EDITOR'S NOTE:
This issue of the World of Composites begins with a summary of activities of ASTM's Committee D–30 on High Modulus Fibers and Their Composites, and a call for papers from Committee E–28 on Mechanical Testing. Activities at the Suppliers of Advanced Composite Materials Association will then be reviewed. This will be followed by news from the Canadian Association for Structures and Composite Materials. Finally, several recent composites publications will be outlined.

ASTM COMPOSITES ACTIVITIES

ISR and D–30 Secure International Harmonization Support

National Science Foundation and the Naval Surface Warfare Center to Provide Funds

The ASTM Institute for Standards Research in cooperation with ASTM Committee D–30 on High Modulus Fibers and Their Composites has recently secured full funding from the National Science Foundation and the Carderock Division of the Naval Surface Warfare Center to move forward on a first phase of an international effort to harmonize composite materials standards.

The objectives of the new ISR program are to:

A. Harmonize ASTM's D 3039 tension test with its ISO counterpart.
B. Validate these methods through an international interlaboratory testing program.
C. Develop the basis for a critically needed composite material database that can be used by U.S. industry for improving the engineering design of advanced composites.

The need to harmonize standards is vital to keep the U.S. composites industry competitive internationally. ASTM has some of the best composite material test methods in the world. It is important that these tests become the basis of international documents. Failure to do so could easily result in another country's technology providing the basis for standards being adopted by ISO and U.S. industry being forced to use them. Without rapid harmonization the U.S. composites industry could be placed in an unfair competitive position by foreign competitors.

Phase 1 of the harmonization effort involves a round robin testing program to validate ASTM D 3039-93, Test Method for Tensile Properties of Polymer Matrix Composite Materials. ASTM D 3039 has been chosen as the first standard in this effort because soon it should be deemed technically equivalent to ISO CD 527-5 (Plastics Determination of Tensile Properties, Part 5: Test Conditions for Unidirectional Fiber Reinforced Plastic Composite). ISO CD 527-5 is being reviewed by ASTM, SACMA, Mil Handbook 17, and AIA to ensure its technical merit and equivalence to current U.S. tension tests including ASTM D 3039.

ASTM D 3039 is perhaps the most commonly used ASTM composite material test method. It is used to establish the tensile modulus and strength of composites, properties which are generally the first given in material property data sheets and are required for most types of analysis. ASTM D 3039 provides the basis for other ASTM composite material standards such as ASTM D 3479 on fatigue and ASTM D 3518 on in-plane shear.

Validating the precision of ASTM D 3039 and ISO CD 527-5 will enhance their technical equivalence and establish them as internationally accepted documents for trade. The new ISR program will ensure that the ASTM D 3039 round robin will be conducted at the same time with the same materials as a similar round robin planned for ISO CD 527-5.

Ten labs have already agreed to voluntarily participate for the U.S. part of the ASTM D 3039 round robin program. They include Ciba Composites, Cincinnati Testing Laboratories, University of Dayton Research Institute (UDRI), Martin Marietta, Hexcel, Texas A&M, DuPont, U.S. Army Research Laboratory, Integrated Technologies, and L. J. Broutman.

The following eight materials have been proposed for the program: carbon/thermoplastic tape, carbon/epoxy tape, glass/epoxy tape, carbon/toughened epoxy tape, carbon/thermoplastic fabric, carbon/epoxy fabric, glass/epoxy fabric, and aramid/epoxy. Hercules, 3M Aerospace, Ciba Composites, and VPI have agreed to contribute five of these materials for the ASTM D 3039 round robin. The remaining will be supplied by international participants.

For more information, please contact: Kathleen Riley, Executive Director, ASTM Institute for Standards Research at 215-299-5527, or Dr. Peter Sjoblom, Project Manager, University of Dayton Research Institute at 513-229-3812.
Life Prediction Methodology for Titanium Matrix Composites

Thirty-three papers were presented at the symposium which was held on 22-24 March 1994 at Hilton Head Island, SC. The papers were divided into five sessions representing all aspects of damage mechanics associated with life prediction methodology required for titanium matrix composites (TMCs). The sessions were as follows:

- Session I: Interface Properties and Microstructure—Chaired by Jim Larsen, USAF Wright Laboratories
- Session II: Fiber Bridging Behavior—Chaired by Tony Evans, University of California—Santa Barbara
- Session III: Inelastic Materials Behavior and Modeling—Chaired by Rod Ellis, NASA Lewis Research Center
- Session IV: Fatigue—Chaired by Paul Bowen, University of Birmingham, U.K.
- Session V: Life Predictions—Chaired by Dave Buchanan, McDonnell-Douglas Aircraft.

The papers covered most of the work conducted as part of the National Aerospace Plane Program and part of the work conducted in the United States for the high-performance aircraft engine programs at NASA Lewis and the Air Force. These collective papers represent the current state of the art and should be a valuable reference for scientists and engineers working in this area.

The audience consisted of representatives from the major engine companies (G.E., Pratt & Whitney, Rolls Royce, etc.), several airframers, many government labs (including Japanese and U.K.), and universities both in the United States and abroad.

Lively discussions were held after each session. In particular the debates on appropriate fiber bridging analysis and time/temperature dependent property modeling were informative. Other discussions centered around future applications of TMCs and areas of needed future research.

All submitted papers will be peer-reviewed by three reviewers. Those papers accepted will be published in an ASTM Special Technical Publication (STP). The anticipated date for publication is Summer 1995. For information pertaining to the STP, contact Ms. Kathy Dernoga at ASTM, 215-299-5581. This symposium was chaired by W. Steven Johnson of NASA Langley Research Center, James M. Larsen of USAF Wright Laboratories, and Brian N. Cox of the Rockwell International Science Center.

E–28 Issues Call for Papers

Symposium on M'D III: Mechanics and Mechanisms of Material Damping


The main objective of this symposium, as a sequel to M'D held in Baltimore, MD in 1991 and to M'D II held in Pittsburgh, PA in 1993, is to continue to bring about a synergistic interaction between researchers in the fields of mechanics of solids and materials science. The symposium is intended to foster a better understanding of the fundamentals of material damping, leading to design of materials with enhanced intrinsic damping. It is hoped that this symposium will promote an increased collaboration between the two disciplines.

Technical papers are invited on all aspects of innovative methods for enhanced material damping including:

- Mechanics of Material Damping
- Mechanisms of Material Damping
- Measurement of Material Damping (Relaxation Mechanisms; The Zener Relaxation; The Snook Relaxation; Grain Boundary Relaxation; Point-Defect Relaxation; Dislocation Damping; Phase Transformations; Magnetoelastic Relaxation; Interfacial Damping)
- Analytical Modeling in Multiphase Materials (Correspondence Principles; Viscoelasticity of Heterogeneous Media; Anelasticity; Irreversible Thermodynamics; Internal State Variables; Plasticity: Micro and Macro; Metallic Foams)
- Novel Techniques for the Measurement of Damping (Nonlinear Damping; Composite Materials: Metal-Matrix, Polymer-Matrix, Ceramic-Matrix, Carbon-Carbon; Damage-Induced Damping; Porous Materials)

Prospective authors must submit a title and a 250 to 300 word abstract by 15 November 1994. The abstract must include a clear definition of the objective and approach of the work discussed, pointing out material that is new, and present sufficient details regarding results. Your presentation and manuscript must not be of a commercial nature nor previously published. Submit the abstract to Dorothy Savini, Symposia Operations, ASTM, 2180 675, Fax: (03) 2180 652; or Dr. L. Kabacoff, Office of Naval Research, Code 1131, 800 North Quincy St., Arlington, VA 22217-5000, Telephone: 703-696-0283, Fax: 703-696-0934; or Ms. C. Wong, Carderock Division, Naval Surface Warfare Center, Code 612, Annapolis, MD 21402-5067, Telephone: 410-267-2835, Fax: 410-267-4885.
SUPPLIERS OF ADVANCED COMPOSITE MATERIALS ASSOCIATION

Conference to Address Environment, Health, and Safety Concerns

SACMA believes that the key to the success of any business is keeping abreast of the latest industry developments, innovative approaches, and advances in emerging fields, particularly environmental, safety, and health technology and research. The prominence of these issues in today’s world is mirrored by the federal government’s daily development of initiatives to regulate how businesses address these issues. With the rapid commercialization and expanding applications of composite materials, particularly in the aerospace community, paying attention to safety and environmental issues is becoming increasingly more important for the industry.

Historically, the Suppliers of Advanced Composite Materials Association has taken a proactive stand in these areas. Most recently, SACMA decided to co-host a conference entitled Environmental, Safety, and Health Considerations for Composite Materials in the Aerospace Industry, to be presented in the fall of 1994. The conference is cosponsored with the Aerospace Industries Association (AIA) and National Aeronautics and Space Administration (NASA); the Department of Defense has been invited as a cosponsor as well.

The conference is part of the Association’s continuing effort to identify, confront, and communicate the latest developments in health and environmental issues. It is designed to be a unique forum for exchanging state-of-the-art environmental and pollution prevention technology developments within the advanced composite industry, aerospace community, and related federal agencies.

The conference will feature significant research and technological advancements in critical areas such as Pollution Prevention; Product Safety and Stewardship; Hazardous Materials Substitutions; Methods for Hazard Evaluation; Composite Dust Studies; Off-Gassing Studies; Industrial Hygiene; Ergonomic Concerns with Composites; Safe Handling of Materials; Ventilation; Hazard Communication Training; and Specific EH&S Problems and Case Studies.

The conference will be held 20-21 October 1994, in Mesa, AZ. SACMA, AIA, and NASA have issued a Call for Papers for the joint conference. Those interested in addressing these and other contemporary environment, health, and safety issues by presenting a paper or attending the conference should contact SACMA staff.

Although environmental, health, and safety concerns are more visible today than ever before, they are not new issues for SACMA. The Association has six established Working Groups under SACMA’s Environment, Health and Safety Committee which track new developments and synthesize the latest advancements into current and credible industry literature. Some of the Committee’s past success stories include publication of Safe Handling of Advanced Composite Materials, and the SAVE YOUR SKIN! booklet and video series. As part of SACMA’s continuing proactive efforts on environmental, health, and safety matters, the information gleaned from the fall conference will be incorporated into a format that provides readily available technical information for communication throughout the advanced composite industry and to allied interests.

For more information on SACMA’s environmental, health, and safety initiatives, contact SACMA staff at 703-841-1556 or Fax: 703-841-1559.

CANADIAN ASSOCIATION FOR STRUCTURES AND COMPOSITE MATERIALS

International Conference on Composite Materials and Energy Announced

Enercomp 95 will bring together the energy industry and the composite materials sector with a view to developing strategic alliances for the future and to promote the transfer of know-how within the scientific community of these two industries.

From 8–10 May 1995, Montreal will be the crossroads for these two industries when the Canadian Association for Structures and Composite Materials (CACSMA) will become host to Enercomp 95, the first international conference on the use of composite materials in the generation, storage, distribution, and utilization of energy.

Enercomp 95 will unite specialists in the fields of ceramic, metal, and polymer composites as well as international leaders in the energy sector in all its forms: electricity, gas, petroleum, nuclear, solar, and wind power. The event will combine two aspects. The first, more scientific, consists of the presentation of some 200 technical papers, a dozen or so to be delivered by invited speakers, all renowned experts in their respective fields. The second aspect involves a technology transfer activity in the form of a poster session where 100 participants will present their products, technologies, and applications in an atmosphere favoring communication and exchange.

Enercomp 95 has been made possible by the collaboration of Hydro-Québec, the Quebec and Canadian governments, the Canadian composite-materials manufacturing and utilization industry, and a number of other partners. It has the full support of a competent technical committee and an advisory committee whose members represent the world’s best known researchers, scientists, and technology specialists in their respective fields. In all, eleven countries from Europe, Asia, and America will be sending participants to this event.

The major themes to be covered by the technical papers and poster sessions include:

• new use of composites in the different energy sectors (oil extraction and transportation, gas bottles and tanks, electric power line hardware, wind turbine blades, photocell plates)
• contribution of composites to energy savings in transportation, construction, and other fields (insulating panels, piping, refractory cooling towers, all lighter structural materials for transportation)
• use of composites in all types of energy storage (batteries, flywheels)

• promising new materials (nanocomposites, selective glasses)
• rupture, degradation, and durability of composites and energy savings
• design methods and energy-efficient manufacturing processes.

RECENT COMPOSITES PUBLICATIONS

ASTM Publishes Two STPs; Dekker Prints Second Edition of Composites Text; Woven Fabric Composites Text Published

Fractography of Modern Engineering Materials: Composites and Metals, Second Volume


Failure analysis of composite materials and metals is the subject of the eleven papers in this new volume, covered in three sections:
• Unique Fractographic Techniques
• Metallic Materials
• Polymeric and Composite Materials.

The section titles reflect the diversity of materials discussed, including crosslinked polyethylene, AISI 52100 steel, 2024 aluminum, and a variety of organic and metal matrix fibrous composites. Case studies also cover a wide range, including failure investigations of an antenna used in deep space exploration and chemical storage tanks. Papers range from theoretical to applied.

This book will aid investigators in conducting failure investigations. It is useful to metallurgists, ceramists, composite material specialists, researchers, and engineers actively involved in failure analysis of materials.

CONTENTS:

Recent Developments in Quantitative Fractography
Computerization of Fracture Features and Failure Analysis of Automotive Composite Materials
Statistical Analysis of Profilometric Sampling for Roughness Parameters
Quantitative Fracture Surface Analysis of Fatigue Crack Propagation Under Variable Amplitude Loading
Deep Space Network 70-Meter Antenna Elevation Bearing Failure Investigation
Fractographic Study of Notch Fatigue Crack Closure and Growth Rates
Effect of Oxidizing Environments on Long-Term Performance of Rotationally Molded XLPE Storage Tanks
Tensile and Tension-Tension Fatigue Fracture Behavior of $\gamma = Al_2O_3/Al$ Metal Matrix Composite at Room and Elevated Temperature
Failure Analysis of Aramid Fiber Reinforced Aluminum Laminates with Surface and Through Thickness Fatigue Cracks

Fractographic Analysis of Quasi-Isotropic Laminates Loaded in Compression
Quantitative Fractography of the Cracked Lap Shear Composite Specimen


This book gives you access to current design, test, and analysis techniques and data for composite materials. Twenty-two peer-reviewed papers cover:
• Materials Testing and Response (transverse tension and shear properties; compression test methods; multiaxial stress state response; other properties)
• Design and Analysis
• Interlaminar Fracture and Strength

It is useful to composite materials suppliers, fabricators, DoD contractors, aerospace contractors, university professors in materials and mechanical engineering, and Army, Navy, Air Force, and NASA research labs.

CONTENTS:

Material Testing and Response

Transverse Tension and Shear Properties
Matrix-Dominated Mechanical Properties of a Fiber Composite Lamina
Scale Effects on the Transverse Tensile Strength of Graphite/Epoxy Composites
Inelastic Shear Response of Unidirectional Composites from Torsion of Solid Bars
Composite Material Shear Property Measurement Using the Iosipescu Specimen

Compression Test Methods

Compression of “Thick” Composites: Two Test Methods
Evaluation of Compression Specimens and Fixtures for Testing Unidirectional Composite Laminates
**Multiaxial Stress State Response**

Measurement of Multiaxial Ply Strength by an Off-Axis Flexure Test

Biaxial Testing and Failure Mechanisms in Tubular G-10 Composite Laminates

**Other Properties**

Elastic Constants of Isotropic and Orthotropic Composite Materials from Plate Vibration Test Data

High Strain Rate Effects for Composite Materials

Matrix-Dominated Stress/Strain Behavior in Polymeric Composites: Effects of Hold Time, Nonlinearity, and Rate Dependency

Thermomechanical Fatigue Behavior of SiC/Ti-24-Al-11Nb(O)

In Air and Argon Environments

**Design and Analysis**

Micromechanical Analysis of Fiber-Matrix Interface Stresses Under Thermomechanical Loadings

Bearing Strength Behavior of Clearance-Fit Fastener Holes in Toughened Graphite/Epoxy Laminates

Experimental Determination of the Effect of Hole Interaction on Stress Concentrations in Angle Ply Graphite/Epoxy Composite Panels

Design and Testing of Composite Laminates for Optimum Extension-Twist Coupling

Modeling of the Termo-Elastic Properties of Woven Fabric Composites in Complex Shapes

Analysis of Thick-Sectioned Composite Cylindrical Shells Under Hydrostatic Pressure

**Interlaminar Fracture and Strength**

The Effect of Mixed-Mode Loading on Delamination Fracture Toughness

A Bilinear Failure Criterion for Mixed-Mode Delamination

Delamination of Ply-Drop Configurations

An Interlaminar Tensile Strength Specimen

**Fiber-Reinforced Composites: Materials, Manufacturing, and Design**


Maintaining the broad, interdisciplinary perspective that made the first edition so popular, this second edition of an invaluable reference/text provides comprehensive discussions of all aspects of fiber-reinforced composites, including materials, mechanics, properties, test methods, manufacturing and design.

Written from a conceptual point of view and emphasizing fundamentals, *Fiber-Reinforced Composites, Second Edition* offers fully up-to-date, thoroughly expanded sections on

- fibers and matrix, including thermoplastic matrices
- discontinuous fibers and laminated structures
- static mechanical properties, fatigue properties, and damage tolerance

- resin flow, bag molding, filament winding, and resin transfer molding
- environmental effects.

With over 1000 literature citations, figures, tables, and display equations, this book is an incomparable reference for mechanical, manufacturing, materials, aerospace, automotive design, and structural engineers, and the text of choice for upper-level undergraduate and graduate students in these disciplines.

**CONTENTS**

Introduction

Materials

Mechanics

Performance

Manufacturing

Design

Metal and Metal Ceramic Composites

Appendices:

- Woven Fabric Terminology
- Residual Stresses in Fibers and Matrix in a Lamina due to Cooling
- Alternative Equations for the Elastic and Thermal Properties of a Lamina
- Halpin-Tsai Equations
- Typical Mechanical Properties of Unidirectional Continuous Fiber Composites
- Properties of Various SMC Composites
- Typical Mechanical Properties of Metal Matrix Composites
- Determination of Design Allowables
- Useful References
- Selected Computer Programs

**Woven Fabric Composites**


Although fiber-reinforced composites have long been recognized for their applications in load-bearing structures, the understanding of the thermomechanical behavior of these materials is still deficient.

This new book presents a unified, quantified examination of the thermomechanical behavior of an important class of composites—woven fabric composites.

Written by Niranjan K. Naik, Aerospace Engineering Department, Indian Institute of Technology, the book includes models for elastic analysis of a variety of laminae and laminates with experimental validation. Experimental investigations explore the effect of stacking sequence on strength and failure, and the book presents guidelines for optimum stacking sequence.

Chapters in the book include: Woven Fabric Composites; Elastic Analysis of a Plain Weave Fabric Lamina; Elastic Analysis of a Plain Weave Fabric Laminate; Elastic Analysis of Mixed and Satin Weave Fabric Laminates; Thermal Expansion Coefficients of a Plain Weave Fabric Lamina; Compact Plain Weave Fabric Laminates; Prediction of Notched Strength of Laminates; Effect of Stacking Sequence on Notch Sensitivity of Woven Fabric Laminates; and Failure Behavior of Woven Fabric Composites Under Off-Axis Loading.
Best Presentation Award

ASTM Committee D–30 Best Presentation Award

Mr. Kevin Koudela of the Applied Research Laboratory at the Pennsylvania State University is a recipient of the D–30 Best Presentation Award for his presentation entitled “A Novel Joining Method for Smooth-Bore Pressure Hulls” at the Symposium on Bolted and Bonded Joints in Composite Materials held during November 1993 in Fort Worth, Texas. The Symposium was sponsored by ASTM Committee D–30 on High Modulus Fibers and Their Composites. The paper presented was coauthored by Jim Sabo, Larry H. Strait, and Mark L. Karasek. The recipient of this award is selected based upon evaluations of all the symposium speakers by five members of the audience.

A Novel Joining Method for Smooth-Bore Composite Pressure Hulls

Kevin L. Koudela, Jim Sabo, Larry H. Strait, and Mark L. Karasek

Although the filament winding process has been successfully used to fabricate light weight composite shells, weight savings and structural performance attainable is generally limited by the type of interface between the composite and metal components. While significant work has been done in composite-to-metal joining, developmental thrusts have not focused on problems specific to the design and fabrication of low-cost circular joints. This paper discusses the development of a novel circular composite-to-metal joint for a filament wound composite pressure hull. The concurrent engineering approach, fabrication methodology, and validation testing of the novel circular composite-to-metal joint are presented.

The design of the circular end attachment was initiated by prescribing the material type(s), number of plies, and ply orientations of the skin laminates. The candidate skin configuration was input to a point stress lamination algorithm and effective laminate properties calculated including directional strengths, stiffnesses, and coefficients of thermal expansion. The effective laminate properties were, in turn, used as inputs to Hart-Smith’s double-lap joint design methodology [1] for prediction of the minimum required joint length and the resultant joint strength. To ensure that the maximum adhesive joint shear strength was achieved, the net longitudinal stiffness of the metal end ring “transition zone” was designed to be within 5% of the stiffness of the mating composite shell. This was accomplished by using double aluminum tangs separated by a low modulus potting material to form the transition zone of the double lap joint. The relative thicknesses of the aluminum tangs and potting material as well as the modulus of the potting material were iterated until the longitudinal stiffness of the composite skins were matched. An additional consideration in the design was the circumferential stiffness mismatch between the composite section and metal end ring. The transition zone of the aluminum end ring was designed to minimize the circumferential stiffness mismatch. This also required iterating on the aluminum tang and potting material thicknesses and potting material moduli.

After the composite-to-metal joint details were finalized, the global collapse pressure of the sandwich pressure hull was predicted using the simple closed form buckling equations developed by Koudela et al. [2]. In addition to the global instability calculation, several local buckling phenomena were checked including local buckling of the aluminum end joint, intracell buckling of the core, face sheet wrinkling of the inner and outer skin laminates, and shear crimping of the core. In order to assess the integrity of the core material and composite face sheets, through-the-thickness and discontinuity stresses were predicted for each candidate pressure hull design using a simplified version of the general Lekhnitski solution [3]. The three-ply Lekhnitski solution was then modified to include thermal effects due to operation of temperatures other than the laminate’s stress-free temperature. Discontinuity stresses generated as a result of the circumferential stiffness mismatch between the composite shell and bonded end joint were predicted from a closed-form solution based on the method prescribed by Ugural [4]. Thermal effects were also included in the discontinuity stress calculations. Two composite pressure hulls were then fabricated to the final design.

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In order to validate the integrity of the composite pressure hull design and specifically the robustness of the circular joint, several structural tests were conducted. First, the composite pressure hull was successfully proof tested to 3.497 MPa or two times the expected service pressure. The second pressure hull was fabricated for destructive testing purposes to evaluate the performance of the novel circular bonded end attachment. This shell was water-jet cut into longitudinal specimens and special tensile grips were designed and fabricated to facilitate tension testing in an Instron test machine. The results of the tests demonstrated an apparent (includes peel moment) tensile strength of the as fabricated joint of 10 510 N/cm. Validation test results demonstrate that the novel circular joint described in this paper is a viable alternative to more complex and costly composite-to-metal circular joints.

References
Calendar on Composites

The following meetings may be of interest to researchers in the field of composite materials.

**26 June–1 July 1994**
Twelfth U.S. National Congress of Applied Mechanics
Seattle, Washington
Contact: Engineering Continuing Education, University of Washington, GG-13, Seattle, WA 98195; Telephone: 206-543-5539, FAX: 206-543-2352

**27–29 June 1994**
ASTM Committee E-08 26th National Symposium on Fracture Mechanics
Idaho Falls, Idaho
Contact: Dr. Walter G. Reuter, EG&G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415-2281; Telephone: 208-526-1708, FAX: 208-526-0690

**18–22 July 1994**
10th International Conference on Experimental Mechanics
Lisbon, Portugal
Contact: Secretariat 10th Intl. Conf. on Exp. Mech. APAET, Laboratorio Nacional de Engenharia Civil, Av. do Brasil, 101, 1799 Lisboa Codex, Portugal; Telephone: 351-1-848-21-31/7, FAX: 351-1-849-76-60

**28 August–1 September 1994**
First International Conference on Composites Engineering (ICCE I)
New Orleans, Louisiana
Contact: Prof. David Hui, University of New Orleans, Department of Mechanical Engineering, New Orleans, LA 70148; Telephone: 504-286-6192, FAX: 504-286-5539, E-MAIL: dxhme@uno.edu

**13–15 September 1994**
2nd European Conference on Composites (ECCM CTS 2) Testing and Standardisation
Hamburg, Germany
Contact: EACM, 2, Place de la Bourse, 33076 Bordeaux Cedex, France

**20–22 September 1994**
American Society for Composites' Ninth Technical Conference and the Center for Composite Materials' Twentieth Anniversary Research Symposium
Newark, Delaware
Contact: Dr. Tsu-Wei Chou, Center for Composite Materials, University of Delaware, Newark, DE 19716; Telephone: 302-831-2904, FAX: 302-831-8525

**10–12 October 1994**
SES 31st Annual Meeting
College Station, Texas
Contact: Dr. David H. Allen, Dept. of Aerospace Engineering, Texas A & M University, College Station, TX 77843; Telephone: 409-845-1669, FAX: 409-845-6051, E-MAIL: dha6186@zeus.tamu.edu

**13–18 November 1994**
ASME Winter Annual Meeting
Chicago, Illinois
Contact: ASME, 345 E. 47th St., New York, NY 10017; Telephone: 212-705-7722

**14 November 1994**
ASTM Committee D-30 Symposium on Fiber Matrix and Interphase Properties
Phoenix, Arizona
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

**14–15 November 1994**
ASTM Committee E-8 Second Symposium on Thermomechanical Fatigue Behavior of Materials
Phoenix, Arizona
Contact: Michael J. Verrill, Co-Chairman, NASA, Lewis Research Center, 2100 Brookpark Rd., Cleveland, OH 44135; Telephone: 216-433-3337, FAX: 216-433-8011, or Michael G. Castelli, Co-Chairman, Sverdrup Technology, NASA, Lewis Research Center, Telephone: 216-433-8464

**14–16 November 1994**
ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting
Phoenix, Arizona
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

**1995**
SES 32nd Annual Meeting
New Orleans, Louisiana
Contact: Dr. David Hui, Dept. of Mechanical Engineering, University of New Orleans, New Orleans, LA; Telephone: 504-286-6192, FAX: 504-286-7413, E-MAIL: DXHME@jazz.ucc.uno.edu

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8–10 May 1995
*International Conference on Composite Materials and Energy (ENERCOMP '95)*
Montreal, Canada
Contact: ENERCOMP 95 Secretariat, 75, boul. de Mortagne, Boucherville, Quebec, Canada J4B 6Y4; Telephone: 514-641-5139, FAX: 514-641-5117

14–16 May 1995
*ASTM Committee D-30 6th Symposium on Fatigue and Fracture*
Denver, Colorado
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

14–17 May 1995
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
Denver, Colorado
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

28 May–2 June 1995
*7th International Conference on Mechanical Behavior of Materials*
The Hague, The Netherlands
Contact: ICMI7 Secretariat, c/o Congress Office ASD, Asvest 22, P.O. Box 40, 2600 AA Delft, The Netherlands; Telephone: 31-15-120234

5–7 June 1995
*The First International Symposium on Thermal Stresses and Related Topics*
Hamamatsu, Japan
Contact: Prof. N. Noda, Chairman, Thermal Stresses '95, Dept. of Mechanical Engineering, Shizuoka University, 5-1, Johoku 3 chome, Hamamatsu, 432, Japan; Telephone: 81-53-471-1171, ext. 267, 268, FAX: 81-53-475-4794, E-MAIL: tmnnoda@mm.shizuoka.ac.jp

5–7 June 1995
*International Conference on Mechanics of Solids and Materials Engineering*
Singapore
Contact: Prof. F. W. Travis, School of Mechanical and Production Engineering, Nanyang Technological University, Nanyang Ave., Singapore 2263; Telephone: 7911744, ext. 5500, FAX: 7911859; Telex: RS 38851 NTU, E-MAIL: MFTRAVIS@NTUVAX

12–15 June 1995
*1995 SEM Spring Conference and Exhibits*
Grand Rapids, Michigan
Contact: Society for Experimental Mechanics, Inc., 7 School St., Bethel, CT 06801

14–18 August 1995
*Tenth International Conference on Composite Materials (ICCM-10)*
Vancouver, Canada
Contact: Anoush Poursartip, Co-Chair, ICCM-10, c/o The University of British Columbia, Dept. of Metals and Materials Engineering, Vancouver, B.C., Canada V6T 1Z4; Telephone: 604-822-3665, FAX: 604-822-3619 E-MAIL: anoush.poursartip@ubc.ca

12–17 November 1995
*ASME Winter Annual Meeting*
San Francisco, California
Contact: ASME, 345 E. 47th St., New York, NY 10017; Telephone: 212-705-7722

14–15 November 1995
*ASTM Committee D-30 Symposium on Environmental Effects on Polymeric Composites*
Norfolk, Virginia
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

14–16 November 1995
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
Norfolk, Virginia
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

19–21 May 1996
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
Orlando, Florida
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

25–31 August 1996
*19th International Congress of Theoretical and Applied Mechanics*
Kyoto, Japan
Contact: Prof. Eiichi Watanabe, Secretary General, ICTAM 1996, Dept. of Civil Engineering, Kyoto University, Sakyo-ku, Kyoto 606-01, Japan; Telephone 81-75-753-5079, FAX: 81-75-752-5296

17–22 November 1996
*ASME Winter Annual Meeting*
Atlanta, Georgia
Contact: ASME, 345 E. 47th St., New York, NY 10017; Telephone: 212-705-7722

19–21 November 1996
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
New Orleans, Louisiana
Contact: Katharine Schaaf, ASTM, 1916 Race St., Philadelphia, PA 19103; Telephone: 215-299-5529

Send items for this calendar to:
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<tr>
<th><strong>Annual Administrative Fee</strong></th>
<th><strong>Organizational</strong></th>
<th><strong>Member</strong></th>
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<td></td>
<td>$350.00†</td>
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<tr>
<td>Participation on ASTM Technical Committees</td>
<td>One Official Rep. Only</td>
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<td>Annual Book of ASTM Standards</td>
<td>One Free Volume</td>
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<td>$3,700.00 (Prepaid)†</td>
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World of Composites—Covers ASTM's Committee D-30 meetings, highlights of other activities in the composite community, summaries of research activities, and outlines of recent composite publications. Please send items of interest to Dr. John Masters.*

Composites Contents—A listing of current literature of interest to the composite community as a service to our readers. Please send items of interest to Dr. Ronald F. Gibson.*

Calendar on Composites—Meetings of interest to researchers in the field of composite materials. Please send items of interest to Dr. Michael W. Hyer.*

W. Steven Johnson, Ph.D.
Editor-In-Chief

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