COLUMBUS, Ohio -- The National Science Foundation announced Wednesday (3/26) that Ohio State University has been chosen as one of six universities to establish and operate five engineering research centers.

Ohio State's Engineering Research Center for Net Shape Manufacturing will receive up to $9.7 million in funding from NSF over five years, according to Donald D. Glower, dean of the College of Engineering.

For the first year of operation, the center will receive about $1,250,000 from NSF, plus $250,000 from the university.

"Pledges of support from industrial firms, additional funding from the State of Ohio's Edison Program, and other sources should enable the center to match the NSF grant," Glower says.

Participating in a ceremony Wednesday recognizing the new center were Gov. Richard Celeste and Rep. Chalmers Wylie of Columbus.

Taylan Altan, director of the new center, expects to start operation this summer. Altan is a professor in the departments of Industrial and Systems Engineering and of Mechanical Engineering.

He says initial projects will be selected by the center's research advisory board. The board will be made up of
representatives from industry and academia, with Robert F. Redmond, associate dean of engineering as chairman.

The focus of the center will be directed toward modernizing traditional manufacturing methods to increase international competitiveness, according to Altan.

"We believe in basic manufacturing," he says. "Someone has to make the parts that go into everything from autos to appliances and there are many efficiencies to be achieved."

Net shape manufacturing is a generic term for processes that give near-final shape to manufactured parts, usually through deformation using dies or molds. Examples of such processes are extrusion, forging and casting.

The net shape approach stresses economies in the manufacture of a product by integrating all operations from selecting the raw material to imparting the product's final shape, says Altan.

"Most people think of machining when they talk about manufacturing, and seem to forget that if excess material isn't put on a part in the first place, it doesn't have to be machined off."

He points out that tool and die making and many manufacturing processes are presently an art and not a science.

"We need to understand the physics of these processes to make them more cost effective and to achieve the benefits they offer. This is especially true for new materials such as composites and ceramics. In short, we must replace art with science and engineering."

Altan says that the costs involved in mechanical manufacturing are not so much in labor as they are in materials,
lead times, quality and equipment utilization.

"Where tools are designed by trial and error the result is long development times and low equipment utilization."

Headquarters for the new center will be on the third floor of Baker Systems Engineering Building. Research will be done in various laboratories at Ohio State, affiliated universities, Battelle Memorial Institute and participating companies.

Nine engineering departments at Ohio State will primarily be involved -- industrial and systems, ceramic, chemical, computer and information science, electrical, engineering mechanics, mechanical, metalurgical, and welding.

Initially about 20 senior researchers will participate in the center's projects, with up to six from Battelle as part of a cooperative agreement in manufacturing research. In addition, large numbers of graduate and undergraduate students will be involved.

The National Science Foundation announced that the six universities would receive up to $56.3 million over the next five years for the engineering research centers. The six recipients were selected from 102 proposals received from 75 institutions.

Besides Ohio State, the universities selected are Brigham Young University and the University of Utah, jointly, for the Advanced Combustion Engineering Research Center; Carnegie-Mellon University for the Engineering Research Center for Engineering Design; University of Illinois at Urbana for the Engineering Research Center for Compound Semiconductor Microelectronics; and Lehigh University for the Engineering Research Center on Advanced Technology for Large Structural Systems.
NSF is funding the establishment of the centers to develop fundamental knowledge in engineering research and thus improve the economic competitiveness of the United States. The centers will combine multi-disciplinary research with education and the participation of people from industry.

#

Contact: Taylan Altan, (614) 292-5063, or George L. Smith Jr., chairperson of the Department of Industrial and Systems Engineering, (614) 292-6041.

(Releases/21)
Major research complex will be built at university

By Bob Reynolds
Lantern staff writer

Ohio State has become the site of a major engineering research center where the College of Engineering and industrial firms will be able to pool their technological resources.

The National Science Foundation chose Ohio State as one of six universities to receive a center. The foundation received requests from over 100 universities.

One of the main goals of the center is to find more cost-effective ways to produce parts through the use of computer animation, said George L. Smith Jr., professor and chairman of Industrial and Systems Engineering and one of the planners of the center.

The OSU center is to receive $9.7 million from the National Science Foundation. The university has pledged $1.5 million to the center. Funding will also come from company membership dues.

Large companies will have to contribute $200,000-$300,000 in membership fees. Small businesses can become associate members by paying $2,000-$3,000 per year, Smith said.

As a member of the center, companies will get access to state-of-the-art research, participation in educational programs and technology transfer, Smith said.

Research at the center will focus on four types of manufacturing techniques: Melt, where molten metal is poured into a mold; sheet, where a flat piece of metal is pressed into shape (a car fender is an example); making bar-shaped pieces of metal called billets; and by powder casting, where powder is molded into shape with heat and pressure.

"We want to be able to design a product and a production process in one integrated activity," Smith said. "This is a new direction."

Smith gave the example of designing a titanium gear by computer. He said they want to design the gear by computer and more importantly, design the production process, simulating expenses.

Battelle Memorial Institute has already agreed to work with Ohio State and Smith said about 20 companies have sent letters of support for the project. Among the supporting companies are Alcoa, Delco, General Electric, General Motors and TRW.
The Engineering Research Center

for

NET SHAPE MANUFACTURING

A partnership between
The National Science Foundation,
The Ohio State University
and more than 80 Manufacturing Companies

339 Baker Systems
1971 Neil Avenue
Columbus, OH 43210
Ph: 614-292-9267
Fax: 614-292-7219
MISSION STATEMENT

- Conduct Scientifically Challenging and Industrially Relevant Research and Development in Net Shape Manufacturing Processes, Tooling, and Machinery
- Educate and Train Students in Manufacturing Engineering, so that they can obtain highly Satisfying Jobs in an Increasingly Competitive Global Market Place
- Assist Large, Medium and Small Size Companies in:
  - Developing and Implementing Innovative and Highly Productive Net Shape Manufacturing Processes
  - Continuous Process and Quality Improvement

Taylan Altan, Director
The ERC/NSM was established in May 1986 to conduct engineering research and education in manufacturing processes. The Center is an intellectual partnership between NSF, The Ohio State University and 80 plus manufacturing companies.

The **FOCUS of the ERC/NSM** is manufacturing of discrete parts to net or near-net dimensions via die casting, polymer processing, sheet and billet forming. To support these activities the ERC/NSM also conducts R&D in die/mold design and manufacturing, as well as rapid prototyping.

The Center's research is directed at reducing development time for new processes by eliminating trial and error. Through computer-aided techniques a) material flow is predicted as a part is shaped in a die so that defects are eliminated and product quality increased; b) dimensional accuracy is improved; and c) part complexity is increased to make NSM more cost effective.

Our **MISSION** is to: a) conduct scientifically challenging and industrially relevant R&D in Net Shape Manufacturing processes, tooling, and machinery, b) **educate and train students in Manufacturing Engineering** so that they can obtain highly satisfying jobs in an increasingly competitive global marketplace, and c) **assist large, medium, and small size companies** in developing and implementing new processes, continuous process and quality improvement as well as in optimizing conventional manufacturing techniques and consulting.

To achieve our mission, our **STRATEGY** consists of: a) **cross disciplinary research** as required by a project, b) **simultaneous consideration of product and process design**, c) close industry and university cooperation, and d) **cooperation and benchmarking** with other national and international centers of excellence in manufacturing.

Organizationally, the ERC is divided into **five thrust areas**: billet forming, sheet forming, polymer processing, die casting, and die/mold manufacturing. Faculty and students from five departments of the College of Engineering participate in ERC's research.

A National Science Foundation Research Center
and its Executive Committee, provide advice and review our activities. **Approximately one half of the Center’s annual $3 million budget is obtained from membership fees of 80+ companies and contract research**, the rest is provided by NSF, The Ohio State University, and the Ohio Board of Regents. Nearly 40 of our members are small businesses with less than 500 employees.

The Center has **extensive facilities for experimental research** as well as **computer software and hardware for CAD/CAM/CAE used in product and die design, process modeling, and rapid prototyping**.

To **TRANSFER** our results, to date we have issued **more than 500 reports, distributed more than 6800 copies**, and published a very large number of technical papers. All of our graduates have jobs, and a very large number, including those with PhD degrees, in industry. Our industrial membership increased steadily, even during the recession years, **see graph**.

The ERC/NSM maintains and continuously expands contacts with various North American Universities (Colorado School for Mines, Michigan Tech, Univ. of Michigan, Florida, British Columbia), and with professional associations (IAMS, FIA, ASM, SME). On an international level, excellent ties have been established with renowned European (Stuttgart, Aachen, Hannover, Darmstadt, Denmark) and Japanese (Tokyo, Kyoto) universities and research centers.

Our innovative **EDUCATION** programs support our research activities and include:

- the Graduate Fellowship Program for US Residents $817k/year plus tuition and fees
- the college-wide Manufacturing and Systems Engineering Programs (MS level)
- the college-wide practice oriented manufacturing engineering program (POME)

**Industrial Membership**

- the Undergraduate Programs, which have several variations, i.e., summer internship, academic year internship, scholarship / internship, 1st year women scholarship / internship; honors program, research experience for undergraduates (REU)
- the combined BSc/MSc program.
- The Undergraduate Summer Internship Program, started in 1987, employed 51 students in 1995.

Many (more than 20) of these students are employed at the ERC for up to 20 hours a week during the academic year. We are also participating enthusiastically in the NSF sponsored REU (Research Experience for Undergraduates) Program.

The ERC/NSM was instrumental in attracting to OSU highly qualified graduate students as well as young faculty. To date 256 students completed our graduate program and, **during the current year (1995-1996) we have 41 students; 13 of whom are ERC Fellows**.

Our **FACILITIES** include more than $4 million worth of new manufacturing processing equipment, die/mold manufacturing machinery and computer hardware/software, assembled into three new laboratories for instruction and research. **These laboratories form a unique software/hardware infrastructure for manufacturing R&D and education that has no equal in the North American engineering educational system**.
The focus of ERC/NSM is manufacturing of discrete parts using processes that produce the net or near-net part geometry through a die or mold. The ERC/NSM concentrates on five technological thrust areas:

- **DIE/MOLD DESIGN & MANUFACTURING**
  (product design for manufacturing, die manufacturing, prototyping)

- **BILLET FORMING**
  (processing-property relations, process planning and simulation, interface conditions)

- **SHEET FORMING**
  (formability, process simulation, machine/process interactions)

- **POLYMER PROCESSING**
  (material behavior, processing-property relations, process simulation)

- **DIE CASTING AND SEMI SOLID METAL FORMING**
  (quality improvement, processing-property relations, heat transfer).
ERC for Net Shape Manufacturing

**Facilities**
- Net Shape Manufacturing Lab
- Die/Mold Manufacturing Lab
- CAD/CAM/CAE Lab

**Educational Programs**
- ERC Fellowship Program
- Manufacturing Systems and Engineering Program (MSEP)
- Practice Oriented Manufacturing Engineering Program (POMEPE)
- Undergraduate Research Internship Program (REU)

**Personnel**
- Faculty
- Full-time Staff
- Students (grad. & undergrad.)
- Visiting Scholars (students, post-docs, professors)

**Funding**
- NSF Grants
- Membership Fees
- University & State Funds
- Industry Contracts

Meetings & International Conferences
Research Results & Reports
Manufacturing Engineering Graduates
Proprietary Research Results
The ERC/NSM has more than 80 company members in three distinct categories: Full Members (with access to all ERC/NSM results at an annual fee of $25,000), Associate Members (interested only in one of the research thrust areas at $10,000 per year), and Affiliate Members (small companies with less than 500 employees at $2000 per year). The interaction with and technology transfer to these members are achieved through:

- Advisory Board and Executive Committee Meetings
- Technical Review Committee Meetings
- Individual project meetings
- Cooperation with, and meetings of professional societies (SME, ASM, NADCA, FIA, SME), presentation of papers
- Faculty/student visits to industry
- Distribution of technical reports and computer programs
- Individual projects on a contractual and confidential basis. With an excellent infrastructure for experimental process research, computational process modeling, and a full time staff, the ERC/NSM is also conducting proprietary contract R&D projects.

### Three Distinct Categories:

- Full Membership
- Associate Membership
- Affiliate Membership

A National Science Foundation Engineering Research Center
# MEMBERSHIP LIST

## FULL
- Agie USA LTD*
- Air Force (US) - ad hoc member
- Alcoa
- Buhler Inc.*
- Cummins Engine Co. Inc.
- Dana Corporation
- Doehler-Jarvis
- Eastman Kodak Company
- Eaton Corporation
- Ford Motor Company
- General Motors - Powertrain - Saginaw - Tech. Center
- Honda Engineering, Inc.
- Johnson Controls Inc.
- LeBlond Makino
- Minster Machine Company*
- NADCA

## ASSOCIATE
- AC Technology (poly)*
- AK Steel Corporation (sheet)
- Alpha 1 (cast)*
- Alusuisse-Lonza Services AG (cast)*
- American Axle & Manufacturing (billet)
- Armco Research Center (sheet)
- Bailey Corporation (poly)
- Bell Aerospace Textron (poly)
- Bethlehem Steel Corp (sheet)
- Chapparral Steel Co. (billet)
- Cincinnati Milacron Inc. (poly)
- Cinpres Limited (poly)
- Dow Chemical Co. (poly)
- GE Superabrasives (poly)
- GenCorp (poly)
- General Electric-Plastics Div. (poly)
- Geon Company (poly)
- Inland Steel Company (billet)
- Kistler Instrument Corp.
- Krupp Hoesch Auto Grp. (billet)
- Lockformer Co. (sheet)*
- LTV Steel Company (sheet)
- MASCO (billet)
- National Machinery Co. (billet)
- Premix, Inc. (poly)
- Ravenswood Alum Corp (sheet)
- Reynolds Metal Co. (sheet)
- Ryobi Die Casting (USA) (cast)
- Teledyne Specialty Equipment (dsgn)
- Timken Company (billet)
- Torrington Co. (sheet)
- Trans-Matic Mfg. (sheet)
- Union Carbide Corp. (poly)
- Xerox Corporation (poly)

## AFFILIATE
- A. Finkl & Sons Co.
- Advanced Machine & Engineering Co.*
- Blue Ridge Pressure Castings Inc.
- Chem-Trend, Inc.
- Cold Heading Co.
- DAPRA Corporation*
- Data M*
- DCD Technologies
- Engr. Systems Int'l Corp*
- Engineering Tech. Assoc. Inc.
- Erie Press Systems
- ExtrudeHone
- Fischer Tool Corp*
- Forming Technologies Inc.
- Helm Instrument Co., Inc.*
- Imageware*
- Impact Forge Inc.
- Ingersoll Cutting Tool Co.
- Intelligent Light
- ITI*
- Modern Tools
- Norwalk Innovation
- Pace Industries
- PCB Piezotronics Inc.*
- Plymouth Tube Company
- Rimrock Corporation*
- SPTC*
- Sterling Inc.*
- Superior Die Set Corp.

*In-Kind Membership Fee

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List of Members (September 1996)

A National Science Foundation Engineering Research Center

[OHIO STATE UNIVERSITY] ERC [NSM]
The ERC/NSM utilizes a number of commercial software packages and specific purpose programs, developed at the ERC/NSM, for die making and to simulate various net shape manufacturing processes:

- Hot and Cold Forging
  - DEFORM, AMG, DIELOAD, FORMEX
  - Rolling
  - TASK, ERCBLG
  - Ring Rolling
  - RING, RINGROLL
  - Radial Forging
- REFORGE
  - Sheet Forming
  - SHEETFORM, SECTION-FORM, PAMSTAMP, COPRA
  - Die Casting
  - MAGMASOFT, FLOW-3D, DIECAST-DESIGN, DIECAST-FLOW, WAVEFORM
  - Injection-Molding, Gas Injection Molding/complete C-MOLD & MOLDFLOW Packages
  - Processing of Polymeric Composites
- RTM, SMC
  - Design & Manufacturing CATIA, CADAM, PRO-ENGINEER, PATRAN, IDEAS, VALY-SIS, ABAQUS, SURFACER, LABVIEW, OPTIMILL, MT CAM, QUICKSLICE (FDM)

To conduct experimental studies, the ERC/NSM has two laboratories equipped with state of the art machines. These machines are either built at the ERC/NSM or acquired as a donation/consignment from companies that generously support our research and education in net shape manufacturing:

<table>
<thead>
<tr>
<th>ERC/NSM</th>
<th>Electric Servo-motor drive 30 ton vertical double action press</th>
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<tbody>
<tr>
<td>ERC/NSM</td>
<td>Electric Servo-motor drive triple action press</td>
</tr>
<tr>
<td>Minster</td>
<td>60 ton high speed (1200 s/min) mechanical blanking press</td>
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<tr>
<td>Minster</td>
<td>160 ton double action hydraulic press with cushion control</td>
</tr>
<tr>
<td>Buhler</td>
<td>250 ton SC cold chamber die casting machine for SSM and die casting</td>
</tr>
<tr>
<td>Rimrock</td>
<td>Robotics accessories for the die casting machine</td>
</tr>
<tr>
<td>Prince</td>
<td>Transparent shot sleeve test stand with VISITRAK control</td>
</tr>
<tr>
<td>Lockformer</td>
<td>10 stand inboard type roll forming machine</td>
</tr>
<tr>
<td>Amesburg</td>
<td>150 ton hydraulic press for plastic processing</td>
</tr>
<tr>
<td>Cincinnati-</td>
<td>75 ton electric drive injection molding machine</td>
</tr>
<tr>
<td>Milacron/Fanuc</td>
<td>Reaction injection molding (RIM) machine</td>
</tr>
<tr>
<td>Krauss-Maffei</td>
<td>Model Maker for 3 axis machining</td>
</tr>
<tr>
<td>Okada</td>
<td>Automatic die polishing robot</td>
</tr>
<tr>
<td>Showa Seiki</td>
<td>Die Sinker EDM machine</td>
</tr>
<tr>
<td>Agie</td>
<td>Wire EDM machine</td>
</tr>
<tr>
<td>Sodick</td>
<td>4-axis horizontal high speed milling center</td>
</tr>
<tr>
<td>Cincinnati-</td>
<td>T-10 Four axis machining center</td>
</tr>
<tr>
<td>Milacron</td>
<td>Electro-chemical polishing (ECP) machine, COTAC 51</td>
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<tr>
<td>Shizuoka-Seiki</td>
<td>Coordinate Measuring Machine (CMM)</td>
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<tr>
<td>Sheffield</td>
<td>4-axis horizontal high speed milling center</td>
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<tr>
<td>Leblond Makino</td>
<td>Fused Deposition Modeling (FDM) system</td>
</tr>
<tr>
<td>Stratasys</td>
<td>for rapid prototyping</td>
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A National Science Foundation Engineering Research Center

Ohio State University ERC NSM
## STEERING COMMITTEE

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Department/Office</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taylan Altan</td>
<td>Director</td>
<td>ERC/NSM</td>
<td>292-5063</td>
</tr>
<tr>
<td>Nuri Akgerman</td>
<td>Associate Director</td>
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<td>292-2487</td>
</tr>
<tr>
<td>W.E Baeslack</td>
<td>Ass. Dean for Research</td>
<td>College of Engineering</td>
<td>292-2570</td>
</tr>
<tr>
<td>Jose B. Cruz, Jr.</td>
<td>Dean</td>
<td>College of Engineering</td>
<td>292-2836</td>
</tr>
<tr>
<td>R.A. Miller, Chair</td>
<td>Industrial Welding and Systems Engineering</td>
<td>(IWSE)</td>
<td>292-7067</td>
</tr>
<tr>
<td>Robert H. Wagoner</td>
<td>Chair, Materials Science and Engineering (MSE)</td>
<td></td>
<td>292-2079</td>
</tr>
<tr>
<td>Kenneth J. Waldron</td>
<td>Chair, Mechanical Engineering (ME)</td>
<td></td>
<td>292-0500</td>
</tr>
<tr>
<td>Liang-Shi Fan</td>
<td>Chair, Chemical Engineering (ChE)</td>
<td></td>
<td>292-6986</td>
</tr>
</tbody>
</table>

## EXECUTIVE COMMITTEE OF THE ADVISORY BOARD

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Daniel Schoch</td>
<td>Chair, P.E.</td>
<td>Minster Machine Company</td>
<td>419-628-2331</td>
</tr>
<tr>
<td>Dr. James N. Cordea</td>
<td>Armco Research Center</td>
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<td>708-292-3600</td>
</tr>
<tr>
<td>Dr. Stephen Midson</td>
<td></td>
<td>Eastman Kodak Company</td>
<td>716-722-1300</td>
</tr>
<tr>
<td>Mr. Darryl E. Miller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. James W. Patten</td>
<td></td>
<td>Cummins Engine Co., Inc.</td>
<td>812-377-7233</td>
</tr>
<tr>
<td>Mr. Alvin M. Sabroff</td>
<td></td>
<td>Eaton Corporation</td>
<td>216-532-6782</td>
</tr>
<tr>
<td>Dr. Walter Smith</td>
<td></td>
<td>DCD Technologies</td>
<td>216-481-0056</td>
</tr>
</tbody>
</table>

A National Science Foundation Engineering Research Center
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PhD, director
292-5063

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292-5328

Jochen Breiting
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(in Dr.-Ing. program)
292-2305

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(in MS program)
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Sven Esche
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(in PhD program)
292-8656

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(in Dr.-Ing. program)
292-3840

Ulrich Jerichow
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(in Dr.-Ing. program)
688-3849

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Haydar Livatyali
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(in PhD program)
292-8656

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(in MS program)
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Ciro Rodriguez
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(in PhD program)
292-3840

Leonid Shulkin
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(in PhD program)
292-8656

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292-3726

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department secretary
292-4354

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(Kinnear Road)
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Darline Wine
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FACULTY

Taylan Altan, metal forming processes and equipment, die manufacturing, ME/ IWSE, 292-5063

Nuri Akgerman, die/mold design manufacturing, geometric modeling, CMM, ME (Adj), 292-2487

Jerald Brevick, automated die polishing, deformation of shot sleeves and air entrapment in die casting, IWSE, 292-0177

Gary L. Kinzel, sheet metal die design and CAD/CAM, ME, 292-6884

Kurt Koelling, properties of polymers, injection molding, gas injection molding, ChE, 292-2256

Ly Jim Lee, manufacture of polymeric composites, reaction injection molding, ChE, 292-2408

Anthony Luscher, design of plastic components, design for assembly, ME, 292-4474

Gary Maul, automation, sensors, material handling, IWSE, 292-7846

R. A. Miller, systems integration, design for manufacturing and process simulation in die casting, IWSE, 292-7067

Carroll Mobley, heat transfer, porosity and solidification in die casting, MSE, 292-5770

Shoichiro Nakamura, fluid flow, gas injection molding, ME, 292-0121

Rajiv Shivpuri, rolling, forging, forming machines, die wear in die casting, IWSE, 292-7874