Pictured above with the latest generation fiber optic coil winder is CMI's own dynamic duo, Holger Wirz and David Chargin. With complementary mechanical design and controls expertise, respectively, Holger and David lead CMI's advanced automation activities. CMI's latest accomplishment is a precision, computer controlled winder used to produce strategic-grade sensing coils for fiber optic gyroscopes. With over 15 coordinated servo-controlled axes, the winder is capable of cost-effectively winding strategic grade coils for long-range navigation and space applications. This machine was developed for Honeywell Corporation and builds upon a long-standing relationship between CMI and the world's premier fiber-optic gyroscope manufacturer.

Fraunhofer USA
Center for Manufacturing Innovation

CMI

Fraunhofer CMI is located on the campus of Boston University

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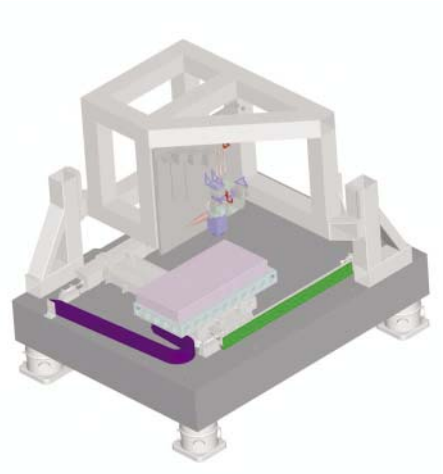
In collaboration with Boston University, Fraunhofer CMI provides manufacturing solutions to a broad range of industries, including optoelectronics, biotechnology, and semiconductor, with a focus on high-precision, process-centric automation systems. Engineers at CMI develop novel production processes and equipment for clients launching new products or who need to improve existing manufacturing operations. CMI also forms engineering "partnerships" with clients, providing product development assistance and objective bench-marking against industry best practices.

In 2005, CMI experienced its best year ever, meeting all of its financial targets and expanding its industrial client base. During the year, CMI worked on and deployed a number of systems. A few representative projects include:

Development of a Laser-Based Interference Lithography System for Writing High-Power Gratings

In partnership with MIT and an industrial client, Fraunhofer CMI is working on the development and commercialization of a new process for the manufacture of high accuracy large scale diffraction gratings. Applications such as high power lasers used for Inertial Confinement Fusion research require gratings that cannot be produced via current techniques. These gratings are nearly a meter in length by half meter in width, with closely placed lines, typically on a 400 nm to 1000 nm pitch, with a phase accuracy of 10 nm over the entire length. The new system writes the lines by scanning an interference pattern of two UV laser beams over the optical substrate. A high speed metrology system optically steers the interference pattern to correct for errors in the mechanical motion of the scan to ensure accuracy. This metrology system makes extensive use of Zerodur and Super Invar components to maximize accuracy and stability. A CAD rendition of the system is shown in the figure below.



Laser-Based Interference Lithography System for Writing High-Power Gratings

Development and Deployment of a Continuous Crystal Growth System for the Production of Solar Cells.

Under NIST ATP sponsorship, Fraunhofer CMI worked with a prominent solar cell manufacturer to develop a continuous crystal growth system that automatically goes from "melt in to wafers out." As the crystal grows, it is automatically cut into wafers that are stacked and ready for down-stream operations. This is a much more efficient alternative to the conventional process of growing crystal in batch, storing it, and later cutting it into wafers. The system shown on page 27 was developed and delivered to the customer in 2005.

Continuous Crystal Growth System for the Production of Solar Cells.

Development and Deployment of an Automated Myocyte Cell Extraction System for the Pharmaceutical Industry

Pharmaceutical companies have a growing need for myocyte cell solutions to test new drugs and develop therapies for disease prevention. The current method for extracting myocyte cells from tissue is manual and requires a trained technician or a scientist to conduct a series of tasks over a four hour period.

Fraunhofer CMI developed a myocyte cell extraction system in which most of routine tasks are automated. A technician sets up the system initially, loads it with the tissue and enters the operation parameters. The system then operates unattended until the cell extraction is complete. It uses pressure-based liquid infusion with volumetric feedback control. This resulting system is user-friendly, reliable, and cost-effective.

Customer testing has confirmed a high survival rate for the cells and the system is expected to significantly reduce the cost for preparing the solution.

Automated Myocyte Cell Extraction System

Cryogenic Micropump

Development of a Cryogenic Micropump for Cooling Satellite Electronics

Under sponsorship of the United States Air Force through a Phase II SBIR, Fraunhofer CMI worked in conjuntion with Foster Miller, on the design and fabrication of a micropump system for satellite cooling. These pumps are used to maintain sensors at cryrogenic temperatures for precise, low noise readings, and need to meet extreme temperature and reliability requirements. Fraunhofer CMI evaluated the design to ensure manufacturability of the components along with compatibility to both cryrogenic temperatures and ultraprecision fabrication techniques. CMI then utilized diamond turning and milling processes to fabricate the miniature pump components with tight tolerances, with only 2 microns of clearance between moving parts. The resulting micropump with some associated internal components is shown above.