

## Optical Fabrication Training in the 80's and Beyond

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### ABSTRACT

This paper presents the skills training that optical fabricators will require in the 1980's and beyond. It is written for those individuals who wish to set up training programs in this area.

### INTRODUCTION

Recently, optical industry journals such as "Photonics Spectra" and "Laser Focus" have published editorials and articles concerning inadequate optical fabrication training resources in the United States. There are not enough qualified young opticians to fill industry's needs and training to fill the need is lacking.

Historically a large percentage of the master opticians in the US immigrated to this country from Europe (predominately Germany) where they served a lengthy apprenticeship before becoming master opticians. Most of these opticians have retired from the industry. The remaining pool of properly trained opticians is not sufficient to fulfill the needs of the expanding technology.

This country now faces a severe shortage of opticians who have been trained in precision polishing where optical surfaces require tolerances of just a few millionths of an inch or less. The labor involved in the polishing/testing process accounts for 40% to 70% of the cost of a finished optical component. Industry recognizing this fact has taken a dual approach. One is to purchase components manufactured offshore. The second is to employ more machine intensive rather than skill intensive processes. Both practices have clearly led to the decline of optics production capacity in the US. Today nearly all large volume commercial optical components are produced offshore. The machine intensive processes have created machine operators - but not skilled opticians.

For the US optics industry to be competitive in the precision optics arena, one of the areas we must focus on is optician training. Currently there are two schools of thought on how to provide training for opticians. Either the older style European apprenticeship being proposed by APOMA (American Precision Optical Manufacturers Association) or an associate degree program from a community college. Both of these programs are roughly 2 years in length and both have their merits as well as pitfalls. Unfortunately they are out of phase with each other. For any training program to be truly successful the first thing that has to be defined is "what skills need to be taught". It is the author's view that the optician of the future will need the basics included in most craft skill training such as:

- 1A. Blueprint reading
- 1B. Basic metrology including hands-on use of equipment.
  - Micrometers
  - Verniers
  - Indicators
  - Spherometers
  - Test plates
  - Collimators and Autocollimators
- 1C. Blocking methods: Spherical surfaces as well as flats and prisms.
- 1D. Generating and grinding: These operations are becoming more machine intensive rather than skill intensive.
- 1E. Polishing: This area should receive major emphasis.
- 1F. Centering: This hand operation has been mostly replaced by automated equipment which employ laser or CCTV attachments.

But in addition, the individual must have advanced academic as well as hands-on training in the following areas:

- 2A. Moderately advanced math skills.
- 2B. Basic computer programming and CNC training.
- 2C. Introduction to CAD/CAM techniques.
- 2D. Working knowledge of how to process the following materials:
  - Infrared
  - Visible
  - Ultraviolet
- 2E. Advanced metrology.
  - A. Interferometers
    - 1. Types, setups and applications and interpretation.
    - 2. Surface analysis both manual and computerized.
    - 3. Integration of polishing correction based on testing data feedback.
  - B. Surface profilometry

#### SUMMARY

The marriage of the old "craft skills" and the proper academic training will produce master opticians for the US precision industry for the 21st century. The success of a training program of this type may best be accomplished by an Academic/Industrial partnership.

#### ACKNOWLEDGMENTS

The author wishes to thank the many individuals from companies too numerous to mention for the many helpful discussions on the topic of optical fabrication training. Also special thanks to APOMA, Dale Josephson of Optical Components Inc., Robert Wiederhold and Frank Smith of GCA/Tropel (A division of General Signal), Norman J. Brown of Lawrence Livermore National Laboratory, and John Egger and Harvey M. Pollicove of Eastman Kodak Co. for their input.

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