

MEL worked with the National Archives and Records Administration to design and manufacture new encasements for America's most precious documents, the Declaration of Independence, the Constitution, and the Bill of Rights, known collectively as the Charters of Freedom. MEL built the encasements in partnership with other NIST Laboratories.



To find out more about how MEL helps American companies compete in today's global economy, visit <http://www.mel.nist.gov>

or call 301-975-3400

or write to:
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Gaithersburg, MD 20899-8200

Cover Photo:
MEL engineer Sammy Ho performs force calibrations of a proving ring, a device developed at NIST to provide industry with traceability to NIST's realization of force.



November 2002

measuring for success



MANUFACTURING

ENGINEERING

LABORATORY

NIST
National Institute of
Standards and Technology
Technology Administration
U.S. Department of Commerce

The Manufacturing Engineering Laboratory (MEL)

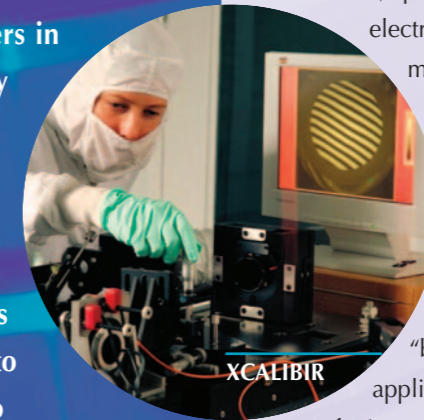
at the National Institute of Standards and Technology (NIST) promotes a healthy U.S. manufacturing economy by solving tomorrow's measurement and standards problems today. MEL works to satisfy the needs of U.S. manufacturers in mechanical and dimensional metrology and in advanced manufacturing technology by conducting research and development, providing services, and participating in standards activities. MEL addresses infrastructural problems to help companies overcome barriers to innovation and improve their access to domestic and foreign markets.

NIST serves the U.S. as our country's National Measurement Institute, and MEL contributes to this role by realizing the SI units of length and mass at the most fundamental level. MEL is a world-class research laboratory with a staff of over 300 people, including about 100 guest researchers and students. MEL and NIST's six other Laboratories comprise a vital component of the nation's technology infrastructure.

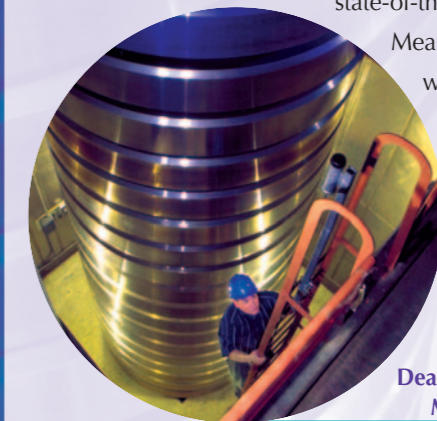


Precision sphere measurement on a coordinate measuring machine

Our people and facilities are the keys to our leading-edge capabilities. Our committed team of researchers has world-class technical expertise in manufacturing from design through production. In dimensional metrology, we developed the world's most accurate coordinate measuring machine to tackle the most demanding length measurements. MEL's X-ray Optics Calibration Interferometer (XCALIBIR) can measure the surfaces of flat, spherical, and aspheric optics used in micro-electronics with unparalleled precision. In mechanical metrology, MEL is the keeper of the U.S. primary kilogram, providing the technical foundation that allows American pharmaceutical companies, grocery stores, and others to dispense accurate quantities of goods. A unique million-pound deadweight machine provides "best-in-the-world" realization of forces for applications ranging from measuring the thrust of a jet engine to certifying load cells used in weighing systems. Relocation of many of MEL's most critical measurement and research facilities to NIST's new state-of-the-art Advanced



XCALIBIR



Deadweight Machine

Measurement Laboratory will ensure that we keep pace with the demands of U.S. manufacturing for years to come.

TRACEABLE

MEL's programs focus on measurements and standards for making things *traceable, right, small, and interoperable.*

We deliver advanced manufacturing research and measurement services in dimensional and mechanical metrology, manufacturing processes and equipment, systems integration and interoperability, and intelligent controls.

Our customers require fast, accurate, in-situ measurements at tight tolerances to ensure that parts can be assembled correctly.

Companies frequently use MEL-developed portable coordinate measuring systems known as laser trackers for precise alignment as they manufacture and assemble large products. To ensure the accuracy of laser trackers, MEL developed the Laser Rail Calibration System that assesses and verifies their performance. These systems help companies reduce or eliminate waste, rework, and low-quality parts, directly saving manufacturers tens of millions of dollars each year.



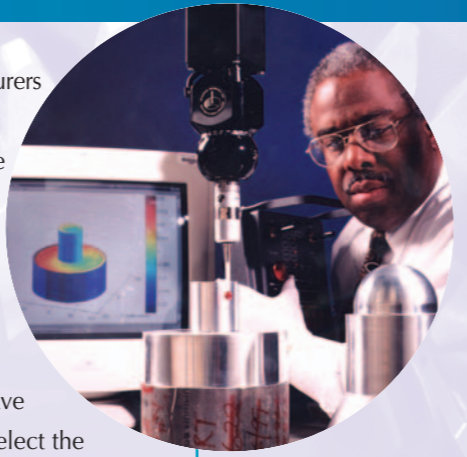
The aerospace industry uses MEL-invented and calibrated laser trackers to help them build large parts accurately

RIGHT

Manufacturers need to machine

complex parts with close tolerances quickly and accurately. Yet, companies typically do not have objective data to select the best machine for a specific task and use it most efficiently. Our research is yielding critical information about how accurately machine tools cut, how tools wear with use, and what forces are necessary to cut certain metals.

Smart sensors help achieve reliable and improved manufacturing operations. Intelligent sensing can monitor machine wear to ensure process control, reduce unneeded maintenance costs and downtime, and increase operational safety. MEL is collaborating with industry in this growing multi-billion dollar field to develop standards and enabling technologies that increase the connectivity of sensors with manufacturing equipment and systems.



MEL engineer Herb Bandy measures a part used to characterize the performance of a turning machine, helping industry achieve more efficient production

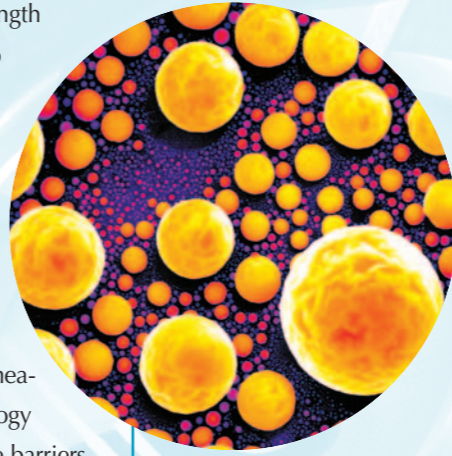


MEL contributes to America's homeland security. Our expertise in intelligent systems enabled us to design search-and-rescue robot test courses that simulate disaster sites. Robots tested on our course were used at the World Trade Center site. MEL's surface metrology program developed standard bullets and casings that help investigators identify firearms used in acts of violence or terrorism.

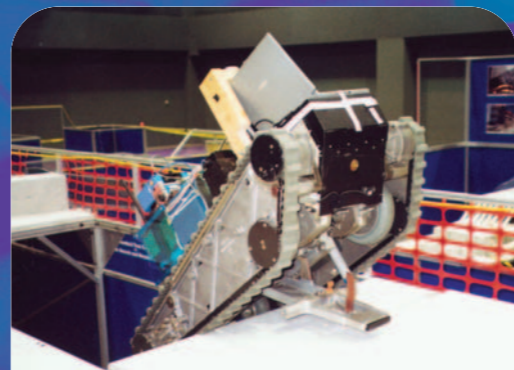
SMALL

Nanotechnology—the creation and use of materials, devices, and systems through the control of matter on

the nanometer-length scale—promises to spark the biggest technological revolution of the 21st century. MEL is at the forefront of nanotechnology, working on the measurement technology needed to remove barriers to innovation in this emerging area. MEL focuses on nanoscale length, force, and mass measurement. We also develop methods to measure the performance of nanodevices and characterize nanoscale fabrication processes.



Processing and fabrication at the nanometer scale require new measuring techniques and devices. MEL collaborates with industry to develop high-resolution image acquisition and analysis systems to enhance the quality and detail of scanning electron microscope images



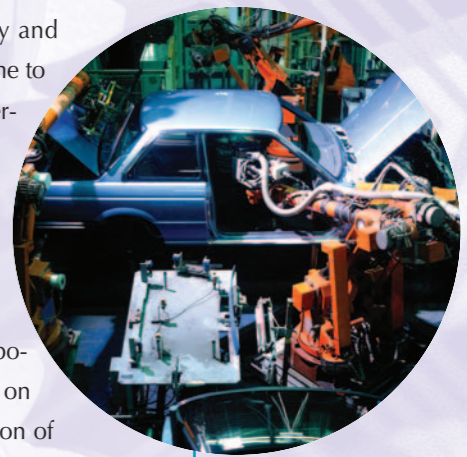
Lola, built by Mike Fair & David Miller at the University of Oklahoma

INTEROPERABLE

Information technology is revolutionizing the performance of manufacturing systems. Continued improvements will depend largely upon how well computers, software, and manufacturing hardware interoperate to share information seamlessly and accurately. Systems that are not interoperable may alter or lose information during exchange, creating enormous costs to manufacturers.

MEL played a leading role in the development of the international standard STEP, Standard for the Exchange of Product Model Data, that provides a neutral way to define and exchange 3-D product data for quick and accurate electronic transmittal throughout a manufacturing enterprise.

As companies increase their productivity and decrease their time to market, new interoperability solutions are needed; traditional standards simply cannot keep pace. MEL collaborates with others on the next generation of semantics-based standards that will enable intelligent systems to self-integrate through meaning embedded within systems of logic in the software. The goal: Manufacturers will be able to “plug and play” different computer systems, saving time and money.



For the automobile industry, a recent study found that imperfect interoperability of software systems imposed at least \$1 billion per year in additional production costs