The North American Manufacturing Research Institution of the Society of Manufacturing Engineers presents its...

20th NORTH AMERICAN MANUFACTURING RESEARCH CONFERENCE

NAMRC XX
MAY 20-22, 1992

Washington State University
Pullman, Washington USA

North American Manufacturing Research Institution
of the Society of Manufacturing Engineers
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NAMRC XX ORGANIZING COMMITTEE

Abdel Bayoumi, Co-Chair
David Hutton, Co-Chair
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ABOUT THE MEETING
The 20th North American Manufacturing Research Conference (NAMRC XX), on May 20-22, 1992, in Pullman, Washington, is designed to provide a forum for the timely presentation and critical discussion of the results of basic and applied research in material forming, material removal, and manufacturing systems/automation. All papers presented at the conference are contained in the bound volume titled "Transactions of the 20th North American Manufacturing Research Institution of SME - 1992." These papers have been accepted based upon a review of full length submissions, and they highlight manufacturing research efforts from universities, centers, and companies around the world. Participants this year will also receive a special 20th Anniversary index of authors and paper titles with abstracts prepared by NAMRI-SME.

The conference will feature three parallel sessions in material forming, material removal, and manufacturing systems. All presentations will be in Carpenter Hall, the newly remodeled School of Architecture building, near the engineering complex. The sessions will include formal presentations of the papers and a discussion period following each presentation. The conference begins with a keynote address and features several panels during the three days. Many informal social events and tours are planned. Being a spouse or guest to enjoy the planned activities!

PULLMAN AND HOW TO GET THERE (See maps)
The conference will be held at Washington State University, in Pullman, Washington, which is located 90 miles south of Spokane and 300 miles east of Seattle. Nestled in the rolling wheat fields known as "the Palouse," Pullman is home to the second largest university in the state with a land grant history surpassing 100 years. Eight miles to the east is Moscow, Idaho, home of the University of Idaho.

Getting to Pullman is easier than reaching many university towns. The Pullman/Moscow Airport is served by Horizon Airlines via connections with Spokane and Seattle, WA; Portland, OR; and Boise, ID. You may choose to fly into the Pullman/Moscow Airport, or arrive in Spokane and drive to Pullman. Take I-90 east and Highway 195 south through Colfax to Pullman. Rental cars are available from the major agencies at both airports. The Campus Link van service from Spokane to Pullman is available by calling (208) 882-1223. If you are taking the Boeing Tour in Auburn until 5:00 p.m. on Tuesday, May 21, there are flights from Seattle to Pullman departing at 6:30 p.m. and 8:35 p.m. If you arrive in Spokane, Campus Link departs to Pullman at 12:05 p.m., 3:40 p.m. and 9:05 p.m. Make reservations early.
as Horizon Air and Campus Link have limited seating. For ground transportation from the Pullman Airport, contact the University Inn or the Quality Inn. Student drivers will assist with local transportation and will meet incoming Pullman flights on Tuesday, May 31. Phone during conference for emergencies, (509) 334-9064.

FARE DISCOUNTS
WSU, on behalf of NAMRC XX has officially named FIRSTRAVEL (travel agency) to assist you with travel arrangements and provide discounts of 5% off excursion fares and 40% off coach fares on domestic flights by United Airlines. Discounts on rental cars are also offered by booking through FIRSTRAVEL. Valid travel dates for airfare discounts are May 17 through May 25, 1992. Please call 1-800-735-6363 as soon as possible for best seat and price availability. Inform FIRSTRAVEL agent that you are participating in the NAMRC conference. Airline tickets will be sent by certified mail or, if necessary, by express service.

MOTEL LODGING
Please make your own motel reservation. The Quality Inn and the University Inn have rooms blocked for this event and can provide transportation to and from the Pullman airport if requested. The Quality Inn will provide transportation to and from Carpenter Hall for NAMRC attendees upon request. Rates for 1 person: Prices do not include tax and are subject to change.

Motel in Pullman, Washington
Area Code (509) American Travel Inn 334-3500 $30.00
Coqer Land Motel 334-3535 $32.00
Hilltop Motor Inn 334-2555 $25.00
Manor Lodge Motel 334-2511 $20.00
Quality Inn, Paradise Creek 332-6500 $42.50

Motel in Moscow, Idaho
Area Code (208) Motel "B" 883-5531 $22.95
Super 8 883-3898 $30.00
University Inn Motel 882-6500 $49.95

CAMPUS HOUSING
Rooms in the WSU Stimson Residence Hall are also available. Within walking distance of the Compton Union Building, this nicely remodeled, older dormitory has shared suites and baths. Rates for a single are $21.00 per night and $15.00 per person for a double (includes linens, blanket and pillow). You may wish to bring hangers for the closet. No smoking is allowed in any university or state building.

TRANSACTIONS AND ANNIVERSARY INDEX
All registered NAMRC participants will receive one hardbound copy of the "Transactions of the North American Manufacturing Research Institution of SME - 1992" at the time of registration. Additional copies may be purchased at the registration desk or by contacting Conferences & Institutes, Proceedings Sales, 201 Van Doren Hall, Washington State University, Pullman, WA 99164-2222. The cost is $65 plus shipping per copy. In honor of NAMRC's 30th year, a special anniversary index of papers and authors will also be given to attendees.

PARKING
Parking on campus is by permit only. Permits will be mailed with your WSU registration confirmation, or pick one up at the first night reception. Parking will be allowed to lots posted as Green, Yellow, Red, or Blue with a permit on your rearview mirror or dashboard. Do not park in covered lots, at meters, fire or handicapped zones.

TOUR OF BOEING FABRICATION FACILITY
Before heading to Pullman for the conference, NAMRC attendees will be allowed to tour the Boeing Metal Fabrication Facility in Auburn, Washington, on Tuesday, May 19, 1:00-3:30 p.m. The Boeing address is 700 15th St. S.W. in Auburn, within 30 minutes from the Seattle-Tacoma Airport. If you drive, take I-5 south to Highway 18. Turn right onto West Valley Road South (Highway 18) and turn left onto 15th St. S.W. Meet at the front entrance. Group bus transportation to and from the Sea-Tac Airport is available at a cost of $12.00, payable to Northwest Convention Services by April 17, 1992 (use separate form provided). The tour will leave the Sea-Tac Airport baggage claim area at 12:45 p.m. and return to Sea-Tac by 4:30 p.m. Meet tour guide in red or blue blazer. Current scheduled horizon flights to Pullman depart at 6:20 p.m. and 8:25 p.m. Enclose a stamped, self-addressed envelope if you would like a confirmation. Please arrive 15 minutes prior to departure. Refunds for cancellations will only be made if a written request is received at Convention Services Northwest by April 17 ($3.00 handling fee), or if tour minimums are not met.

SPouse/GUEST PROGRAM
There are two parts to this program designed for visiting spouses, guests and others who are not attending the conference. On Wednesday, May 20, a trip to the Nez Perce National Historical Park is planned for 1:30 p.m. departure from Pullman's Quality Inn Motel. Cars or vans will take you on a magnificent 45 mile drive down the Lewiston grade, across the Clearwater River and on to the park where the Nez Perce Indian history is richly portrayed. Instead of returning to Pullman, the van will take you directly to the evening Bar-B-Q along the banks of the Snake River. Return with the others to Pullman around 9:00 p.m.
The second part of the program is a six-hour tour on Thursday, May 21, of the local area known as the Palouse. This tour through the rolling hills near Pullman will make your introduction to the area a memorable one. Leaving at 9:00 a.m., from the Quality Inn Motel, a local historian will explain the geological events that formed the unique, undulating landscape that figures prominently into the agricultural and timber industry of the Palouse. Stops include a pioneer village, Colfax (our county seat), the historic Perkins House for lunch, the Dry Pea and Levlil Commission and the Appalosa Horse Club and Museum. Cost for the Palouse Tour is $30, payable to Wheatland Travel by April 20th, address: S. 1690 Grand Ave, Pullman, WA 99163, phone (800) 336-8161, Suzanne Myklebust. Complete the separate form provided.

HELL'S GATE PARK SALMON BARBECUE

Dress casually and relax after a busy day of meetings at the all-conference Salmon Barbecue on Wednesday, May 30. This event will be from 5:00 to 9:00 p.m. at the Hell's Gate State Park on the Snake River just south of Lewiston, Idaho. Bus transportation is included in the registration fee and will depart Pullman's Quality Inn Motel at 4:00 p.m. At the Park, enjoy refreshments and a fabulous salmon dinner under the picnic shelter of this spacious park on the quiet banks of the Snake River. At 7:00 p.m. there will be a special display of Nez Peru Indian Nation culture with dancers, drumming performed by local drummers and dancers in full costume. You may even learn one of the Indians' dances! The Park closes at sunset. This barbecue is included in the registration fee. Extra Spouse/Guest tickets can be purchased. Use the WSU Registration form.

BLount, INC., MANUFACTURING TOUR

On Friday, May 22, following the NAMRC program and a sandwich lunch at the Quality Inn, there will be a post-conference tour of Blount, Inc., in Lewiston, Idaho. Blount is a small but modern manufacturing firm that is primarily a metal forming plant for cartridge breech. You may sign up for the tour on the WSU registration form and pay a $10.00 additional fee for the round trip bus ride. The tour departs at 1:00 p.m. from the Quality Inn Motel and returns around 4:00 p.m.

CONFERENCE REGISTRATION

Registration fees for NAMRC XX are $2725.00 (U.S. funds) for advance registration and $300 for registration after May 11. This fee, payable to Washington State University, includes admission to all sessions, a bound copy of the 1995 Transactions of NAMRC/SME, the Special 20th Anniversary Index, refreshments, three luncheons, and the Salmon Barbecue. There are no one-day registration fees or reduced fees for authors or session chairs.

Students will be admitted to the conference for $900.00. Retirees will be admitted for $165.00. These fees include all the refreshment breaks, conference meals, but do not include the Transactions. Bound copies of the Transactions with a copy of the Index can be purchased at the registration desk for $65, or contact Conferences & Institutes Proceedings Sales, Washington State University, 206 Van Doren Hall, Pullman, WA 99164-5222. Extra tickets to conference meals may be purchased in advance or at the conference, at least one day prior to the meal. Please indicate requests for additional meal tickets on the registration form.

REFUNDS

The registration fee is refundable in full up to five working days before the conference. Cancellation within five days of the conference will be subject to a $50 cancellation fee. No refunds once the conference begins.

TO REGISTER

Complete the registration forms, include the proper fees, and send to the separate vendors as indicated. Checks, money orders, purchase order numbers or VISA/Mastercard are accepted for WSU payments. All other vendors accept checks only. There are three easy ways to register and pay for the conference and events handled by WSU:

1. Call by phone with PO or bankcard, (509) 335-3350
2. FAX form and payment information to (509) 335-0045
3. Mail form and payment to Conferences & Institutes, Washington State University, 206 Van Doren Hall, Pullman, WA 99164-5222

FOR OTHER EVENTS, FILL OUT THE FORM AND MAIL WITH YOUR CHECK TO THE ADDRESS

For additional information about the program content, contact Dr. David Hutton, Conference Co-Chair, at (509) 335-7437. For registration, call Conferences & Institutes at (509) 335-3530. For specific questions about tours, events and lodging, call Nancy Mack or Lea Turnbow at C & I, (509) 335-3530.

POST-CONFERENCE EVENTS

WHITE WATER RAFT TRIP

On Saturday, May 23, ride the rapids of the famous Salmon River "No Return" in a sturdy rubber raft with certified outfitters and guides. Begin at 7:00 a.m. with a 2 1/2 hour van ride to Riggins, Idaho, where you will load onto rafts for a day of white water rafting through some of the Salmon River's most magnificent rapids. Enjoy a famous riverside deli lunch. All equipment except wet suits are provided. You can rent a wetsuit from WSU for $30.00 plus deposit.
The cost is $68.00 which includes transportation, lunch and equipment. Make your raft trip payment to Salmon River Experience, 812 Truman, Moscow, Idaho 83843 (208) 882-2385. Use the form provided. The trip will finish at 5:00 p.m. arriving back in Pullman by 8:00 p.m. There will be an opportunity to stop for snacks on the way home. Extremely unfavorable weather, water conditions or insufficient reservations can be cause for trip cancellation. Reservations must be made by April 20, 1982.

**JET BOAT TRIP**

For sheer excitement, few experiences can match a jet boat ride through Hells Canyon, the deepest canyon in North America! On Saturday, May 23, if you aren’t up to rating, try a comfortable jet boat ride up the Snake River. Adventure, unequaled scenery, abundant wildlife, fascinating geologic formations and the intriguing flavor of the American West combine to provide a memorable trip. Departure time is 8:00 a.m. from Port of Wilma, in Lewiston, Idaho. Arrival time back at Lewiston is 5:00 p.m. You must provide your own transportation to and from Lewiston. Cost is $78.00 per person including lunch, payable by check to Beemer’s Landing, P.O. Box 1223, Lewiston, ID 83501, by May 5th. Water conditions or insufficient reservations can be cause for trip cancellation. Use the special form in this brochure.

**TRIP TO VICTORIA, BRITISH COLUMBIA, CANADA**

Take a 24/2-hour voyage aboard the Victoria Clipper jet catamaran on Sunday, May 24 departing at 7:30 a.m. from Seattle’s Pier 68. Victoria Clipper terminal and returning at 8:45 p.m. in Seattle. Cruise the Pacific Northwest’s iconic coastline, past the Juan Islands and into one of the prettiest city harbors in the world. Spend the afternoon exploring Victoria, B.C’s antique stores, Butchart Gardens, and the Empress Hotel (reservations required for high tea). Proof of citizenship (birth certificate, driver’s license or voter registration) is required by Canadian Customs. Cost is $777 (U.S.) per person. Make payment by check to Convention Services Northwest, by April 17, 1992, using the separate form enclosed. Please arrive 15 minutes prior to tour departure. Refunds for cancellations will only be made if written request is received at the Convention Services Northwest office by April 17, 1992, or tour minimums are not met. There is a $5.00 handling fee for refunds. Address: Tower Building, Suite 1200, 300 7th Ave, Seattle, WA 98101 phone (206) 292-9098, FAX (206) 292-0598 Kris Eastman. If you would like a confirmation, please enclose a self-addressed stamped envelope.
WSU REGISTRATION FORM

Society of Manufacturing Engineers

NAMRC XX
May 20-22, 1992
Pullman, Washington

Duplicate this form for additional persons.

Please print or type:

First

Middle Initial

Last

Company/Organization

Business Address

City ______________________ State ________ Zip+4 ________ Country ________

Business Telephone: ( )

Indicate Your Fees, payable to "Washington State University":

- Advance registration Fee, includes lunches, salmon barbecue (transportation provided), Transactions and special Index, $375.00
- Registration Fee postmarked after May 11, 1992, includes same as above, $300.00
- Students, includes meals no Transactions, $90.00
- Retirees, includes meal no Transactions, $165.00
- Extra copy of Transactions, $65.00
- Transportation to May 22 Industry tour to Bixler, Inc., $10.00
- Wednesday, May 20 extra barbecue ticket with transportation, $20.00
- Wednesday, May 20 extra lunch ticket, $11.00
- Thursday, May 21 extra lunch ticket, $11.00
- Friday, May 22 extra lunch ticket, $11.00
- Spouse/Guest Transportation May 20 to Indian Park, $10.00

Campus Housing Option in Simson Residence Hall (see page 5 of this brochure)

- Single room $23.00 per night x _______ nights. Dates: __________
- Double room $15.00 per night x _______ nights. Dates: __________

$_________ TOTAL PAYMENT in U.S. Funds

☐ Check enclosed payable to "Washington State University"

☐ Purchase Order - number

☐ Charge my: ☐ VISA ☐ Mastercard ☐ Other

Card Number ___________ Expiration Date ___________

THREE EASY WAYS TO REGISTER WITH WSU:
1. Call by phone with PO or bankcard, (509) 335-3630
2. FAX form and payment information to (509) 335-0465
3. Mail form and payment to: Conferences & Institutes, Washington State University, 206 VanDoren Hall, Pullman, WA 99164-3022

☐ This confirms a telephone registration.
TRANSPORTATION TO BOEING TOUR, MAY 19
VICTORIA, B.C. BOAT TRIP, MAY 24

Send check by April 17th payable to NW Convention Services, Tower Building, Suite 1200, 1809 7th Ave., Seattle, WA 98101. FAX: 206-292-0595.

☐ Yes, sign me up for transportation from Sea-Tac Airport to the Boeing Facility Tour, Auburn, WA, on May 18. Cost: $12.00.
☐ Yes, sign me up for the May 24th trip to Victoria, B.C. Cost: $77.00

NAME ____________________________
ADDRESS ____________________________
CITY __________________ STATE ______ ZIP ______
PHONE ____________________________

JET BOAT DAY TRIP ON THE SNAKE RIVER, MAY 23

Send check payable to Beamer's Landing, PO. Box 1223, Lewiston, ID 83501. Phone: (208) 745-6800. Fees must be received by May 15th.

☐ Yes, sign me up for the Jet Boat Trip, and lunch. Cost: $70.00
Note: You must provide your own transportation to Lewiston's Port of Wilma departure point.

NAME ____________________________
ADDRESS ____________________________
CITY __________________ STATE ______ ZIP ______
PHONE ____________________________

WHITE WATER RAFT TRIP, MAY 23,
ON THE SALMON RIVER

Send check payable to Salmon River Experience, 812 Truman, Moscow, ID 83843. Phone: (208) 922-5965. Fees must be received by April 20th.

☐ Yes, sign me up for the White Water Raft Trip, including lunch and roundtrip transportation to Riggins, ID, from Pullman, WA. Cost: $68.00.

Note: We suit cases available for $3.8 rent plus deposit at WSU, pay when you arrive.

NAME ____________________________
ADDRESS ____________________________
CITY __________________ STATE ______ ZIP ______
PHONE ____________________________

SPOUSE/GUEST PROGRAM, MAY 21

Send check by April 20th payable to Wheatland Travel, S. 1650 Grand Ave, Pullman, WA 99163, phone (509) 336-3036, Suzanne Myklebust.

☐ Spouse/Guest Tour on May 21: a six-hour tour of the Palouse with lunch, $30.00

Name of spouse or guest:

NAME ____________________________
ADDRESS ____________________________
CITY __________________ STATE ______ ZIP ______
PHONE ____________________________
TUESDAY, MAY 19

6:00 - 9:00 pm  
REGISTRATION AND RECEPTION  
Lewis Alumni Centre

7:00 pm  
NAMRI/SME BOARD OF DIRECTORS DINNER  
Quality Inn, Pullman

8:00 pm  
NAMRI/SME BOARD OF DIRECTORS MEETING  
Quality Inn, Pullman

WEDNESDAY, MAY 20

7:30 - 9:00 am  
REGISTRATION  
Carpenter Hall Lobby

8:30 - 9:00 am  
OPENING SESSION  
Carpenter Hall, Room 102

OPENING REMARKS  
A.E. Bayoumi and B.V. Hutton, Co-Chairmen, NAMRI XX Organizing Committee

WELCOMING REMARKS  
Samuel H. Smith, President, Washington State University  
Reid C. Miller, Dean of Engineering and Architecture, Washington State University

INTRODUCTORY REMARKS  
Ranga Komanduri, NAMRI/SME President, Oklahoma State University

9:00 - 10:00 am  
KEYNOTE PRESENTATION  
"Evolution and Revolution in Engineering"  
A.D. "Bert" Welliver, Senior Vice President, Engineering and Technology, The Boeing Company, Seattle, Washington

10:00 - 10:30 am  
BREAK

10:30 am - 12:00 noon  
SESSION 1

SESSION F-1  
Carpenter Hall, Room 101  
Co-Chairmen: G.S. Ponnuswamy, The Ohio State University  
G. D. Low, The Timken Company

F-1-1: "Characterization of Wire and Bar Rolling by Three Dimensional Elastic-Plastic Finite Element Method," J. Yasumoto and M. Kikutani, University of Tokyo

F-1-2: "A Multipoint Temperature Sensor for Metal Rolling," S. Zou and J. Jeswiet, Queen's University
THURSDAY, MAY 21

8:30 - 10:00 am

SESSION F-1 Carpenter Hall, Room 101
Panel Discussion: “Challenges and Progress in Superplastic Forming”
Chairman: C.H. Hamilton, Washington State University

SESSION F-2 Carpenter Hall, Room 102
Co-Chairmen: R. Komanduri, Oklahoma State University
and W.R. DeVries, Rensselaer Polytechnic Institute

SESSION F-3 Carpenter Hall, Room 212
Co-Chairmen: S.M. Pandit, Michigan Technological University
and J.L. Garbini, University of Washington

10:00 - 10:30 am

SESSION G-1 Carpenter Hall, Room 101
Co-Chairmen: R.A. Kober, University of Missouri - Rolla
and K. Kerr, Blount Incorporated

SESSION G-2 Carpenter Hall, Room 102
Co-Chairmen: I.S. Jawahir, University of Kentucky

SESSION G-3 Carpenter Hall, Room 212
Panel Discussion: “Quality Issues in Manufacturing”
Chairman: L.A. Kendall, University of Minnesota - Duluth

BREAK

10:30 am - 12 noon

SESSION H-1 Carpenter Hall, Room 101
Co-Chairmen: T.W. Sutherland, Michigan Technological University
and B. Minardi, M. He and B. Shelton, University of Central Florida

SESSION H-2 Carpenter Hall, Room 102
Co-Chairmen: J.C. Sheppard, Ball State University
and N. Anastasia, Massachusetts Institute of Technology

SESSION H-3 Carpenter Hall, Room 212
Panel Discussion: “Computer Integrated Design for Manufacturability (DIM)
through a Hierarchical CIM System Structure,” M.L. Philpot, R.P. Datta
and D. Bornschein, University of Illinois at Urbana-Champaign

SESSION I-1 Carpenter Hall, Room 101
Co-Chairmen: H. Kipp, University of Michigan - Dearborn
and J.P. Roman, University of Michigan - Ann Arbor

SESSION I-2 Carpenter Hall, Room 102
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION I-3 Carpenter Hall, Room 212
Co-Chairmen: J. Liedtke, University of Massachusetts - Amherst
and J. Weimer, University of Colorado - Boulder

SESSION J-1 Carpenter Hall, Room 101
Co-Chairmen: J. Stahl, University of California - Berkeley
and J. Weimer, University of Colorado - Boulder

SESSION J-2 Carpenter Hall, Room 102
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION J-3 Carpenter Hall, Room 212
Co-Chairmen: J. Liedtke, University of Massachusetts - Amherst
and J. Weimer, University of Colorado - Boulder

SESSION K-1 Carpenter Hall, Room 101
Co-Chairmen: M. Breyer, California Institute of Technology
and J. Stahl, University of California - Berkeley

SESSION K-2 Carpenter Hall, Room 102
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION K-3 Carpenter Hall, Room 212
Panel Discussion: “Effect of Thermal Load on Wire Rupture in WEDM,” W.M.
Wang, K.R. Rajurkar and S. Royana, University of Nebraska - Lincoln

SESSION L-1 Carpenter Hall, Room 101
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION L-2 Carpenter Hall, Room 102
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION L-3 Carpenter Hall, Room 212
Panel Discussion: “Laser Contouring of Space Shuttle Tiles,” E.J. Bishop, A.
Minardi, M. He and B. Shelton, University of Central Florida

SESSION M-1 Carpenter Hall, Room 101
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION M-2 Carpenter Hall, Room 102
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION M-3 Carpenter Hall, Room 212
Panel Discussion: “Investigating the Effect of Laser Removal Rates in
Rotary Ultrasonic Machining,” D. Prebula and P.M. Ferrari, University of
Illinois at Urbana-Champaign; M. Hasekorn, Caterpillar, Inc.

SESSION N-1 Carpenter Hall, Room 101
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

SESSION N-2 Carpenter Hall, Room 102
Co-Chairmen: R.J. Proctor, University of California - Berkeley
and M. Breyer, California Institute of Technology

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and M. Breyer, California Institute of Technology

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and M. Breyer, California Institute of Technology

SESSION Q-2 Carpenter Hall, Room 102
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Panel Discussion: “Investigating the Effect of Laser Removal Rates in
Rotary Ultrasonic Machining,” D. Prebula and P.M. Ferrari, University of
Illinois at Urbana-Champaign; M. Hasekorn, Caterpillar, Inc.
SESSION F-4 Carpenter Hall, Room 101
Co-Chairmen: K. Sivakumar, University of Minnesota
K.J. Weimann, Michigan Technological University
F-4-1: "Effect of Optimal Stress-Induced Extrusion Die on Process and Product," M.S. Jooj and S.M. Hwang, Korea Institute of Science and Technology
F-4-2: "Roll Design System for ERW Tubes and Pipes," A. Tani and M. Kasaichi, University of Tokyo

SESSION N-4 Carpenter Hall, Room 102
Co-Chairmen: David Hutton, Washington State University
A. Thangaraj, Michigan Technological University
N-4-1: "Assessing Final Plastic Deformation in the Chip Formation Zone Based on Frictionless Compression Test Data," W. Grelinski, Opale Technical University; J. Litwin, CEGETEP de Saint-Laurent
N-4-3: "A Cutting Force Model for Face Milling with a Step Cutter," F. Gu, S.G. Kapoor and R.E. DeVor, University of Illinois at Urbana-Champaign; P. Banerjepadhyay, General Motors Research Laboratories

SESSION S-4 Carpenter Hall, Room 212
Co-Chairmen: A. Lehtinen, Pennsylvania State University
S. Smith, University of Florida
S-4-1: "Robot MIG Weld Seam Tracking by Dip-Resistance Monitoring," M.L. Philpott, University of Illinois at Urbana-Champaign
S-4-2: "Identification of Root Causes of Variation in Automobile Body Assembly," S.J. Hu and S.M. Wu, University of Michigan at Ann Arbor

12:00 noon - 1:30 pm
NAMRI/SME Luncheon
Compton Union Building, Cascade Room
1:30 - 3:00 pm
SESSION S

SESSION F-5 Carpenter Hall, Room 101
Co-Chairmen: D.R. Durham, University of Vermont
M. Ramulu, University of Washington
F-5-2: "An Approach to a New Forming Operation for Optical Drums," M. Saito, Sansaku College of Technology; K. Ichida, City University
F-5-3: "Characterization of Glass Mat Thermoplastics at Forming Temperatures," Y.C. Shiau, EJ Shih and R. Allard, Oklahoma State University

SESSION N-5 Carpenter Hall, Room 102
Panel Discussion: "Modeling, Design and Selection of Composite Materials"
Chairman: H. Zbib, Washington State University

SESSION S-6 Carpenter Hall, Room 212
Co-Chairmen: V. Venkatesh, Tennessee Technological University
Q. Yu, St. Cloud State University
S-6-1: "Sensor-Based Supervision of CNC Machining," R.L. Wells, S. Smith, J. Thusty, University of Florida
S-6-3: "Restrain Analysis of Machining Fixtures," R.C. DeMeter, Pennsylvania State University
3:00 - 3:30 pm
BREAK
3:30 - 5:00 pm
SESSION 8 Carpenter Hall, Room 102
MANUFACTURING IN THE PACIFIC NORTHWEST
Chairman: D.V. Hutton, Washington State University
This session is devoted to presentations by major manufacturing companies having significant operations in the host region: Boeing and Hewlett-Packard.
5:00 - 6:00 pm
SOCIAL RECEPTION Carpenter Hall Lobby
6:00 pm
NAMRI/SME MEMBERSHIP MEETING Electrical and Mechanical Engineering Building, Room 154
7:00 pm
ASME PRODUCTION ENGINEERING DIVISION MEETING Electrical and Mechanical Engineering Building, Room 154
Please note that this meeting will start immediately following the NAMRI/SME Membership Meeting.

DINNER ON YOUR OWN
Information on local restaurants will be provided.

FRIDAY, MAY 22

8:30 - 10:00 am
SESSION 7
SESSION F-7 Carpenter Hall, Room 101
Co-Chairmen: H. Zbib, Wasington State University
R. Shivpuri, The Ohio State University
F-7-1: "An Integrated Approach to Process Simulation and Die Stress Analysis in Forging," M. Knorr, T. Lange and T. Altan, The Ohio State University
F-7-2: "Finite Element Simulation of Induction Heat Treatment and Quenching of Steels," K.F. Wang, S. Chandrasekar; H.T.Y. Yang, Purdue University
M-7-3: "Spindle Speed Regulation and Tracking in Interrupted Cutting," T.-C. Tsao and K.-C. Fong. University of Illinois at Urbana-Champaign
SESSION 5-7 Carpenter Hall, Room 212
Co-Chairmen: O. Eyada, Virginia Polytechnic Institute and State University
O. Masory, Florida Atlantic University
S-7-1: "Symmetric and Computational Conjugate Geometry for the Manufacture of Helically Swept Surfaces," R.S. Voruganti, S.G. Dhonde, and C.F. Reinholdt, Virginia Polytechnic Institute and State University
S-7-3: "Geometry Cotion in the Routing of Automated Guided Vehicles," J. Huang and U.S. Palekar, University of Illinois at Urbana-Champaign
10:00 - 10:30 am
BREAK
10:30 am - 12:00 noon
SESSION 6
SESSION F8 Carpenter Hall, Room 101
Co-Chairmen: S. Kalpakjian, Illinois Institute of Technology
A.E. Bayoumi, Washington State University
F-6-1: "Effect of Metal Forming Parameters on Strength and Fatigue Behaviour of Extruded Workpiece," W. Müller, B. Hager and W. Schwab, Universität Stuttgart
F-6-2: "A Friction Test Based on Combined Backward Can - Forward Bar Extrusion with Emphasis on Backward Flow," M.E. Pepelek, Saginaw Division of General Motors, K.J. Weinmann and S.A. Majlessi, Michigan Technological University
F-6-3: "Investigating the Effect of Extrusion Power and the Lubricant Film Thickness on the Surface Quality of the Extrudate," S. Momir and R. Shivpuri, The Ohio State University
SESSION M-8 Carpenter Hall, Room 102
Co-Chairmen: R.E. DeVor, University of Illinois at Urbana-Champaign
H.P. Bao, University of Missouri - Columbia
M-6-1: "Radial Forces in Short Hole Drilling and Their Effects on Drill Performance," C. Nedoss and U. Gunther. Technische Universität Hamburg-Harburg
SESSION 5-8 Carpenter Hall, Room 212
Co-Chairmen: C. Reinholdt, Virginia Polytechnic Institute and State University
E. DeMoor, Pennsylvania State University
S-8-1: "An Automatic Process Planner for Cold Extrusion of Components," Q. Sun and J.R. Dixon, University of Massachusetts at Amherst
S-8-3: "Quantification of Part Mix Complexity Using an Entropy Measure," A. Deshmukh, J.J. Takavage and M.M. Barash, Purdue University
12:00 noon
LUNCHEON Quality Inn, Pullman
ADJOURNMENT