Advanced Composite Tetratruss for the Space Station

Large truss structures will serve as the backbone of the Space Station that NASA will deploy some time in the 1990s. Among the requirements for these trusses are high specific strength and stiffness and low coefficient of thermal expansion. Conventional lightweight tubular aluminum structures will not be suitable. Furthermore, it may be necessary to make the truss deployable in order to minimize expensive and risky extravehicular construction time.

The requirements stated above clearly indicate the advantages of fabricating the truss with advanced composites. To verify the capability of these materials for this application and to help establish the manufacturing technology necessary for large-scale production, NASA-JSC selected MDAC-HB to design and build a full-scale deployable tetratruss cell made almost entirely of advanced composites. The cell (Fig. 1) consists of 24 struts, each 10 ft (3 m) long, 15 of which fold in the middle to allow the cell to collapse. The strut tubes were roll wrapped with unidirectional preimpregnated AS4/976 tape from Fiberite in a [+10/-10/+30/-10] ply orientation. Hinge fittings, tube end fittings, and truss nodes were compression molded using graphite/epoxy tape and chopped fiber molding compounds. The end fittings consist of two clevises bonded to a cruciform centerpiece with epoxy adhesive. The hinge consists of two androgynous pivot fittings and several smaller parts in a spring loaded assembly. End fittings and hinges were bonded into the tubes with epoxy adhesive. Four assembly tools were designed and built for end fitting assembly, match drilling of hinges, and strut assembly. The end fittings and hinges have locking mechanisms which lock the structure into the fully deployed position and assure overall structural stiffness.

The fully deployed cell (Fig. 2) measures approximately 20 by 17.5 by 8.5 ft (6 by 5.3 by 2.6 m) and collapses into a bundle about 10 ft long and 20 in. in diameter. The deployment of the unit was demonstrated successfully several times before delivery to NASA-JSC in July 1986. Mechanical testing of the graphite/epoxy tubes was conducted by the Structures and Mechanics Division at NASA-JSC. The test results indicated a compressive strength of 92.3 ksi (634 MPa), compressive modulus of 14.4 msi (97 MPa), tensile strength of 192.4 ksi (1310 MPa), and tensile modulus of 15.6 msi (103 MPa). All of these values were within 12.5% of analytically obtained predictions.

The overall truss configuration, most likely a combination of one-dimensional beams and large planar arrays, will form a network on which the habitation modules of the station and all auxiliary structures will be mounted. The technology developed and the fabrication experience gained in this early development program will be valuable as the space station effort progresses. Other potential applications for this type of structure include the trusswork that will be included on the orbiting platforms envisioned for the Strategic Defense Initiative.

M. J. Robinson
McDonnell Douglas Astronautics Company
Huntington Beach, CA

SPE Composites Institute Publishes Directory of Resources

The Composites Institute, the largest division of the Society of the Plastics Industry, Inc. (SPI), has published a Directory of Resources—the first of its kind for this industry—to provide a myriad
of information to its members and those interested in reinforced plastics and composites. The directory is an easy-to-use, comprehensive catalog designed for finding and obtaining data and information on the industry and the Institute itself.

"The Institute hopes to save its members and the allied industry hours of time otherwise spent searching for information," said Catherine A. Randazzo, Institute manager. "The Directory of Resources provides them with a comprehensive, single information source, loaded with all kinds of data, resources and published material."

The several 100 pages of data housed in the Directory of Resources include: technical literature, related trade journals, newsletters, films, videotapes, slides, film strips, market data, industry reports/studies, market research consultants, schools, educational courses, training sessions, domestic and international associations, company publications, regulations, as well as a listing of Institute members, Institute subcommittees and other pertinent information.

The above data can be used in a variety of ways by a variety of people. Those interested in obtaining information on a particular market segment or a reinforced plastics/composites process would have this information at their fingertips. The Directory also lists the names and addresses of editors from approximately 380 publications, which cover the plastics industry. Information housed in this piece is sure to whet the appetite of those seeking data on the reinforced plastics and composites industry.

The Directory of Resources, which is now available, is priced at $50 for SPI members and $100 for nonmembers. Multiple copies are also available.

For further information on the Directory of Resources or instructions on how to order, please write to the Composites Institute, SPI, 355 Lexington Ave., New York, NY 10017 or call 212/370-7349.

National Center for Composite Materials Research

The National Center for Composite Materials Research (NCCMR), Urbana, IL, was established in Nov. 1986 as a DoD Center of Excellence for Multidisciplinary Research at the University of Illinois in Urbana-Champaign by an initial $18 million grant from the Office of Naval Research under the DoD-University Research Initiative Program.

NCCMR is administered by the College of Engineering of the University of Illinois at Urbana-Champaign with Dr. S. S. Wang, Prof. of Theoretical and Applied Mechanics and Prof. of Aeronautical and Astronautical Engineering, as Director and Dr. P. H. Geil, Prof. of Materials Science, and Prof. H. T. Corten, of Theoretical and Applied Mechanics, as Associate Directors.

Participating universities include Drexel University, Michigan State University, University of Maryland, Virginia Polytechnic Institute and State University, North Carolina A&T State University, Tuskegee University, and National Technological University.

The mission objectives of the Center are as follows:

(1) to conduct basic research on critical chemistry, materials science, mechanics and structural problems of advanced composite materials and structures;
(2) to attract and increase the number of the highest quality graduate and undergraduate students and to train them with quality education in the science and engineering of composite materials; and

(3) to promote interaction with scientists and engineers in DoD laboratories and industry through active research collaboration and exchange of ideas, technical information, and scientific personnel.

The Center's large-scale, well-coordinated, multidisciplinary research program addresses all critical areas of materials science, mechanics and structures of composite materials. The current research thrusts include chemistry and physics of composite constituent materials; composite interface/interphase thermodynamics, kinetics, and mechanics; effects of processing variables, microstructural control and modification; microstructure, defect and damage characterization, and associated nondestructive evaluation; micromechanisms and micromechanics of deformation and failure, composite material constitutive equations; mechanics and failure theory of thick-section composite laminates; composite structural analysis, testing, and design optimization; advanced computational mechanics and methods; durability, fatigue-life prediction, and thermal, hygroscopic and other environmental effects.

In addition to regular composites courses, workshops, seminars and symposia, the NCCMR's education programs, available to all participants, include: (1) an ONR-URI composites graduate fellowship program, (2) an industrial-affiliates composites graduate fellowship program, (3) a graduate research assistantship program for Center's core research, (4) an undergraduate research assistantship program, and (5) various research seminars, symposia, workshops, short courses, and related activities.

The Center's industrial affiliates program facilitates companies' participation in the research planning, evaluation, and execution. Representatives of selected industries are invited to serve on the Center's Advisory Panel. Also, each industrial affiliate will identify a technical coordinator to ensure proper input and collaboration with Center researchers.

For further information about the Center, please contact Prof. S. S. Wang, Director, National Center for Composite Materials Research, University of Illinois at Urbana-Champaign, 216 Talbot Laboratory, 104 South Wright St., Urbana, IL 61801; Phone: (217)333-1835.

International Collaboration in Composites Research

Science is international. It is a human intellectual occupation that transcends national boundaries and unifies people irrespective of their cultural and religious backgrounds. A scientist possesses a natural urge to reach out to a fellow scientist who may be living in an entirely different environment but has his mind absorbed in the same mystery of nature or in the same technical problem. A meeting of two scientific minds is seldom without mutual stimulation, excitement and enrichment. It is therefore important that universities and other research establishments provide favorable conditions for contacts between scientists. In recent years, however, political and economic considerations have advanced to restrict scientific exchange. This is unfortunate and certainly short-sighted since the result will be detrimental to the development of scientific fields and thereby to society at large.

The Journal of Composites Technology & Research supports international collaboration and has, as a concrete measure, appointed a member of the Editorial Board as International Coordinator. The undersigned is honored to be charged with the assignment and pledges to work wholeheartedly for the purpose.

The readers of the journal are urged to communicate any thoughts on how the journal may be of service towards enhancement of international collaboration in composites research. To begin the process, I propose the following initiatives.

1. The journal might provide information regarding possibilities for financial support of international collaboration in composites research. This may be done by listing, at regular intervals, the relevant funding organizations, procedures for application, deadlines, etc. Announcements regarding possible visiting scientist positions at universities may also be published.

2. The journal might act as a forum for the discussion of matters regarding international collaboration. The readers may here express their views on restrictions on exchange of scientific information placed by national authorities, new initiatives for enhanced scientific exchange, etc. Also, short notes reporting collaborative research efforts in progress or completed may be published.

Readers are encouraged to respond directly to: Ramesh Talreja, International Coordinator, Department of Solid Mechanics, The Technical University of Denmark, DK-2800 Lyngby, Denmark.
Calendar on Composites

Oct. 1987
EUROMECH 230: Asymptotique Modelling of Compressible Fluids
Lille, France
Contact: R. Zeytounian, Laboratoire De Mecanique De Lille, U F R De Mathematics, B P 36, 59655 Villeneuve D'Ascq, Cedex, France

5-9 October 1987
EUROMECH 229: Nonlinear Applied Dynamics
Stuttgart, Federal Republic of Germany
Contact: Prof. Dr.-Ing W. O. Schiehlen, Institute B fur Mechanik, Universitat Stuttgart, Pfaffenwaldring 9, 7000 Stuttgart 80, Federal Republic of Germany

6-9 Oct. 1987
EUROMECH 231: Constitutive Equations in Viscoelasticity
Slovenice, Czechoslovakia
Contact: Prof. J. Brilla, Institute of Applied Math and Computing Techniques Comenius University, Mlynska Dolina, 852 15 Bratislava, Czechoslovakia

13-15 October 1987
19th International SAMPE Technical Conference
Washington, DC
Contact: Marge Smith, SAMPE, P.O. Box 2459, Covina, CA 91722
Telephone: 818-331-0616

18-22 Oct. 1987
19th International SAMPE Technical Conference
Washington, DC
Contact: Marge Smith, SAMPE, P.O. Box 2459, Covina, CA 91722
Telephone: 215-299-5413

25-28 Oct. 1987
1987 SEM Fall Conference on Experimental Mechanics, Dynamic Failure
Savannah, GA
Contact: Kathy Ramsay, Society for Experimental Mechanics, 7 School St., Bethel, CT 06801
Telephone: 203-790-6373

15-20 November 1987
ASME Winter Annual Meeting
New York, NY
Contact: ASME, United Engineering Center, 345 E. 45th St., New York, NY 10017

13-18 Dec. 1987
ASME Winter Annual Meeting
Boston, MA
Contact: American Society of Mechanical Engineering, United Engineering Center, 345 E. 47th St., New York, NY 10017

6-9 Jan. 1988
International Conference on Composite Materials and Structures
Madras, India
Contact: George Springer, Aeronautics and Astronautics, Stanford University, Standford, CA 94305

18-19 April 1988
1988 Southeastern Conference on Theoretical and Applied Mechanics—SECTM XIV
Biloxi, MS
Contact: Dr. R. M. Hackett, Dept. of Civil Engineering, University of Mississippi, University, MS 38677
Telephone: 601-232-7191

24-29 April 1988
Composite Materials—Testing and Design (9th Symposium)
Las Vegas, NV
Contact: Matt Lieff, ASTM, 1916 Race St., Philadelphia, PA 19103
Telephone: 215-299-5516

25-26 April 1988
10th Conference on Composite Materials: Testing and Design
Las Vegas, NV
Contact: S. Garbo, Sirkorsky Aircraft, 6900 N. Main St., Stratford, CT 06601
Telephone: 203-386-4576

4-10 June 1988
1988 SEM Spring Conference on Experimental Mechanics
Portland, OR
Contact: Kathy Ramsay, Society for Experimental Mechanics, 7 School St., Bethel, CT 06801
Telephone: 203-790-6373

5-10 June 1988
6th International Congress on Experimental Mechanics
Portland, OR
Contact: Society for Experimental Mechanics, 7 School St., Bethel, CT 06801
Telephone: 203-790-6373

6-8 June 1988
International Symposium on Structural Failure
Cambridge, MA
Contact: Prof. T. Wierzbricki, Dept. of Ocean Engineering, Room 5-218, Massachusetts Institute of Technology, Cambridge, MA 02139

13-17 June 1988
7th International Conference on Computational Methods in Water Resources
Cambridge, MA
Contact: Michael A. Celia, Parsons Lab, Room 48-207, Dept. of Civil Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139

15-17 June 1988
New Developments and Trends in Fracture and Damage of Concrete and Rock
Vienna, Austria
Contact: Dr. H. P. Rossmanith, Institute for Mechanics, Technical University Vienna, Karlsplatz 13, A-1040 Vienna, Austria
Telephone: 222 5601 X 3121
27–29 June 1988
4th US-JAPAN Conference on Composite Materials
Washington, DC
Contact: Prof. J. R. Vinson, Dept. of Mechanical and Aerospace Engineering, University of Delaware, Newark, DE 19716

11–14 July 1988
4th International Symposium on Applications of Laser Anemometry to Fluid Mechanics
Lisbon, Portugal
Contact: Prof. D. F. G. Durao, Institute Superior Technico, Mechanical Engineering Dept., 1096 Lisbon Codex Portugal

18–22 July 1988
Third International Conference on Recent Advances in Structural Dynamics
Southampton, United Kingdom
Contact: M. Petyt, Institute of Sound and Vibration Research, The University of Southampton, S09 5NH, United Kingdom
Telephone: 0703-559122 X2344/2310

24–28 July 1988
First National Fluid Dynamics Conference
Cincinnati, OH
Contact: Thomas Morel, Integral Technologies, 415 East Plaza Dr., Westmont, IL 60559

21–27 August 1988
17th International Congress of Theoretical and Applied Mechanics
Grenoble, France
Contact: Prof. Germanine, Ecole Polytechnic, Paris, France

27–30 Sept. 1988
20th International SAMPE Technical Conference
Minneapolis, MN
Contact: Marge Smith, SAMPE, P.O. Box 2459, Covina, CA 91722
Telephone: 818-331-0616

6–9 November 1988
Society for Experimental Mechanics Fall Conference
Indianapolis, IN
Contact: Kathy Ramsay, Society for Experimental Mechanics, 7 School St., Bethel, CT 06801
Telephone: 203-790-6373

November–December 1988
ASME Winter Annual Meeting
Chicago, IL
Contact: American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th St., New York, NY 10017

20–24 March 1989
7th International Conference on Fracture
Houston, TX
Contact: Dr. Kamel Salama, Mechanical Engineering Dept., University of Houston-University Park, Houston, TX 77004
Telephone: 713-749-2244

28 May–2 June 1989
Society for Experimental Mechanics Spring Conference
Cambridge, MA
Contact: Kathy Ramsay, Society for Experimental Mechanics, 7 School St., Bethel, CT 06801
Telephone: 203-790-6373

Calendar prepared by Prof. Michael W. Hyer, Department of Mechanical Engineering, The University of Maryland, College Park, MD 20732.
1916 Race Street
Philadelphia, PA 19103
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TWX: 710-670-1037

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