SPACE OPTICS FIND DOWN-TO-EARTH APPLICATIONS

Can You Imagine . . .

. . . automated techniques that reduce the manufacturing cost of precision aspheric optics.

The famous repair of the Hubble Space Telescope illustrates the utility of precision optical components. The National Aeronautics and Space Administration built the telescope, designed to reveal the outer reaches of the universe, at a cost of $1.5 billion and launched it in 1991. In orbit, however, the telescope's flawed primary optics greatly impaired its vision. Correcting Hubble's optics required fabricating and installing several nonspherical optical components called aspheres. With these components, Hubble's enormous telescopic power achieved its designed capacity.

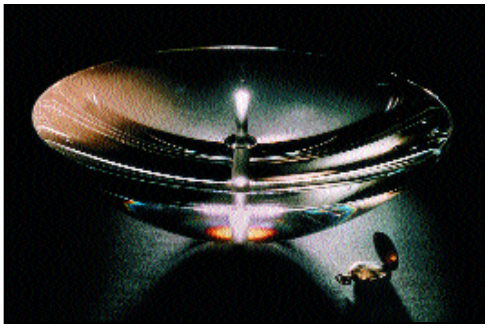
Other fields also demand precision aspheres. The asphere, whose surface can be tuned to a specific application, opens up many advantages to the optical designer, among them reduced weight and size and improved light throughput. However, the aspheres' high cost and the difficulty of making them have limited their widespread use in commercial applications. With the help of BMDO funding, Tinsley Laboratories, Inc. (Richmond, CA), developed sophisticated automated manufacturing techniques to make aspheres more efficiently.

Grinding and polishing tools and the accuracy of measurement tools previously limited the fabrication and testing of aspheres. Tinsley's techniques combine high-speed equipment with computerized control to automate these processes, saving one-third of the time needed to build and test aspheres and making new applications economically feasible. Applications for Tinsley aspheres range from tiny lenses for image projection and videography to large optics for astronomy and space surveillance sensors.

Tinsley expects its collaboration with Lawrence Livermore National Laboratory (Livermore, CA) to result in new ultraprecision aspherical optics for microlithographic and laser fusion applications. The team will be developing new technology for the precision optics required for the next generation of "steppers," machines used to manufacture computer chips. In another project, Tinsley is developing aspheric focus lenses for the laboratory's experiments in inertial confinement fusion.

TINSLEY HAS INTRODUCED A WIDE-ANGLE ASPHERE AS A COMPACT, LIGHTWEIGHT ACCESSORY TO VIDEO-CAMERA LENSES.

Through its recent acquisition of Century Precision, Tinsley supplies advanced optical products, including aspheres, for cinematography, the professional video market, and gyrostabilized video cameras for television news and sports coverage. The company has already introduced a wide-angle adaptor consisting of a single-element, two-sided asphere as an accessory to video-camera lenses. The asphere provides a wide-angle image without adding to the distortion of the camera, and videographers appreciate its compact, lightweight design.



■ This oddly shaped lens was designed to concentrate light for a laser-fusion project.

ABOUT THE TECHNOLOGY

Developed in the BMDO-sponsored Aspheric Surfacing Technology (AST) program, Tinsley's techniques include computer-controlled optical surfacing, high-speed profilometry, and phase-measuring interferometry. BMDO's plan to develop a fleet of missile-tracking satellites required precision optical components for sensor-based surveillance systems.

The computer-generated hologram (CGH) risk-reduction experiment provided a key to the AST program. In the past, combinations of spherical and cylindrical optics canceled out the aberrations normally produced by the aspheric optic. CGH technology, long viewed as an attractive alternative to multiple optics, proved difficult to implement in the manufacture of complex aspherics. However, Tinsley's AST-funded CGH successfully demonstrated the feasibility of using a CGH as a null corrector to test aspheric optics for defects.