Conformal Optics Manufacturing Technology Objective (MTO)

PROBLEM / OBJECTIVE

Situation awareness, fire control accuracy, and ultimate battlefield control are directly impacted by the precision of the optical systems being fielded. As sensors improve, optical surface form and figure must improve in order to realize a total system performance increase that extends the limits of threat detection range, target acquisition, and imaging resolution.

Today, designers are constrained in their ability to maximize optical performance because of the surface geometry limits imposed by conventional optical manufacturing technologies. Current technology is incapable of affordably producing optical components to the extreme optical surface accuracy and finishes required to maximize sensor performance. The objective of this effort is to develop the manufacturing technology that will produce optical surfaces, shapes and geometries that satisfy next generation requirements.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

Second generation deterministic microgrinding (DMG) machinery has been commercialized and is being used to manufacture optics for Apache, Javelin, M1A2, and other systems. A new generation magnetorheological finishing (MRF) system continues the revolution in optical polishing. Its extreme accuracy and computer-controlled stability makes the fabrication and polishing of precision optical surfaces possible – and affordable.

Implementation and Technology Transfer:

DMG and MRF technology are proven successes on the factory floor and have been adopted by optical shops large and small. MRF is used by every major producer of optics for the semiconductor industry in the world.

Present day example: Center for Optics Manufacturing (COM) manufactured a "could-not-be-purchased" reflective hyperboloid aspheric mirror for the Army Night Vision Laboratory - a critical element in the Multi-Function Staring Sensor Suite (MFS3) ATD. MFS3 is a multi-spectral (visible, mid-wave and long-wave infrared) imaging system. COM's affordable deterministic manufacturing techniques produced the mirror in less than 6 hours and exceeded the performance specification. (A compromise elliptical mirror that also exceeded the specification was quoted at $10,130).

As a result of this ManTech effort, DMG and MRF machines are commercially available. Almost every manufacturer of optics now uses computer controlled grinding equipment that is based on COM developed technology. The Q22-Y MRF has received industry-wide acclaim and is being used to produce highly precise plano and prism optics. Many shops have multiple MRF machines. Over 90 MRF machines are now on the shop floor!

Expected Benefits:

The use of this technology will have a positive effect on every military system that requires precision optics.

Next generation example: XM-35 will employ 5 aspheric surfaces in the newly designed Fire Control System that reduced the weight of the system from 7+ pounds to 3.

TIME LINE / MILESTONE

Start Date	January 2000
End Date	May 2002

FUNDING

Army ManTech	$7.9M
PM FLIR	$.1M
PM Comanche	$1.925M
PM Small Arms	$.45M

PARTICIPANTS

Center for Optics Manufacturing
APOMA (over 100 U.S.optical shops)
Eastman Kodak
Lockheed Martin
Moore Tools
QED Technologies
Raytheon
Tropel
Army Research Laboratory