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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 10 OCT 01	3. REPORT TYPE AND DATES COVERED FINAL TECHNICAL REPORT	
4. TITLE AND SUBTITLE ADVANCED COMPUTATIONAL MODELS FOR FABRIC-REINFORCED COMPOSITES.			5. FUNDING NUMBERS  F49620-97-C-0012	
6. AUTHOR(S) Dr. Gilbert Hegemier				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Tran-Science Corporation 7777 Fay Avenue, Suite 112 La Jolla, CA 92037			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NA 801 North Randolph Street Room 732 Arlington, VA 22203			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
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13. ABSTRACT (Maximum 200 words) This project developed a new predictive computational tool for fabric-reinforced composites. The software enables the prediction of global properties including, stress, deformation and failure modes in 3-D fabric reinforced composites.				
14. SUBJECT TERMS including stress, deformation and failure modes			15. NUMBER OF PAGES 13	
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**COMPANY  
BACKGROUND**

Trans-Science Corporation (TSC) was founded in 1980 in La Jolla, California by Dr. Gilbert A. Hegemier, who has been its President and CEO since inception. TSC is a high-tech research and development (R&D) organization devoted to advanced technology development, cutting-edge computer simulation programs, and material models. TSC services many government agencies, including: the Defense Advanced Research Projects Agency (DARPA), the Defense Threat Reduction Agency (DTRA), the Office of Naval Research (ONR), the Naval Research Laboratory (NRL), the Los Alamos National Laboratory (LANL), the Airforce of Scientific Research (AFOSR), and the National Aeronautics and Space Administration (NASA). TSC services are performed in a wide range of technical areas, including:

- **Blast response of underground and aboveground structures.**
- **Earthquake response of civil infrastructure.**
- **Hypervelocity penetration and impact response of space structures.**
- **Development of ceramic shields for satellite protection.**
- **Composite-based retrofit technology for civil infrastructure.**
- **Advanced composite designs for ship structures.**
- **Advanced computational models for High Temperature Superconducting (HTSC) thin films.**
- **Development of micromechanical models for textile composites.**

Trans-Science Corporation  
3655 Nobel Drive Suite 440  
San Diego, CA 92122-1005  
Tel (858) 459-1240

Fax (858) 459-0210

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### Composite Solutions to Acquire Trans-Science Corp.

*SAN DIEGO, March 8* - Composite Solutions, Inc. (CSI) (OTC Bulletin Board: KIPS) today announced that it has signed a letter of intent to acquire privately held Trans-Science Corporation (TSC), involving an exchange of TSC shares for CSI shares. The total number of CSI shares for the acquisition are to be determined by an independent business evaluator based on the average CSI share price for the month of February 2000.

San Diego-based Composite Solutions uses advanced composites to strengthen buildings and bridges and to minimize the damage that can be inflicted by earthquakes, bombs and overloading. Trans Science Corp., also based in San Diego, recently developed the only comprehensive design software for the seismic retrofit of civil structures using composite overlays, and is now extending its design software to include explosive threats.

"TSC's unique expertise concerning the computer design/analysis of composite structures and the use of advanced composites in the civil arena will give CSI a significant market advantage," said Don Nicholson, CEO of Composite Solutions. "Moreover, with the acquisition of Trans Science Corp., CSI can

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now extend its advanced composite technology to include blast retrofit design and construction."

TSC's work on explosive blasts is part of a counter-terrorism program sponsored by the Defense Threat Reduction Agency (DTRA). In recent tests conducted by DTRA on a full-scale building at the White Sands Missile Range in New Mexico, composite overlays prevented damage to structural elements after an explosion.

"Counter-terrorism has been identified as a priority for the federal government in the fiscal year 2001 budget," said Duane Gee, CSI's executive vice president. "The president's budget allocates more than \$1.1 billion in Embassy Security Funding to reduce the risk of loss of life from terrorist attacks on overseas diplomatic missions, representing an important market for the CSI/TSC solution."

Since its inception in 1980, TSC has created cutting-edge computer simulation programs for many government agencies, among them the Defense Advanced Research Projects Agency, the Office of Naval Research, the Defense Nuclear Agency, the Naval Research Laboratory, Los Alamos National Laboratories, the Air Force Office of Scientific Research and NASA. Other customers include E-Systems, Composite Optics, Inc. and the University of California, San Diego.

Composite Solutions, Inc., based in San Diego, provides a comprehensive solution to seismic retrofitting of buildings, bridges and other structures using advanced composite overlay materials and technology licensed by the University of California, San Diego.

Except for historical information contained in this document, the matters discussed are

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forward-looking statements that involve risks and uncertainties. When used in this document, words such as "anticipate," "believe," "estimate," "expect," "intend" and similar expressions, as they relate to the company and its management, identify forward-looking statements. Such forward-looking statements are based on the beliefs of the company's management, as well as assumptions made by and information currently available to the company's management. Among the factors that could cause actual results to differ materially are the following: the effect of business and economic conditions; the impact of competitive products and pricing; capacity and supply constraints or difficulties; product development, commercialization or technological difficulties; the regulatory, reimbursement and trade environment; and the risk factors reported from time to time in the company's reports.

For more information contact: Duane Gee, Executive Vice President of Composite Solutions, 858-459-4843; or Media, Eve Gumpel, of Hilary Kaye Associates, 714-426-0444 for Composite Solutions.

Contact: Duane Gee, Executive Vice President of Composite Solutions, 858-459-4843; or Media, Eve Gumpel, of Hilary Kaye Associates, 714-426-0444 for Composite Solutions

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## Gilbert A. Hegemier

### Faculty

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Professor of Structural Engineering  
 Department of Structural Engineering  
 JSOE School of Engineering  
 University of California, San Diego  
 9500 Gilman Dr.  
 La Jolla, CA 92093-0085

[ghegemier@ucsd.edu](mailto:ghegemier@ucsd.edu)  
 858-534-4280 Fax: 858-534-6373

#### Education:

Ph.D., California Institute of Technology, 1964 (Solid Mechanics and Structures)  
 M.S., California Institute of Technology, 1960 (Solid Mechanics and Structures)  
 B.E.S., Brigham Young University, 1959 (Mechanical Engineering)  
 Liberal Arts Pasadena City College, 1956 (Engineering)

#### Other Related Experience (teaching, industrial, etc.):

1958-1959 Mechanical Engineer, Naval Ordnance Laboratory, Corona, California  
 1970-1975 Mechanical Engineer, National Engineering Science Company, Pasadena, California  
 1962-1964 Mechanical Engineer, Space Technology Lab - TRW Systems, Redondo Beach, California  
 1964-1966 Research Fellow, California Institute of Technology

#### Patents:

- Chairman of the Board: Commercial Applications of Advanced Fiber-reinforced Polymer Matrix Components for Retrofit (seismic, blast, corrosion) of Civil Structures and New Construction. Dec. 19, 2000 U.S. Patent No. 6,003,276
- Reinforcement of Cementitious Walls with Carbon Overlays to Resist Seismic Forces. Feb. 20, 2001 U.S. Patent No. 6,189,286

#### Principal Publications:

- S. Shkoller and G.A. Hegemier, "Homogenization of Plain Weave Composites Using Two-Scale Convergence", *Int. J. Solids, Structures*, Vol. 32, No. 617, 1996, pp. 783-794.
- V. Karbhari, F. Seible, G.A. Hegemier, and L. Zhao, "Fiber Reinforced Composite Decks for Infrastructure Renewal - Results and Issues," *Proceedings 1997 International Composites Expo, Nashville, Tennessee, January 27-29, 1997*, pp. 3C-1 to 3C-6.
- F. Seible, G.A. Hegemier, V. Karbhari, R. Burgueno, and A. Davol, "The Carbon Shell System for Modular Short and Medium Span Bridges," *Proceedings 1997 International Composites Expo, Nashville, Tennessee, January 27-29, 1997*, pp. 3D-1 to 3D-6.
- F. Seible, G.A. Hegemier, M.J.N. Priestley, and D. Innamorato, "Seismic Retrofit of RC Columns with Continuous Carbon Fiber Jackets," *ASCE Journal of Composites for Construction*, May 1997, Vol. 1, pp. 52-62.
- G.A. Hegemier, F. Seible, J. Kosmatka, and V. Karbhari, "Advanced Composites Technology Transfer/Bridge Infrastructure Renewal Consortium," *Division of Structural Engineering, University of California, San Diego, June 1997, Report No. ACTT/BIR-97/53*, 288 pp.
- G.A. Hegemier, F. Seible and V. Karbhari, "Fiber Reinforced Polymer Matrix Composites (PMCs) for Civil Structures," *Proceedings, 4th International Conference on Composites Engineering, July 6-12, 1997*, 4 pp.
- G.A. Hegemier, S. Shkoller, and K.J. Moesslacher, "On the Prediction of Petal Evolution in Hypervelocity Impact Events," *PVP - Vol. 373, Fatigue, Fracture and Residual Stresses, ASME International, 1998*, pp. 229-236.
- F. Seible, V. Karbhari, G.A. Hegemier, L. Zhao, and R. Burgueno, "PMC Deck System Fabrication Specifications for the Kings Stormwater Channel Bridge," *Charles Lee Powell Structural Research Laboratories Report No. TR-98/09, July 1998*, 23 pp.
- F. Seible, V. Karbhari, G.A. Hegemier, A. Davol, and L. Zhao, "Carbon/Epoxy Shell Fabrication Specification for the Kings Stormwater Channel Bridge," *Charles Lee Powell Structural Research Laboratories Report No. TR-98/10, July 1998*, 13 pp.
- M. Wernli, F. Seible, V. Karbhari, and G.A. Hegemier, "Advanced Composite Stay-Cable Survey Short-and-Long Term Tests," *University of California, San Diego, Structural Systems Research Project Report No. SSRP-99/11, July 1999*, 48 pp.

#### Professional Memberships:

American Institute of Aeronautics and Astronautics  
 American Society of Mechanical Engineers  
 The Society of Sigma Xi, California Institute of Technology Chapter-  
 Earthquake Engineering Research Institute  
 California Universities for Research on Earthquake Engineering

#### Honors and Awards:

Outstanding Paper Award, The Masonry Society, 1993  
Who's Who in 1994 (Annual Tribute to San Diegans Who are Making a Difference), San Diego Magazine, 1994  
Chancellor's Associates Shiley Achievement Award, 1994  
Election to Golden Key National Honor Society, 1995  
Recognition by American Institute of Aeronautics and Astronautics, 1995  
  
CERF (Civil Engineering Research Foundation) Charles Pankow Award for Innovation, 1996  
Teacher of the Year, UCSD School of Engineering Annual Teaching Award (Mechanical Engineering), 1996  
Elected a Fellow of ASME International (American Society of Mechanical Engineers), 1997  
Best Paper Award (ASCE Journal), 1997  
Best Application Paper Award (Journal of Composites for Construction), 1998

**Institutional and Professional Service:**

- Co-Director, Powell Structural Research Laboratories, University of California, San Diego
- Director, Advanced Composites Technology Transfer (ACTT) Consortium
- Advisor, Defense Advanced Research Projects Agency (DARPA)
- Member, SE Executive Committee, 1999-2000
- Member, SE Undergraduate Aerospace Program Committee, 1999-2000
- Member, SE Graduate Affairs Committee, 2000-2001

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**The Department of Structural Engineering**

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**ONR-** Office of Naval Research

- Shock response in advanced materials.
- Microstructural models and numerical algorithms for ceramics.
- Process and structure modeling of high temperature superconducting.

**LANL-** Los Alamos National Laboratory

- Chemistry development for soft kill support.

**DARPA-** Defence Advance Research Projects Agency

- Electrodynamics, micromechanics, and device design.
- Composites for bridge infrastructure renewal.
- Hypervelocity penetration and shield technology.
- Ceramic shields for satellite protection against Hypervelocity.
- Incorporation of ceramics in shield system.
- Analysis of residual stresses and distortions in diamond films.

**E-Systems**

- Development of computer-aided Engineering tools.

**NRL-** Naval Research Laboratory

- Analytical and Computational Modeling of HTSC thin films.

**NIST-** National Institute of Standards and Technology

- Seismic upgrading of bridge columns.
- Development of design software.

**DOT-** Department of Transportation (MARITECH)

- Advanced materials technology applied to ship design and construction.
- Internationally competitive fast ferries and composite ship technologies.

**AFOSR-** Air Force Office of Scientific Research

- Advanced computational models for fabric-reinforced composites.

**NASA-** National Aeronautics and Space Administration

- Numerical simulation, analytical studies and test support.

**COI-** Composite Optics, Inc.

- Models for triaxial-woven composite grids.

**UCSD-** University of California, San Diego

- Design of composite truck trailers.

**Gionatti Corporation**

- Design and analysis of a large composite door for ship applications.

**TPI Composites, Inc.**

- Design and analysis of composite bus.

Trans-Science Corporation  
3655 Nobel Drive Suite 440  
San Diego, CA 92122-1005  
Tel (858) 459-1240  
Fax (858) 459-0210

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## CORPORATE FACT SHEET

**Synopsis:** Composite Solutions, Inc. (CSI) offers a comprehensive solution to repair or limit the damage that earthquakes, weather-related calamities, bombs, or overloading can inflict on bridges, buildings and other structures. CSI specializes in lightweight, advanced composite materials applied like wallpaper to structures to strengthen them. The comprehensive solution includes structural analysis, design, system implementation, quality control and inspection.

**Services:** CSI offers end-to-end solutions, which incorporate in-depth research data from full-scale structural testing, an expert team of scientists and structural engineers, proprietary software that makes analysis faster and easier, and construction project management teams. The high-strength composite overlays used by CSI drastically reduce retrofit costs and duration compared with current methods, such as retrofitting with steel rebar, metal jackets or additional concrete.

**Objective:** CSI brings to market composite technology licensed from the University of California, San Diego. The technology licenses have been validated with over a decade of innovative research and design programs at the university's world-class Charles Lee Powell Structural Research Laboratories

**Corporate office:** 3655 Nobel Drive, Suite 440  
San Diego, CA 92122  
(858) 459-4843 fax (858)459-0210  
[Info@CompositeSolutionsInc.com](mailto:Info@CompositeSolutionsInc.com)

**Corporate officers:**  Chairman, Dr. Gilbert Hegemier, Ph.D.  
 President and CEO, TBD  
 Executive Vice President, TBD  
 Chairman of the Advisory Board, Wolfgang A. Mack, Ph.D,

**Ticker Symbol:** Composite Solutions trades on the OTC market as BB:KIPS.

**Media Relations:** Cheryl Monblatt  
(858) 459-4843 x 301  
[MR@CompositeSolutionsInc.com](mailto:MR@CompositeSolutionsInc.com)

**Investor Relations:** Cheryl Monblatt  
(858) 459-4843 x 301

[IR@CompositeSolutionsInc.com](mailto:IR@CompositeSolutionsInc.com)



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## **GILBERT A. HEGEMIER, Ph.D.**

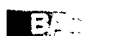
### **Chairman**

As one of the developers of composite overlay technology, Gilbert A. Hegemier, Ph.D. is an expert on the application of composite materials in the field of civil engineering. In his role as chairman of Composite Solutions, Inc., he provides guidance and expertise to the business operation.

A professor of structural engineering at University of California, San Diego, Hegemier is also co-founder and co-director of the university's Charles Lee Powell Structural Research Laboratories – the largest and most sophisticated facility of its kind in the United States. The laboratory is dedicated to full-scale validation testing on civil, marine and aircraft/aerospace structures.

When the Cold War ended in 1989, Hegemier used the opportunity to expand composite technology from the defense industry to new markets. He enlisted the aid of the Defense Advanced Research Projects Agency (DARPA), which provided \$44 million to move advanced composites from aerospace and defense into the civil arena. The result has been: 1) affordable seismic retrofit and repair methods for bridges and buildings 2) retrofits to strengthen buildings against explosions and 3) an advanced composite shell system for new construction.

A Fellow of the American Society of Mechanical Engineers International, Hegemier is the recipient of numerous honors and awards, including the 1996 Civil Engineering Research Foundation's Charles Pankow Award for Innovation and the 1994 University of California Chancellor's Associates Shiley Achievement Award.



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## Fuller Joan Civ AFOSR/AFRL

---

**From:** Fuller Joan Civ AFOSR/AFRL  
**Sent:** Monday, April 09, 2001 10:51 AM  
**To:** 'hegemier@ucsd.edu'  
**Cc:** 'Info@CompositeSolutionsInc.com'  
**Subject:** Request for copy of old final report

Dr Hegemier:

Would it be possible to get a copy of an old final report from you for a 1997 AFOSR project on Advanced Computational Models for Fabric Reinforced Composites? I have recently taken over the Ceramic Materials Program at AFOSR and ran across your project in the active projects files. I would like to close out the folder but it requires a final Report or some other technical document that details the results of the effort.

Please call me if you have any questions or need additional details.

V/R,

/s/

Dr. Joan Fuller  
Ceramic and Non-Metallic Materials Program Manager  
AFOSR  
801 N. Randolph Street, Room 732  
Arlington, VA 22203-1977  
phone:(703)696-7236  
fax:(703)696-8451

## Fuller Joan Civ AFOSR/AFRL

---

**From:** Fuller Joan Civ AFOSR/AFRL  
**Sent:** Tuesday, August 07, 2001 12:23 PM  
**To:** 'hegemier@ucsd.edu'  
**Cc:** 'Info@CompositeSolutionsInc.com'  
**Subject:** OVERDUE FINAL REPORT

Dear Professor Hegemier,

Please submit a final report for your Air Force Office of Scientific Research project (F49620-97-C-0012) by August 31 or let me know immediately if there is a problem with submitting the required paperwork to complete the contract.

V/R,  
/s/

Dr. Joan Fuller  
Ceramic and Non-Metallic Materials Program Manager  
AFOSR  
801 N. Randolph Street, Room 732  
Arlington, VA 22203-1977  
phone:(703)696-7236  
fax:(703)696-8451

-----Original Message-----

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V/R,

/s/

Dr. Joan Fuller  
Ceramic and Non-Metallic Materials Program Manager  
AFOSR  
801 N. Randolph Street, Room 732  
Arlington, VA 22203-1977  
phone:(703)696-7236  
fax:(703)696-8451