attended one or more of the sessions. These individuals were generally quite candid in discussing what their particular establishments could and could not provide in terms of im-

proved glasses, melt data, and special forms, and on what delivery schedule.

At each of the workshops, a poor but honest *opticker*, and even those not so poor and/or honest, could find in one place and at one time knowledgeable individuals in all phases of optical manufacturing. In this smorgasbord, there was something for everyone, and, with few exceptions, a willingness to discuss openly the triumphs and tragedies of their experience.

For those interested in single units of complex systems, Verne Muffoletto or Bill Caithness of Applied Optics Center told in some detail how they went about making the esoteric—one at a time, very carefully. For small-to-moderate volumes such luminaries as Bob Hopkins of Tropol, John Plummer of Plummer Precision, Joe Appels of Arizona, and the aforementioned Frank Cooke went into considerable detail on how they do it—several at a time, very carefully. Large-volume producers, represented by Carl Kipphut of Bausch & Lomb, Mel Miller of Kodak, and Dick Weeks of Polaroid, would either bore or excite you with talk of A.Q.L.'s, R.O.I.'s, and the automatic testing of thousands of units a day—still made very carefully.

In summary, I think the road show was the expected success, but perhaps not the success that was expected. Although it may have failed to reach, involve, and educate the rank and file of America's practicing opticians, it did provide a forum and mechanism for a constructive and reasonably open exchange of information within the American optical industry, a service that in the long run may have a far greater benefit than the workshops' original intent. The road show also confirmed my long-held suspicion that the real secret of optical manufacturing is that there are no secrets.