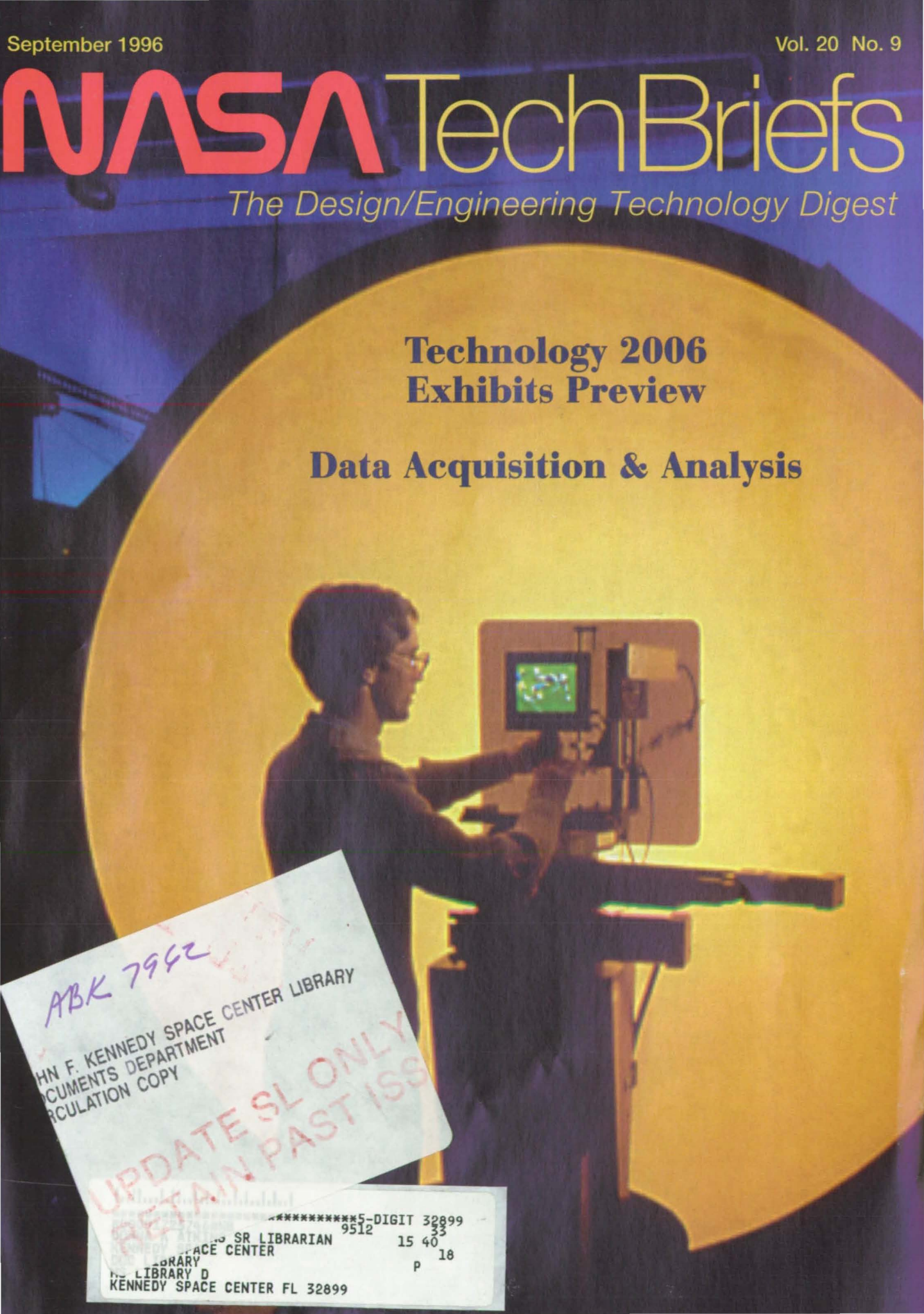
September 1996 Vol. 20 No. 9

NASA Tech Briefs

The Design/Engineering Technology Digest

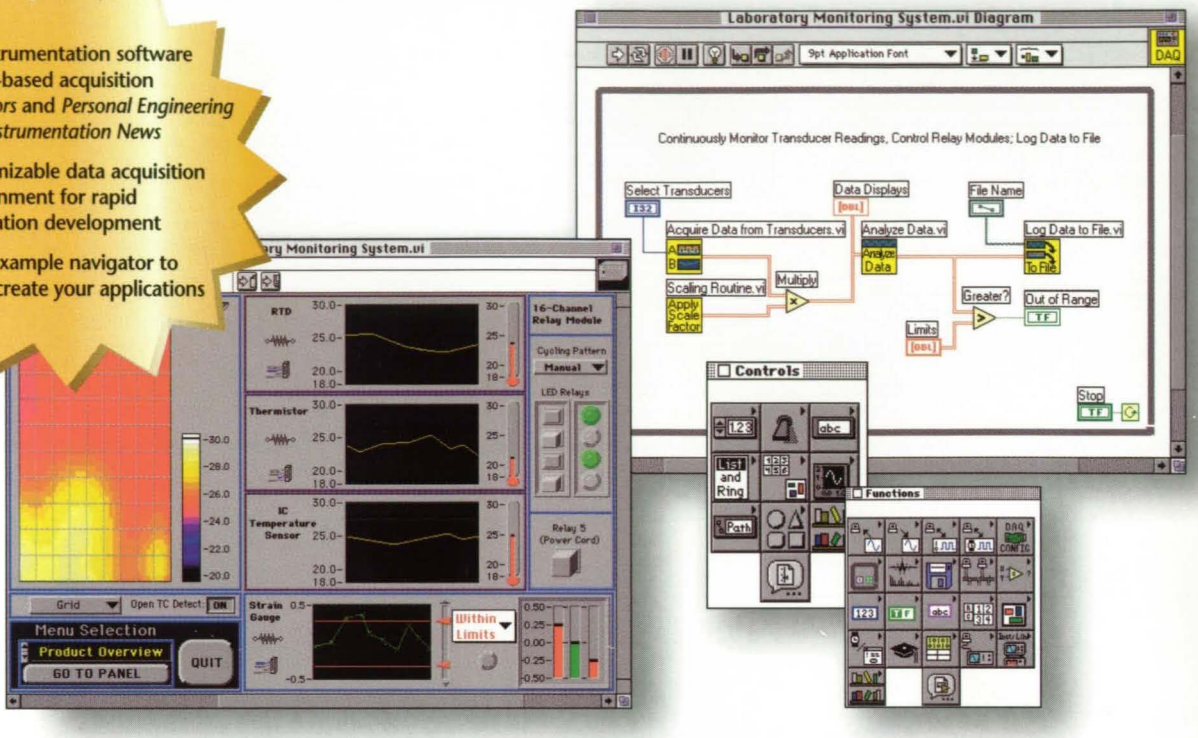
Technology 2006 Exhibits Preview

Data Acquisition & Analysis



LabVIEW® 4.0

- #1 Instrumentation software for PC-based acquisition – *Sensors* and *Personal Engineering and Instrumentation News*
- Customizable data acquisition environment for rapid application development
- DAQ example navigator to easily create your applications



Designed for Data Acquisition

Introducing LabVIEW 4.0 – our most innovative data acquisition (DAQ) software package ever. It's easy to use, yet versatile enough to handle your most demanding data acquisition and analysis applications.

Designed to Simplify DAQ System Development
LabVIEW 4.0 features a complete graphical DAQ development environment, integrating all of your acquisition, analysis, and presentation needs into a single, easy-to-use package. To meet your diverse application requirements, LabVIEW is available on Windows NT, Windows 95, Windows 3.1, Macintosh Power PC/68K, Sun Solaris, and HP-UX.

Designed for Productivity
Now, with LabVIEW 4.0, you can be even more productive. Time-saving editing and debugging tools make developing DAQ applications even easier than ever before. And, the optimized 32-bit graphical compiler ensures that you have all the performance you need when you're displaying, analyzing, and logging data to disk.

Designed for Industry-Standard Connectivity
Using LabVIEW 4.0, you can acquire data from the industry's widest selection of plug-in and external data acquisition and signal conditioning devices, taking advantage of technologies like PCMCIA for portable applications and PCI for high-speed benchtop systems. You can rapidly develop distributed DAQ systems throughout your organization using built-in OLE automation, DDE, TCP/IP, and SQL database calls.

If you want to learn more about the leading DAQ software package, give us a call. LabVIEW 4.0 – **it's not just designed for data acquisition - it's Designed for You.**

NATIONAL INSTRUMENTS®
The Software is the Instrument®

Call **(800) 433-3488** today for a **FREE** LabVIEW demonstration package.

Corporate Headquarters • 6504 Bridge Point Parkway • Austin, TX 78730-5039 USA
Tel: (512) 794-0100 • Fax: (512) 794-8411 • E-mail: info@natinst.com • WWW: http://www.natinst.com

Branch Offices: Australia 03 9 879 9422 • **Austria** 0662 45 79 90 0 • **Belgium** 02 757 00 20 • **Canada** 519 622 9310 • **Denmark** 45 76 26 00
Finland 90 527 2321 • **France** 1 48 14 24 24 • **Germany** 089 741 31 30 • **Hong Kong** 2645 3186 • **Italy** 02 413091 • **Japan** 03 5472 2970
Korea 02 596 7456 • **Mexico** 95 800 010 0793 • **Netherlands** 0348 433466 • **Norway** 32 84 84 00 • **Singapore** 2265886 • **Spain** 91 640 0085
Sweden 08 730 49 70 • **Switzerland** 056 200 51 51 • **Taiwan** 02 377 1200 • **U.K.** 01635 523545

File Edit View Go Bookmarks Options Directory Window Help

Home | Custom Design | Custom Eng. | New Products | Calibration | Sales & Service | omega www | Tech Training | Stop

Location: http://www.omega.com

ISO 9001 CERTIFIED CORPORATE QUALITY

See Us at the ISA Show (Booth 4818) & the Sensors Expo (Booth 700)

Portable Data Logging System

NEW

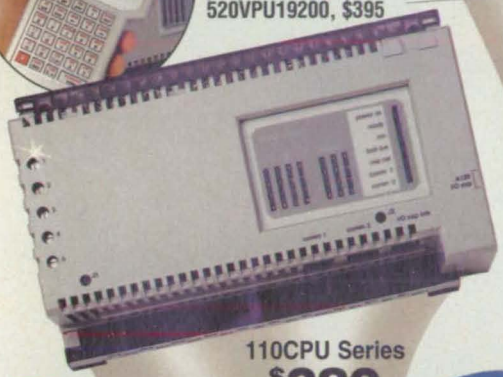
OM-320
$2680
Basic System

Circle No. 631 or Request Document #6399, OMEGAfax℠ Service

Fixed I/O Programmable Logic Controller (PLC) System

NEW

Micro-controller shown with handheld programmer, Model 520VPU19200, $395



110CPU Series
$380

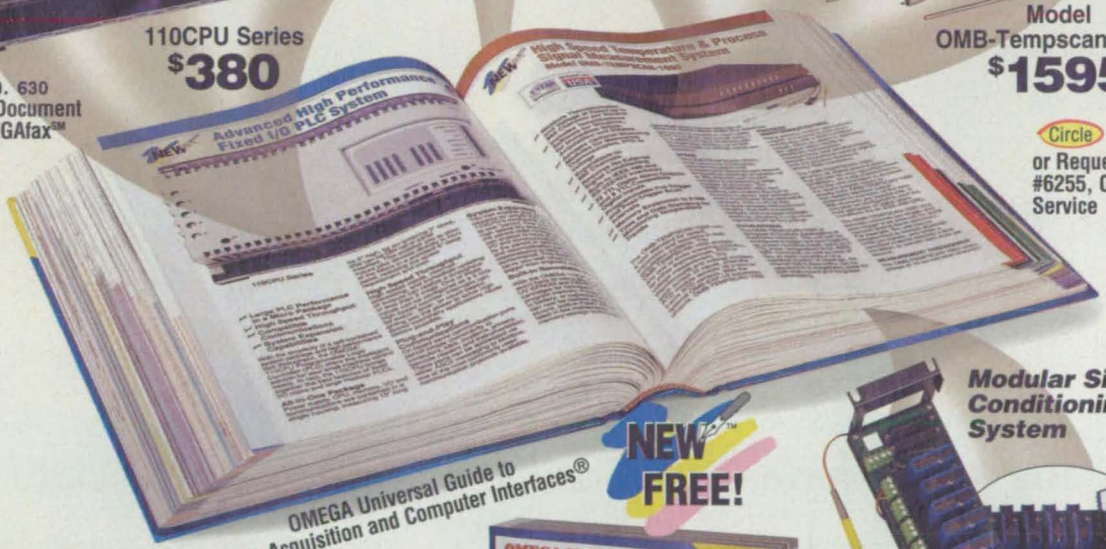
Circle No. 630 or Request Document #6315, OMEGAfax℠ Service

High Speed Temperature & Process Signal Measurement System

NEW

Model OMB-Tempscan-1000A
$1595

Circle No. 632 or Request Document #6255, OMEGAfax℠ Service



NEW FREE!

OMEGA Universal Guide to Data Acquisition and Computer Interfaces®

Modular Signal Conditioning System

OM7 Series
$110

Circle No. 633 or Request Document #6361, OMEGAfax℠ Service

To Request The Encyclopedia OMEGA®
Circle No. 634 or Request Document #9988, OMEGAfax℠ Service, Dial 1-800-848-4271

OMEGAfax℠
OMEGA's 24-Hour-a-Day, On-Demand Publishing Service
DIAL 1-800-848-4271

OMEGAnet℠ ON-LINE SERVICE
See OMEGA on the World Wide Web! http://www.omega.com

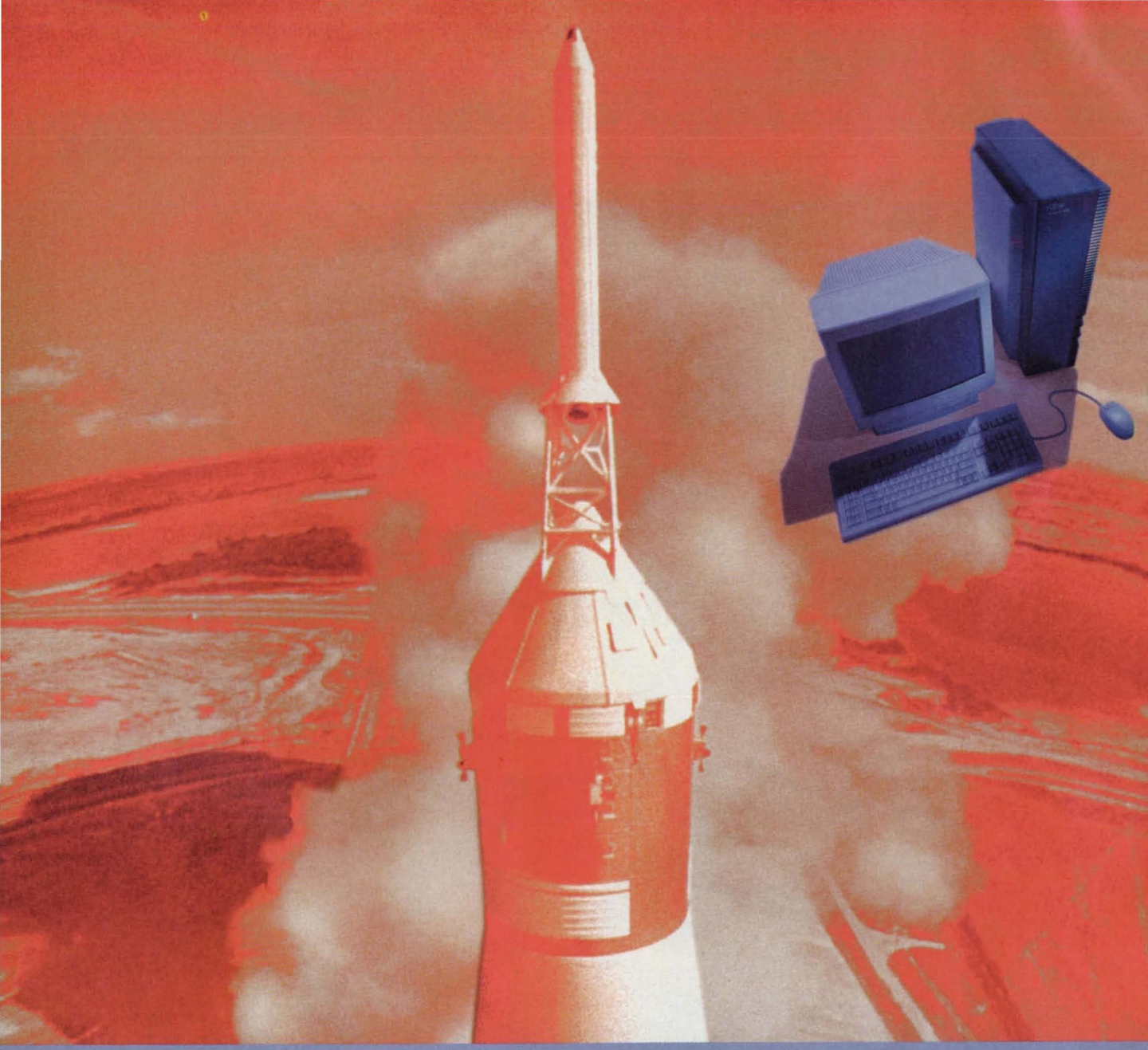
For Sales and Service:
1-800-82-66342℠
1-800-TC-OMEGA

omega.com™
ΩOMEGA®

http://www.omega.com

e-mail: info@omega.com

OMEGA ENGINEERING, INC., ONE OMEGA DRIVE, P.O. BOX 4047, STAMFORD, CT. 06907-0047



Actually, you do have to be a rocket scientist to appreciate it.

Introducing the Fujitsu,™ HALstation™ 300 Series.

A system that can do in hours what others would be lucky to accomplish in days.

We're not suggesting that using the HALstation 300 will get you the Nobel Prize – but it will get you in the running that much faster.

After all, we're talking about the world's first 64-bit SPARC™/Solaris® – compatible workstation. An environment that can blow right past 32-bit workstations as if they were standing still.

At the heart of the system is the first 64-bit implementation of Solaris 2.4, our very own SPARC 64/OS™ 2.4. An OS capable of making your existing applications fly.

One that's so compatible, we guarantee it'll run your favorite Solaris programs, or your money back.

Here's something else to consider. Responsive service and support. We've got it where the other SPARC environments don't even come close.

The HALstation 300 Series. It may not be the normal way to work, but it's probably the ideal way for somebody with a sizable I.Q. like yours.

Don't be normal. Call today for more information, 1-800-425-0329. Or http://www.hal.com/

HAL COMPUTER SYSTEMS
A Fujitsu Company

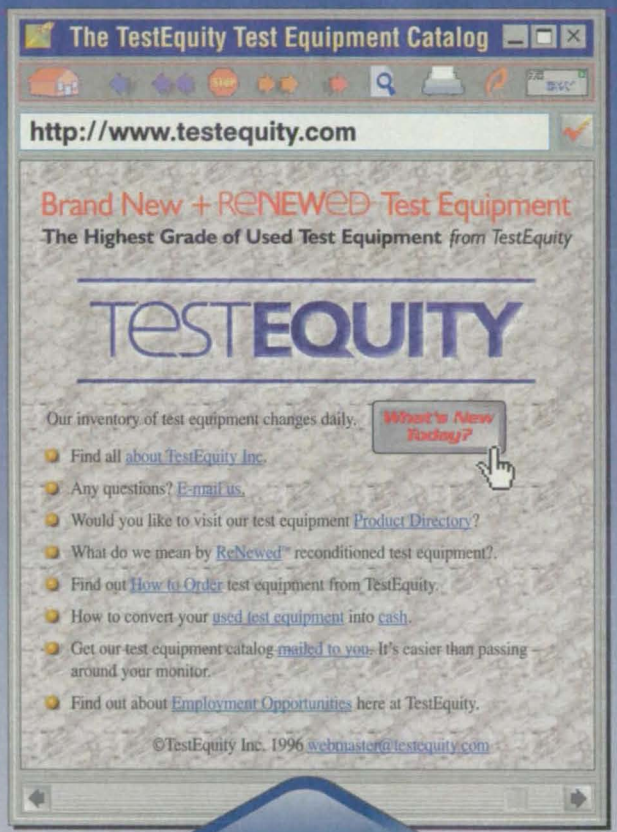
Not your normal Workstation.

For More Information Write In No. 623

What's New Today?

ReNEWeD BRAND™

The Highest Grade of Used Test Equipment *from TestEquity*



ON PAPER
1-800-455-3457

ONLINE
http://www.testequity.com

Now TestEquity is online with a brand new cyber catalog filled with today's latest arrivals & sale priced specials.

- New Tektronix & Fluke equipment in stock, ready to ship today
- ReNewed™ - the highest grade of used test equipment, now with a One Year Warranty on most items
- We also buy test equipment; FAX your list to 1-800-272-4329
- For a ***free catalog,*** to sell your equipment, or to find out more about TestEquity call 1-800-455-3457

TESTEQUITY

TestEquity Inc. 2450 Turquoise Circle, Thousand Oaks, CA 91320 · 805-498-9933 · Fax: 805-498-3733

For More Information Write In No. 660

Presenting a new era in the evolution of production solid modeling.

1996
SolidWorks 96
Powerful modeling for the mainstream user. Native Windows. Loves low cost hardware.

1988
Parametric
Powerful modeling for the specialized user. Interface can drive you bananas.

1981
PC CAD
Limited functionality—will turn you green and make you croak.

1975
Primitive drafting on mainframes.
Old, big, slow and headed for extinction.

Meet SolidWorks™ 96.

The highly-advanced 3D production solid modeling software.

SolidWorks 96 is exceptionally easy to use and affordable, yet powerful enough to compete with specialized high-end systems. In fact, we've already earned six of the industry's most coveted awards. Which suggests that selecting SolidWorks 96 for your organization is a most intelligent decision.

SolidWorks 96 is available on fast, affordable workstations including Digital's Pentium, Pentium Pro and Alpha systems. All providing unprecedented price/performance on the Microsoft® Windows® platform.

"We are convinced that SolidWorks will have the most significant impact on the mechanical design market in nearly a decade."
– David E. Weisberg, Engineering Automation Report

Call 800-693-9000 ext.192 today for a free SolidWorks 96 seminar near you.

CAD Editors Choice Award · NDES Best Product of the Year · NASA Tech Briefs 1995 Product of the Year · Industrial Contribution Award for Best Product Manufacturing Week · Cadence Magazine Editor's Choice Award · CAD/CAM Recommended

Bringing the most affordable, easy-to-use, production solid modeling system to your desktop.

SolidWorks

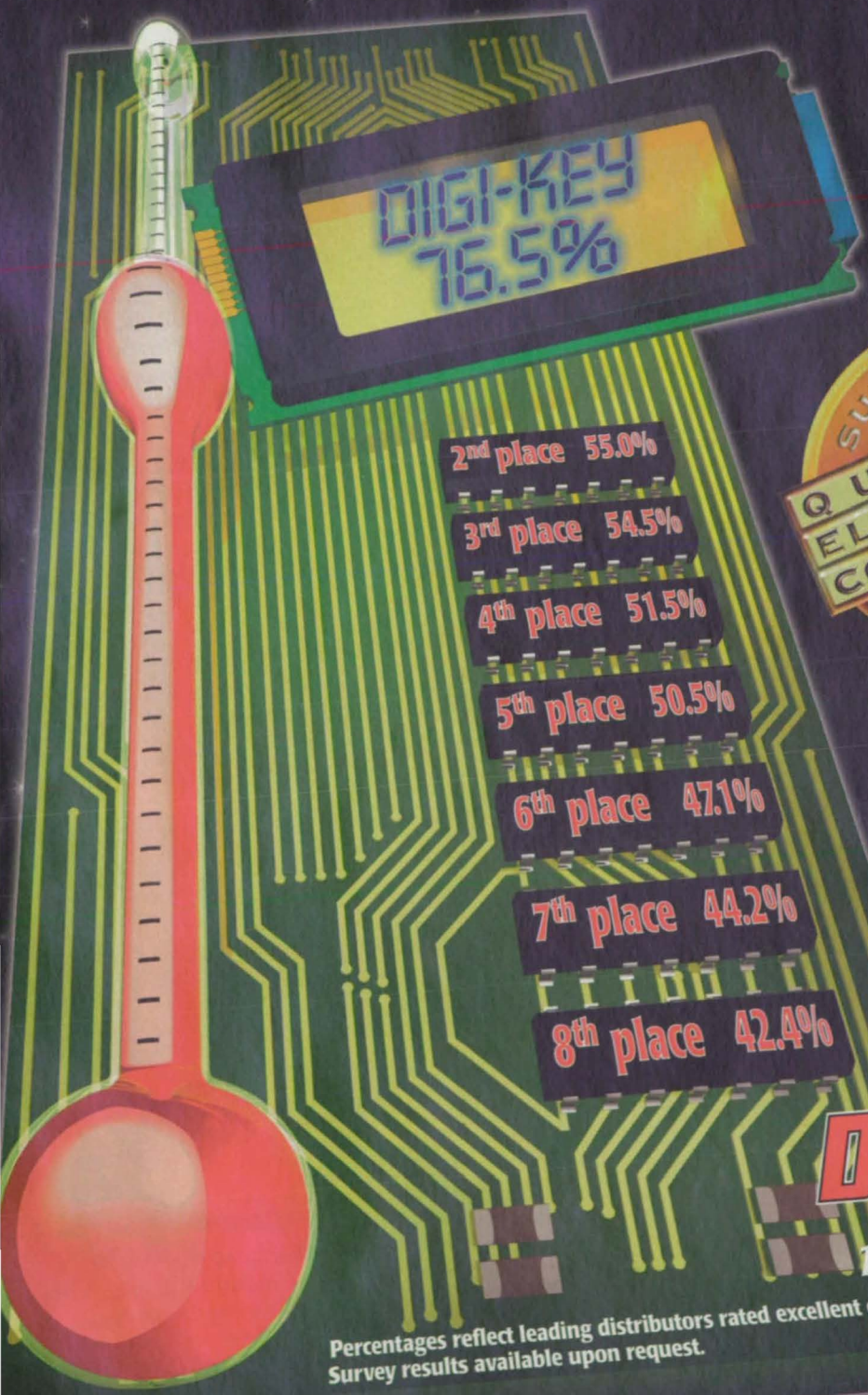
AccelGraphics

SolidWorks Corporation, 150 Baker Avenue Ext., Concord, MA 01742 Phone: 508-371-2910 x192 Fax: 508-371-7303 Email: info@solidworks.com Web: http://www.solidworks.com/192

For More Information Write In No. 575

HOTTEST!

Rated #1 for Overall Performance, Again!



SUPERIOR QUALITY ELECTRONIC COMPONENTS SERVICE

Call, write, fax or visit us on the Internet for your FREE CATALOG today!

Digi-Key

1-800-344-4539

Percentages reflect leading distributors rated excellent or very good.
Survey results available upon request.

701 Brooks Ave. South, Thief River Falls, MN 56701 • Fax: 218-681-3380 • http://www.digikey.com

Write In No. 545

September 1996
Volume 20 Number 9

Contents

NASA Tech Briefs
Official Publication of the National Aeronautics and Space Administration

FEATURES

TECHNICAL SECTION

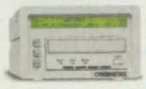
(continued on page 8)

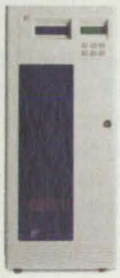
Two F/A-18 Hornets collided during an April 22, 1996 training mission about 35 miles from the North Carolina coast, damaging the nose-cone, right engine, and canopy of one of the planes. In this case, both pilots were able to control their aircraft and land safely; the results of many such crashes are not as favorable. Neural net software being developed by NASA's Ames Research Center may help pilots cope with this kind of damage. For more on the software, see NASA NewsBriefs on page 24.

Photo courtesy of Ames Research Center

Save 250 GB At 18 MB Per Second.

3.5"





The CY-8000 is available in a single or multi-drive desktop, rack mount, or tape library configuration. Capacity extends from the 25 GB single drive to up to 15 TB with our fully loaded 120-tape library.

Save 25 GB to a single tape at 3 MBS.
Boost capacity to up to 125 GB and speed to 9 MBS with optional Data Compression.

With the CY-8000 8mm tape subsystem, you'll not only get tremendous capacity in a compact, 3.5" form factor, but you'll also be able to use AME 8mm tapes, the strongest, hardest tape media available — suitable for 20,000 uses. What's more, the CY-8000 features a self-cleaning mechanism that virtually eliminates the need for head cleaning cartridges.

With breakthrough developments in form factor, capacity, media reliability, and convenience, the CY-8000 is fast becoming the solution of choice for demanding backup and storage applications.

Multi-drive configurations can take advantage of the Advanced SCSI Processor, providing maximum flexibility with five recording modes:

Striping	*Mirroring*	*Cascade*	*Independent*	*Offline Copy/Verify*
Write data to multiple tape drives at once, to maximize throughput.	Write the same data to multiple tapes to add fault tolerance and make duplicate tapes.	Automatically write to the next tape when the previous tape is full.	Write data to one drive and restore with another.	Make duplicate tapes for off-site storage or data exchange without tying up the host.

Other options include Data Encryption to protect confidential data, Accelerated File Access to speed file restore, the Digital Data Recorder interface which allows you to write directly to tape from instrument recorders, and our Robotic Control Software which gives you hands-free control over any of our tape libraries.

Plug compatible with virtually every type of computer system, the CY-8000 features a two year warranty and free telephone technical support. Small in size but massive in performance, the CY-8000 is the 8mm tape subsystem you've been waiting for.

Plug Compatibility With:

Alliant
Alpha Micro
Altos
Apollo
Arix
AT&T
Basic-4
Concurrent
Convergent
Data General
DEC
Gould/Encore
HP
IBM
ICL
Intergraph
Macintosh
McDonnell Douglas
Motorola
NCR
NeXT
Novell
OS/2
PS/2
Parallel Port PC
Pertec
PICK
Plexus
Prime
Pyramid
Sequent
Silicon Graphics
STC
Stratus
Sun
Texas Instruments
Unisys
Ultimate
Wang
Windows NT
— and more

(804) 833-9000

CYBERNETICS

111 Cybernetics Way • Yorktown, Virginia 23693 • Fax (804) 833-9300

For More Information Write In No. 636

Contents *(continued)*

DEPARTMENTS

81 Mechanics

88 Machinery/Automation

90 Manufacturing/Fabrication

On the cover:

Measurements of light intensity, color spectra, and other variables provide objective indicators for judging the performance of video displays. George Jones, a physicist with the National Institute of Standards and Technology (NIST) in Gaithersburg, MD, positions a flat-panel television set within a two-meter-wide hemisphere used in making such measurements. NIST will be displaying this and other technologies at Technology 2006, October 29-31, 1996 in Anaheim, CA. A preview of exhibitors begins on page 28.

Photo courtesy of NIST

98 Mathematics and Information Sciences

100 Books and Reports

1a - 22a Electronics Tech Briefs

Follows page 80 in selected editions only.

NASA Tech Briefs, ISSN 0145-319X, USPS 750-070, copyright © 1996 by Associated Business Publications Co., Ltd. Copyright is not claimed for the individual "tech briefs" contained in this publication. The U.S. Government has a paid-up license to exercise all rights under the copyright claimed herein for governmental purposes. NASA Tech Briefs is published monthly by Associated Business Publications Co., Ltd., 317 Madison Ave., Ste. 921, New York, NY 10017-5391. Editorial, sales, production, and circulation offices at 317 Madison Ave., New York, NY 10017-5391. Subscription for non-qualified subscribers in the U.S., Panama Canal Zone, and Puerto Rico, $75.00 for 1 year; $125 for 2 years; $200.00 for 3 years. Single copies $10.00. Foreign subscriptions one-year U.S. Funds $150.00. Remit by check, draft, postal, express orders or VISA, MasterCard, and American Express. Other remittances at sender's risk. Address all communications for subscriptions or circulation to NASA Tech Briefs, 317 Madison Ave., New York, NY 10017-5391. Second-class postage paid at New York, NY and additional mailing offices.

POSTMASTER: Please send address changes to NASA Tech Briefs, P.O. Box 10523, Riverton, NJ 08076-0523

For Information on Finite Element Design and Analysis

Stop by Our Place

WWW.ALGOR.COM

Algor's Internet Home is the fastest way to find out about:

- Houdini: CAD/FEA Integration with 8-node "Bricks"
- Finite Element Design and Analysis Software
- Plant and Piping System Design and Analysis Software
- Multimedia Products for Engineers (books, videos, etc.)
- Speed-Mesh: CAD to 8-node "Brick" Modeling Service
- Algor Education Seminars

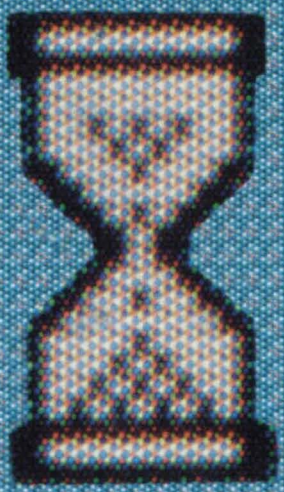
When you visit you can...

- Learn more about FEA, whether you're a novice, or a "guru"
- Download free software - real software, not just demos
- Find the information you need fast with Algor's Magellan Search Commander
- Compare notes with other engineers through Algor's application illustrations
- Try your hand at a variety of verification problems
- Get the latest update and new product information for Algor customers
- Communicate directly with Algor sales, engineering and development people
- Do something new every time you return

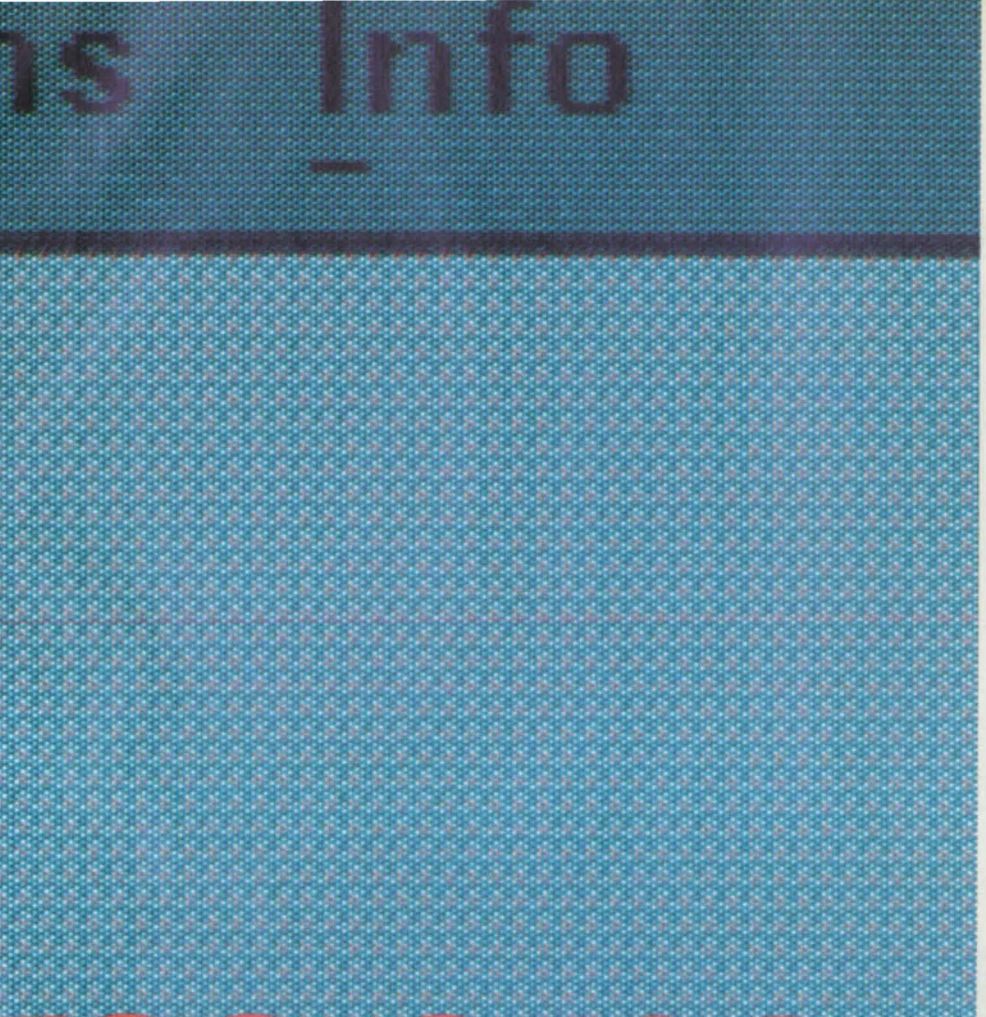
E-mail: info@algor.com
Phone: +1 (412) 967-2700
Fax: +1 (412) 967-2781

For More Information Write In No. 525

Go Views Optio



no



The new* HP VISUALIZE *workstation with PA-8000 performance.

The longer you have to wait for your workstation, the longer it takes to get your product to market. But with our new line of HP VISUALIZE *workstations, you can have blindingly fast access to information as you visually navigate through data, no matter where it resides in your organization. These workstations let you and your colleagues work simultaneously in real time from different locations. In fact, seamlessly and quickly connecting people, processes and information across your virtual enterprise is the hallmark of our* HP VISUALIZE *workstation line. So why wait? Visit us at www.hp.com/go/workstations.*

HEWLETT® PACKARD

NASA Tech Briefs

BPA ABP

Published by ..... Associated Business Publications
President/Chief Executive Officer ..... Bill Schnirring
Publisher ..... Joseph T. Pramberger
Chief Editor ..... Linda L. Bell
Editor, Federal Lab Tech Briefs ..... Robert Clark
Production Manager ..... Donna Pituras
Advertising Coordinator ..... Margery Koen
Art Director ..... Lois Erlacher
Production Artist ..... Brian Edgar
Circulation Director ..... Martin J. Horan
Assistant Circulation Director ..... Lori Coppin
Telemarketing Specialist ..... Evelyn Mars
Assistant to Reader Service Manager ..... Damiana Garcia

BRIEFS & SUPPORTING LITERATURE: Written and produced for NASA by **Advanced Testing Technologies, Inc.**, Hauppauge, NY 11788
Technical/Managing Editor ..... Ted Selinsky
Sr. Technical Analyst ..... Dr. Larry Grunberger
Art Manager ..... Eric Starstrom
Administrator/Chief Copy Editor ..... Greg Galitzine
Staff Writers/Editors ..... Dr. Theron Cole, George Watson, Howard Falk, Gail Pyke
Graphics ..... Robert Simons
Editorial & Production ..... Joan Schmiemann, Caroline Weaver, Becky D. Bentley

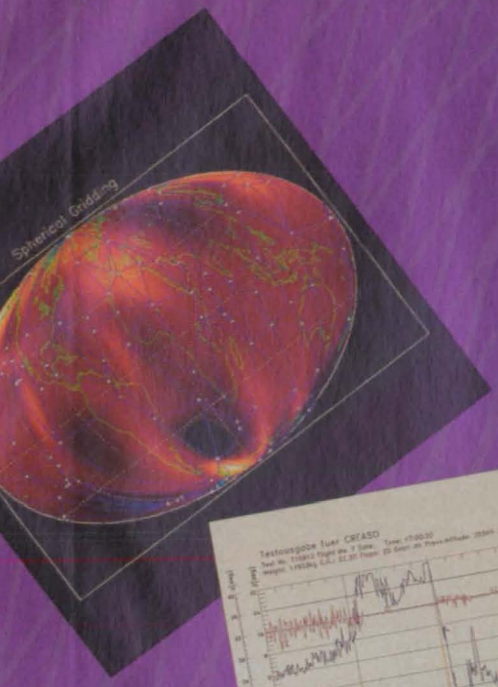
NASA:
NASA Tech Briefs are provided by the National Aeronautics and Space Administration, Technology Transfer Division, Washington, DC:
Administrator ..... Daniel S. Goldin
Director, Commercial Technology ..... Robert Norwood
Publications Director ..... Carl Ray

ASSOCIATED BUSINESS PUBLICATIONS
317 Madison Avenue, Suite 921, New York, NY 10017-5391
(212) 490-3999 FAX (212) 986-7864
President/Chief Executive Officer ..... Bill Schnirring
Executive Vice President/Chief Operating Officer ..... Domenic A. Mucchetti
Treasurer ..... Joseph T. Pramberger
Credit/Collection ..... Felecia Lahey
Staff Accountant ..... Larry Duze
Director of Marketing/New Business Development ..... George L. DeFeis
Trade Show Director ..... Wendy S. Corvi
Exhibition Sales Manager ..... Wayne Pierce
Exhibition Sales Representative ..... Joanna Lipton
Trade Show Coordinator ..... Tracy A. Wenz
Human Resources Manager ..... Lourdes Del Valle
MIS Manager ..... Ted Morawski
Assistant MIS Manager ..... Pak Tong
MIS Data Entry ..... Roxanne Portella
Office Manager ..... Sylvia Valentin
Mailroom Operations ..... Alfredo Vasquez, Rose D'Addozio
Administrative Assistant ..... Christine Saluzzi

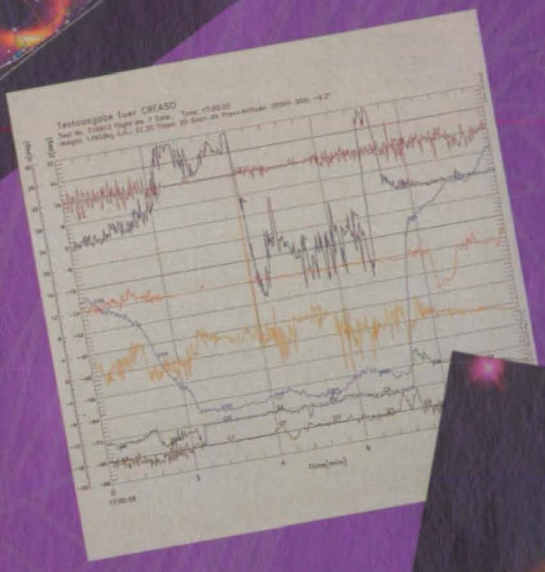
***NASA TECH BRIEFS* ADVERTISING ACCOUNT EXECUTIVES**
Headquarters ..... (212) 490-3999
NY, NJ (Area Code 201), Eastern Canada ..... John Waddell at (212) 490-3999
PA, DE, NJ (Area Code 908, 609), VA, DC, MD, WV ..... Tara Morie at (610) 640-3118
Eastern MA, NH, ME, RI ..... Paul Gillespie at (508) 429-8907, Bill Doucette at (508) 429-9861
Western MA, CT, VT ..... George Watts at (802) 875-3310
Southeast, South Central ..... Robert Hubbard at (910) 299-7754
OH, MI, IN, KY ..... Louise Clemens at (216) 397-7477
IL, WI, MO, IA, MN, ND, SD, NE, KS, Central Canada ..... Melinda Mead at (312) 296-2040
N. Calif., CO ..... Bill Hague at (408) 730-6800
WA, OR, ID, MT, WY, UT, Western Canada ..... Bill Madden; Bill Hague at (206) 858-7575
S. Calif., AZ, NM, NV (For *NASA Tech Briefs*) ..... Blake Dahlgren at (310) 288-0391
S. Calif., AZ, NM, NV (For *Federal Lab Tech Briefs*) ..... Richard Ayer; Jane Hayward at (714) 366-9089
Japan ..... Akio Saijo at 03 (5691) 3335

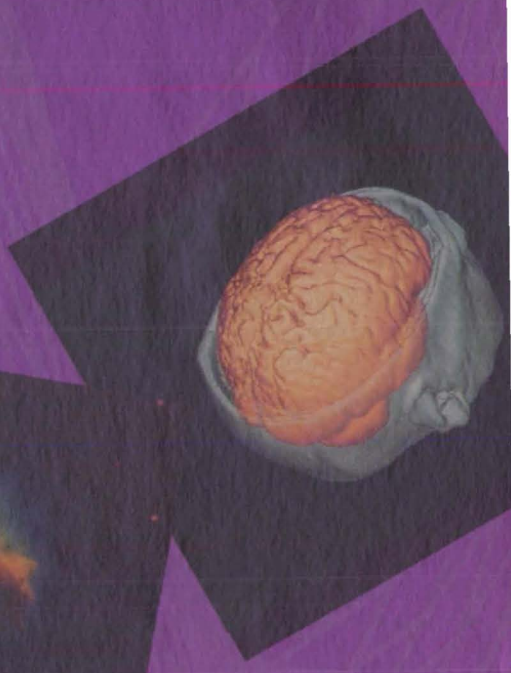
How To Reach Us On Line

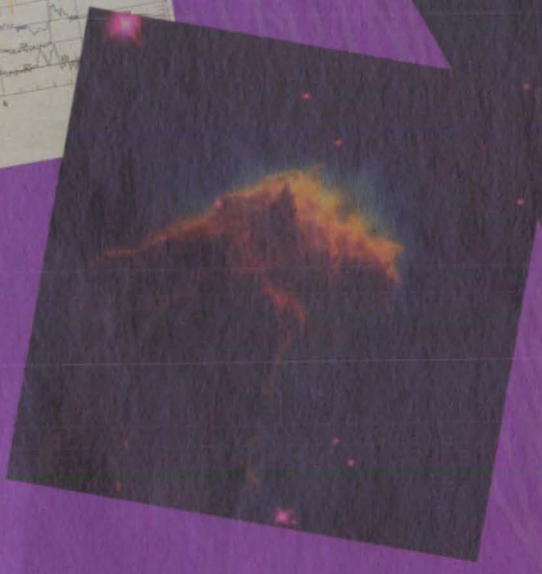
NASA Tech Briefs home page: http://www.nasatech.com
Letters to the editor: ntb_edit@interramp.com
To find out about advertising opportunities: ntb_advertise@interramp.com



The Answers to Your Questions...







IDL®

GET RESULTS QUICKER

Immediately gain insight from your data with IDL, the pioneering software for interactive analysis and application development. If you analyze data from tests, experiments, simulations, or images – or write applications for others to use – IDL will give you clear results faster.

IMPROVE YOUR PRODUCTIVITY

Dramatically improve your productivity using IDL for visual data analysis, rapid prototyping, or application development. Nothing else provides the speed, flexibility, and breadth of built-in functions for access, manipulation, and display of scientific and engineering data.

See results "on the fly" with integrated graphics, image processing, mathematics, and statistics. Quickly turn your ideas into powerful applications using IDL's high-level, array-oriented programming language and cross-platform GUI tools.

REDUCE DEVELOPMENT TIME

Only a few lines of IDL code can do the job of several hundred lines of C or Fortran. Plus, you can call functions in other languages or link IDL to your existing C or Fortran applications.

IDL programs are portable. You can deliver complete solutions on UNIX®, VMS™, Windows, Windows NT™, Macintosh®, and Power Macintosh, while writing programs only once.

So why waste time starting from scratch? Exploit IDL and find the answers – in less time, with less programming, and less hassle.

For a free demo CD, call

303-402-4641

info@rsinc.com

http://www.rsinc.com

Research Systems

Software ≡ Vision™

Research Systems, Inc. 2995 Wilderness Place Boulder CO 80301 303.786.9900 FAX 303.786.9909 Email: info@rsinc.com • **BRAZIL** SulSoft 55 51 337 38 91 • **CHINA** 3-Link Systems Pte Ltd. 8610 261 0161
FRANCE Fast Parallel Solutions 33 1 46 87 25 22 • **GERMANY** CREASO, GmbH 49 8105 25055 • **ITALY** Alliant Computer Systems SRL 39 39 6091766 • **JAPAN** Adam Net Ltd. 81 35802 2251 • **KOREA** InterSys 82 42 869 4746
SPAIN Estudio Atlas 34 45 298 080 • **TAIWAN** Concentrate Corporation 886 2 883 7752 • **UK** Floating Point Systems UK Ltd. 44 1734 776333

For More Information Write In No. 597

NASA Commercial Technology Team

NASA's R&D efforts produce a robust supply of promising technologies with applications in many industries. A key mechanism in identifying commercial applications for this technology is NASA's national network of commercial technology organizations. The network includes ten NASA field centers, six Regional Technology Transfer Centers (RTTCs), the National Technology Transfer Center (NTTC), business support organizations, and a full tie-in with the Federal Laboratory Consortium (FLC) for Technology Transfer. Call (206) 683-1005 for the FLC coordinator in your area.

NASA's Technology Sources

If you need further information about new technologies presented in *NASA Tech Briefs*, request the Technical Support Package (TSP) indicated at the end of the brief. If a TSP is not available, the Commercial Technology Office at the NASA field center that sponsored the research can provide you with additional information and, if applicable, refer you to the innovator(s). These centers are the source of all NASA-developed technology.

Ames Research Center
Selected technological strengths: Fluid Dynamics; Life Sciences; Earth and Atmospheric Sciences; Information, Communications, and Intelligent Systems; Human Factors.
Syed Shariq
(415) 604-1919
syed_shariq@qmgate.arc.nasa.gov

Dryden Flight Research Center
Selected technological strengths: Aerodynamics; Aeronautics Flight Testing; Aeropropulsion; Flight Systems; Thermal Testing; Integrated Systems Test and Validation.
Lee Duke
(805) 258-3802
duke@louie.dfrf.nasa.gov

Goddard Space Flight Center
Selected technological strengths: Earth and Planetary Science Missions; LIDAR; Cryogenic Systems; Tracking; Telemetry; Command.
George Alcorn
(301) 286-5810
galcorn@gsfc.nasa.gov

Jet Propulsion Laboratory
Selected technological strengths: Near/Deep-Space Mission Engineering; Microspacecraft; Space Communications; Information Systems; Remote Sensing; Robotics.
James Rooney
(818) 354-2240
james.a.rooney@jpl.nasa.gov

Johnson Space Center
Selected technological strengths: Artificial Intelligence and Human Computer Interface; Life Sciences; Human Space Flight Operations; Avionics; Sensors; Communications.
Hank Davis
(713) 483-0474
hdavis@gp101.jsc.nasa.gov

Kennedy Space Center
Selected technological strengths: Emissions and Contamination Monitoring; Sensors; Corrosion Protection; Bio-Sciences.
Bill Sheehan
(407) 867-2544
billsheehan-1@ksc.nasa.gov

Langley Research Center
Selected technological strengths: Aerodynamics; Flight Systems; Materials; Structures; Sensors; Measurements; Information Sciences.
Dr. Joseph S. Heyman
(804) 864-6005
j.s.heyman@larc.nasa.gov

Lewis Research Center
Selected technological strengths: Aeropropulsion; Communications; Energy Technology; High Temperature Materials Research.
Ann Heyward
(216) 433-3484
ann.o.heyward@lerc.nasa.gov

Marshall Space Flight Center
Selected technological strengths: Materials; Manufacturing; Nondestructive Evaluation; Biotechnology; Space Propulsion; Controls and Dynamics; Structures; Microgravity Processing.
Harry Craft
(202) 544-5419
harry.craft@msfc.nasa.gov

Stennis Space Center
Selected technological strengths: Propulsion Systems; Test/Monitoring; Remote Sensing; Nonintrusive Instrumentation.
Anne Johnson
(601) 688-3757
ajohnson@wpogate.ssc.nasa.gov

NASA-Sponsored Commercial Technology Organizations

These organizations were established to provide rapid access to NASA and other federal R&D and foster collaboration between public and private sector organizations. They also can direct you to the appropriate point of contact within the Federal Laboratory Consortium. To reach the Regional technology Transfer Center nearest you, call (800) 472-6785.

Ismail Akbay
National Technology Transfer Center
(800) 678-6882

Robert Stark
Far-West Technology Transfer Center
University of Southern California
(213) 743-2353

Dr. William Gasko
Center for Technology Commercialization
Massachusetts Technology Park
(508) 870-0042

J. Ronald Thornton
Southern Technology Applications Center
University of Florida
(904) 462-3913

Gary Sera
Mid-Continent Technology Transfer Center
Texas A&M University
(409) 845-8762

Lani S. Hummel
Mid-Atlantic Technology Applications Center
University of Pittsburgh
(412) 648-7000

Chris Coburn
Great Lakes Industrial Technology Transfer Center
Battelle Memorial Institute
(216) 734-0094

NASA ON-LINE: Go to NASA's Commercial Technology Network (CTN) on the World Wide Web at http://nctn.hq.nasa.gov to search NASA technology resources, find commercialization opportunities, and learn about NASA's national network of programs, organizations, and services dedicated to technology transfer and commercialization.

NASA Program Offices

At NASA Headquarters there are seven major program offices that develop and oversee technology projects of potential interest to industry. The street address for these strategic business units is: NASA Headquarters, 300 E St. SW, Washington, DC 20546.

Gene Pawlik
Small Business Innovation Research Program (SBIR)
(202) 358-4661
gpawlik@oact.hq.nasa.gov

Robert Norwood
Office of Space Access and Technology (Code X)
(202) 358-2320
rnorwood@oact.hq.nasa.gov

Philip Hodge
Office of Space Flight (Code M)
(202) 358-1417
phodge@osfms1.hq.nasa.gov

Gerald Johnson
Office of Aeronautics (Code R)
(202) 358-4711
g_johnson@aeromail.hq.nasa.gov

Bill Smith
Office of Space Sciences (Code S)
(202) 358-2473
wsmith@sm.ms.ossa.hq.nasa.gov

Bert Hansen
Office of Microgravity Science Applications (Code U)
(202) 358-1958
bhansen@gm.olmsa.hq.nasa.gov

Granville Paules
Office of Mission to Planet Earth (Code Y)
(202) 358-0706
gpaules@mtpe.hq.nasa.gov

NASA's Business Facilitators

NASA has established several organizations whose objectives are to establish joint sponsored research agreements and incubate small start-up companies with significant business promise.

Karen Robbins
American Technology Initiative
Menlo Park, CA
(415) 325-5353

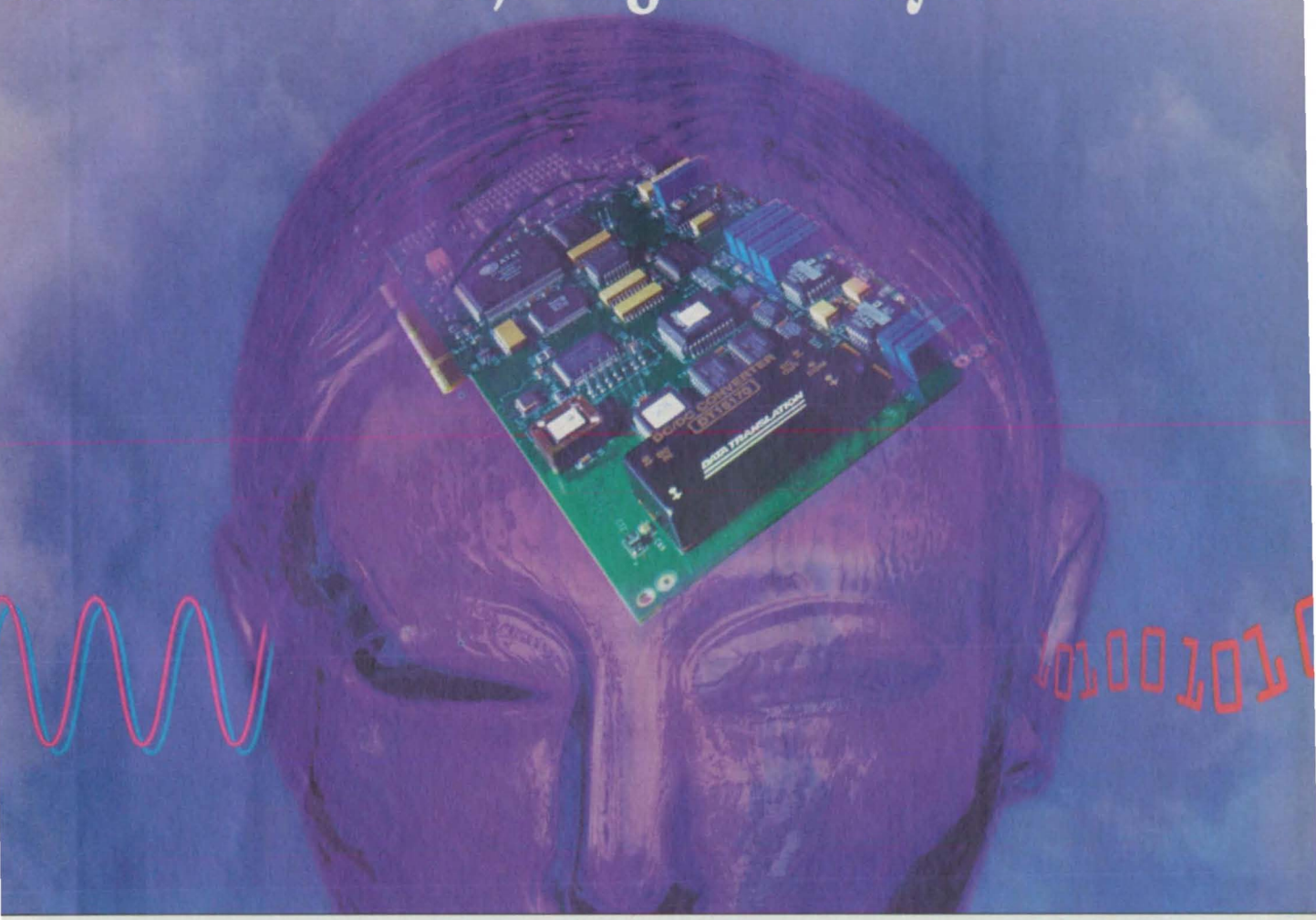
Dr. Jill Fabricant
Johnson Technology Commercialization Center
Houston, TX
(713) 335-1250

John Gee
Ames Technology Commercialization Center
Sunnyvale, CA
(408) 734-4700

Dan Morrison
Mississippi Enterprise for Technology
Stennis Space Center, MS
(800) 746-4699

If you are interested in information, applications, and services relating to satellite and aerial data for Earth resources, contact: Dr. Stan Morain, **Earth Analysis Center,** (505) 277-3622. For software developed with NASA funding, contact **NASA's Computer Software Management and Information Center (COSMIC)** at phone: (706) 542-3265; Fax: (706) 542-4807; E-mail: http://www.cosmic.uga.edu or service@cosmic.uga.edu.

At 2.5 times faster, imagine what you could do.



PCI-EZ's speed and precision meet your data acquisition needs head on.

2 1/2 Times the Speed Puts You Ahead

Unlike ISA-based boards, the PCI-EZ boards are not limited by the bandwidth of the bus. They are designed to maximize the data transfer between the board and the PC. With the ability to transfer data at 1000 KS/sec (KiloSamples per second), all the functions of the PCI-EZ board can run full-out without any loss of data or impact on other applications.

In contrast, ISA-based boards are limited by the bandwidth of the ISA bus, supporting a bidirectional transfer rate of only 400 KS/sec, thus limiting your analog to digital and digital to analog conversion, as well as any digital input/output and counter/timers. With PCI-EZ, there's no limit to what you can do.

Data Translation Offers Better Value, Head-to-Head

Our family of PCI-based products are the lowest priced products on the market. For the same price as an ISA-based board, you can achieve 2 1/2 times the performance with PCI-EZ.

DTOL, for Whatever Direction You're Headed

DT-Open Layers are a set of open standards for developing integrated modular software under Windows® 3.1 and Windows® 95. DTOL provides:

- Portability
- Modularity
- Windows Ease
- Expandability

ENOB, Head and Shoulders Above the Rest

Each board is designed, manufactured, and tested to the ENOB criteria, the industry-accepted method for characterizing the dynamic accuracy of a converter-based system. As a result, you are assured of receiving the most effective dynamic range of any board on the market, at all levels of performance including: throughput, the number of channels, and channel gain. You know with confidence how the board will perform in all cases. **So call us today, and discover for yourself why PCI-EZ is turning a lot of heads!**

1-800-525-8528

INTERNET: http://www.datx.com

E MAIL: info@datx.com

Product	Price	Resolution	Channels	Throughput	DAC's (12-bit)
DT3001	$995	12-bits	16SE/8DI	330 kHz	2x200 kHz
DT3002	$1095	12-bits	32SE/16DI	330 kHz	
DT3003	$1395	12-bits	64SE/32DI	330 kHz	2x200 kHz
DT3004	$1450	16-bits	16SE/8DI	100 kHz	2x200 kHz

Remember, only DT VEE Software gives you completely adaptable data acquisition for any application.

DT-VEE™ DT-Open Layers™ **DATA TRANSLATION®**

World Headquarters: (508) 481-3700, UK Headquarters: (01734) 793838, Germany Headquarters: (07142) 95 31-0.

Sales Offices: Argentina 322-3791; Australia (02) 9979 5643; Austria 13697660; Belgium 02-5 69 56 47; Brazil (011)564-6024; Canada (508) 481-3700, (416) 625-1907; Chile 638 7806; China 8428276, 10 833 1145; Denmark 48 14 14 88; Finland (90) 351 1800; France (1) 69 07 92 12; Greece (301)3846200; Hong Kong 2515-0018; India (22) 2831040; Israel 9-581860; Italy 39 6 52200028; Japan (03) 5489-3871; Korea (02) 718-9521; Malaysia (03) 261 6786; Mexico (5) 575-6091; The Netherlands 010-47 95 700; New Zealand 94158362; Norway 2243 4150; Portugal 01/793 48 34; Singapore 773 4300; South Africa 12803 7680; Spain 91-555.8112; Sweden 08-765 02 80; Switzerland 01/908 13 13; Taiwan (02) 561-2211; Thailand (02) 668-5080; Turkey (21) 288 6213 05/22/96

For More Information Write In No. 617

Reader Forum

Reader Forum is devoted to the thoughts, concerns, questions, and comments of our readers. This month, we feature letters from readers seeking help with specific problems or requesting answers to technical questions. If you have an answer for one of your fellow readers, or if you have a question for a future issue, send your letter to the address below.

I hope the Technical Support Package I requested from the brief, "Thirst, Drinking Behavior and Dehydration," (June 1996, page 84) will help in a personal pursuit of mine: cycling. Summer riding/racing differs from winter riding only in the amount of dehydration to which one is subjected. I enjoy reading anything that might help me avoid the effects of dehydration.

Walter C. Walge
Senior Electrical Engr.
ITT Research Institute
Annapolis, MD

(**Editor's Note**: Walter, you may be interested in two briefs that appeared in the August issue: "Improved Hyperhydration Beverage" on page 96, and "Vascular Uptake of Six Rehydration Drinks at Rest and Exercise" on page 116.)

The Reader Forum is great. I think in time you will find that it will become almost as important as the entire NASA Tech Briefs. *As to my present needs/requests: 1) Where would I find a simple math formula or software to tell me the effect of three magnetic fields acting on a rotating aluminum plate or on a rotating, pulsed electrostatic field; 2) the thrust needed to land a 20-ton ship on the Moon and then take off after landing cargo; and 3) where would I find more information on ballutes and the work being done in that field?*

James Oates
National Weather Service
Miami, FL

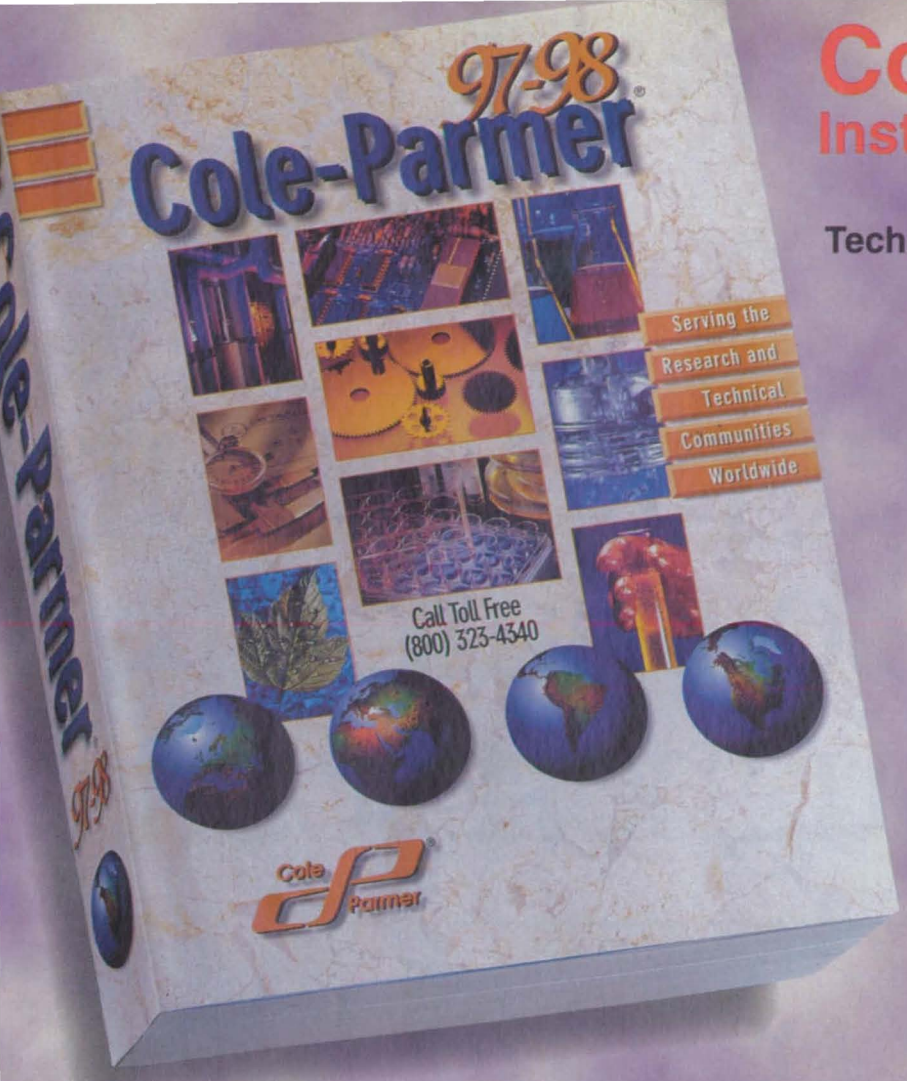
For over a year now, I have been seeking a true zero shrinkage (or as close as possible) polymeric compound. The goal is to cast front surface optics (applying the mirror coat at a later time) – thus, shrinkage upon cure will warp the proper surface figure the liquid possesses. I need a polymeric compound (epoxy, urethane, etc.) that exhibits zero shrinkage upon room-temperature set and cure. The polymeric liquid needs to possess a relatively low viscosity, preferably is unfilled, and should be mechanically rigid upon cure. A two-component system with a relatively long pot life is desired, with specified shrinkage characteristics.

As my field of research is rather diverse, I have always found NASA Tech Briefs *to be extremely useful in keeping abreast of current research.*

Bob Richardson
Chemistry Dept.,
University of Idaho
Moscow, ID

Send your letters to the Editor at:
Reader Forum, *NASA Tech Briefs*, 317 Madison Ave., Ste. 921, New York, NY 10017.

Fax: 212-986-7864; E-mail: ntb_edit@interramp.com
Please include your name, company (if applicable), address, and phone number or E-mail address.



Cole-Parmer®
Instrument Company

Serving the Research & Technical communities worldwide

When you order from Cole-Parmer you receive quality products along with complete Sales, Applications, and Customer Satisfaction service. . . . and much more! We now offer extended hours, a NEW Web site, and enhanced Applications Service.

The Cole-Parmer catalog gives you a selection of more than 32,000 products for Research, Industry, and Education. . .

. . . and it's FREE!

The Cole-Parmer catalog also serves as a convenient resource—it includes technical information, conversion tables, and chemical resistance charts.

Here's how to receive your FREE 1997-1998 Cole-Parmer catalog:

- **Fax back the coupon at left**
- **Or call our literature hotline at (800) 443-3434**
- **Or e-mail us at catalog@coleparmer.com**
- **Or visit our NEW Web site at http://www.coleparmer.com**

For More Information Write In No. 604

We cater to your original equipment manufacturer (OEM) requirements by offering custom design and private label on many of our products. Call (800) 323-4340, extension 9-6092 for more information on our OEM services.

Fax this coupon to us at (847) 549-7676 to receive your FREE 1997-1998 Cole-Parmer Catalog!

Name: _____

Title/Mail Stop: _____

Company: _____

Address: _____

City: _____

State: _____ **Zip:** _____

Phone: _____ **Fax:** _____

NASA 9/96

Cole Parmer®

Cole-Parmer® Instrument Company
625 East Bunker Court
Vernon Hills, Illinois 60061-1844

Vespel® parts can handle some of the toughest jobs.

Like paying for themselves.

Everyone knows that Vespel® polyimide parts improve performance in severe service applications by withstanding extreme heat, friction, pressure and contamination – with minimal or no lubrication. But now manufacturers who use Vespel parts in general applications are beginning to notice improvements somewhere else: *the bottom line*. That's because the reliability and long life of Vespel parts can make them the most cost-effective choice for general applications in the long term.

If your applications require parts that can withstand extreme temperatures (-350°F to 550°F), Vespel should be your first choice. Vespel should

Insulators. *In plasma-arc cutting torches, Vespel insulators provide superior strength and durability at high temperatures up to 550°F, lasting up to six times longer than fragile ceramic insulators.*

Seal Rings. *In the assembly of automobile transmissions, Vespel seal rings reduce costs by replacing expensive metal rings, which can fracture or deform during assembly. They also reduce warranty costs by producing a better seal.*

Thrust Washers. *In farm tractor transmissions, Vespel thrust washers reduce costs and manufacturing time by eliminating the need for secondary machining. Vespel washers also exhibit high performance and low wear with limited or no lubrication.*

Bearings. *In photocopiers, Vespel composite idler gear hub bushings are a cost-effective alternative to metal. The Vespel parts provide ultra-high temperature resistance and dimensional stability while offering a low coefficient of friction, as well as long life without lubrication.*

Bushings. *In aircraft engine vanes, Vespel bushings withstand high-frequency vibration dithering and offer excellent stability and lubricity at high temperatures. They also reduce assembly time.*

Wear Strips. *In textile equipment, Vespel tenter frame clip wear strips reduce costs by eliminating the need for lubrication. They also improve textile manufacturing quality by eliminating oil contamination, and provide good wear and temperature resistance.*

also be considered if you have parts that rub together, if metal parts are too noisy, or if fluid flow needs to be controlled.

Superior strength and reliability aren't the only ways Vespel can save you money. Often, you can consolidate two or more existing parts in one Vespel piece. And Vespel parts can be direct-formed, which eliminates machining costs.

When you consider how cost-effective Vespel parts can be in the long term, it's clear that we don't just make better bushings, bearings, washers and seals. *We make better sense.*

IF YOU WANT TO GET TECHNICAL

For information, call 1-800-426-7246. Or write: DuPont Vespel® Product Information Center, P.O. Box 1138, Bloomfield Hills, MI 48303-1138.

DUPONT

Vespel®

Only by DuPont

New Product Ideas

New Product Ideas are just a few of the many innovations described in this issue of *NASA Tech Briefs* and having promising commercial applications. Each is discussed further on the referenced page in the appropriate section in this issue. If you are interested in developing a product from these or other NASA innovations, you can receive further technical information by requesting the TSP referenced at the end of the full-length article or by writing the Commercial Technology Office of the sponsoring NASA center (see page 14).

Real-Time Flush Air-Data Sensing System

Using 11 small pressure ports, this system measures airflow about an aircraft and processes the sensor outputs in real time for use in research and flight control. There are no intrusive booms and pitot tubes that are vulnerable to damage, misalignment, and false readings.
(See page 70.)

Miniature Quadrupole Mass Spectrometers

Large numbers of these instruments can be used on manned and unmanned space missions. They also could be more easily distributed to chemical waste dumps, chemical processing plants, and other sites where there is a need to monitor exhaust fumes.
(See page 74.)

Durable High-Emissivity Coatings for Solar-Energy Systems

Mixtures of alumina and titania can be used to form surface layers on solar thermal energy receivers and heat radiators. The envisioned benefits are redistribution of heat away from local hot spots and/or reduction in the size of a surface necessary to radiate a given thermal power.
(See page 76.)

Apparatus Aids Evaluation of Threaded Fasteners

This apparatus can be used for testing nuts, bolts, and threaded inserts in a variety of sizes and materials. It is relatively inexpensive, and because it is portable, it can be used to test fasteners in the field.
(See page 81.)

Automatic Stand-Off Control for Arc Welding

The stand-off distance is controlled more directly, without regard for arc voltage or current. This method requires very little new equipment and maintains better control of true arc length.
(See page 90.)

Floor-Mounted Tool for Friction Stir Welding

The weight of a workpiece itself is used to advantage to press against a friction-stir welding tool. This scheme eliminates expensive tooling that has been used to create the strong forces necessary for this type of welding. Tooling cost in welding a large-diameter tank is about one-tenth the original.
(See page 90.)

Experience Grace Under Pressure Measurements.

When the stress of dynamic pressure measurements seems too great to bear, call Endevco to relieve the strain.

We offer a wide range of piezoresistive pressure transducers. And our unique, silicon sensing-diaphragm is at the heart of each one. That's why Endevco pressure transducers can take such extreme vibration, shock, overpressure, heat, cold, and humidity. And why they're unsurpassed for sensitivity, dynamic response, and miniature size—whether you're measuring inches of water or 20,000 psi.

If you test in a wind tunnel, an engine test cell, or in flight—we have the right transducer for you. The same goes for automotive measurements such as ABS, air bags, transmission fluid, hydraulic systems, and engine manifolds. We also handle petrochemical, marine, and medical applications.

Plus Endevco offers an extensive line of electronics and accessories. So you're assured of a complete pressure measurement solution. With great prices and delivery schedules to calm your nerves. To avoid a major blow-out, call Endevco now at 1-800-982-6732.

To request your free Endevco Dynamic Measurement Poster, with key formulae, conversion tables, and constants, call 1-800-982-6732 or e-mail us at freebie@endevco.com.

ENDEVCO

MEGGITT AEROSPACE 30700 RANCHO VIEJO ROAD, SAN JUAN CAPISTRANO, CA 92675 USA, TEL (800) 982-6732 FAX (714) 661-7231

MORE MULTIPROCESSING POWER.

"The impact we're going to have with the [Windows] NT*/Pentium® Pro [processor]-based system is lower cost, better performance and more productivity."

Gary LeDuc,
Design Engineer,
ABB Vectogray

5.5 Million Transistors.
(Go ahead, count 'em.)

"Engineering Automation Report has been recommending to its readers for some time now that they take a serious look at Pentium® Pro [processor-based] workstations, along with Windows NT*, as fundamentally being the wave of the future."

David Weisberg, Editor,
Engineering Automation Report

SUPPORTS FASTER MULTITASKING.

On-board L2 cache brings loads of extra performance to your processor.

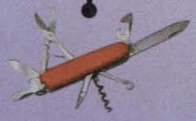
intel inside®

PENTIUM® PRO
PROCESSOR

"I think that there is no question that with AutoCAD* software and Mechanical Desktop* applications the speed of Pentium Pro [processor-based] systems is superior to anything we have seen in the past few years."

Ed Russell,
President,
Devtron Russell, Inc.

Runs your business and technical software on one system.



www.intel.com/pentiumpro

For even more information, visit our Web site.

PROUD PARTNER

150 1846-1996 Smithsonian

Have a nice Web experience.

Among the Pentium® Pro processor'

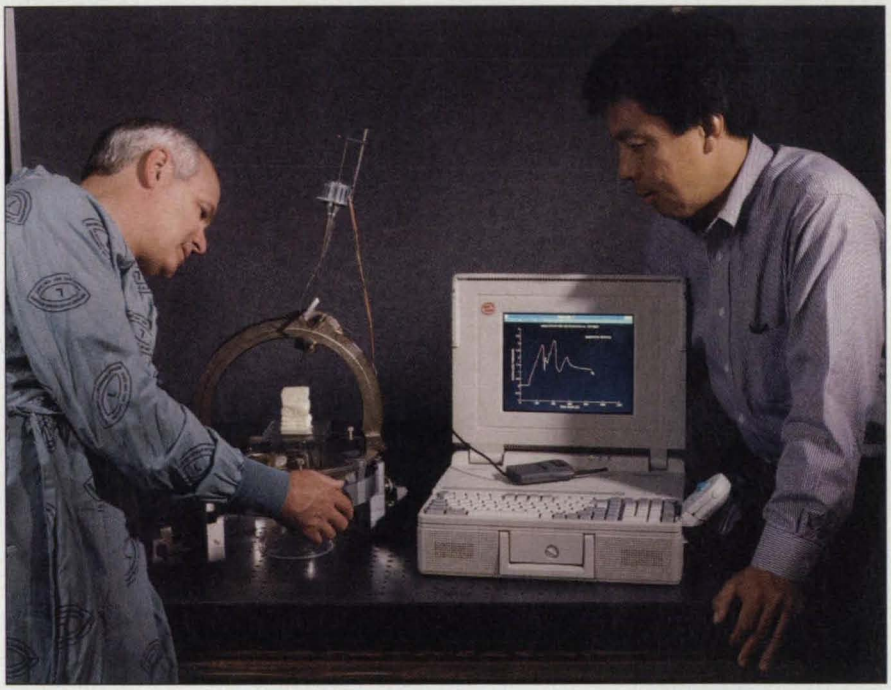
Shift productivity into high gear when you run Autodesk® Mechanical Desktop® or AutoCAD® on a Pentium Pro processor-based workstation.

eatures, one has your name on it.

intel®
The Computer Inside.™

NASA NEWS BRIEFS

Brain surgeons may have better control of surgical instruments during delicate operations thanks to a robot that can learn the physical characteristics of the brain. NASA Ames Research Center's NeuroEngineering Group is developing a new procedure in which a robotic probe will learn the brain's characteristics using neural net software similar to that used to focus video recorders. The probe, equipped with a tiny pressure sensor, will enter the brain, gently locating the edges of tumors while preventing damage to critical arteries. According to principal investigator Dr. Robert W. Mah of the NeuroEngineering Group at Ames, the robot will be able to "feel brain structures better than any human surgeon, making slow, very precise movements during an operation."



Dr. Robert W. Mah (right) of NASA Ames and Dr. Russell J. Andrews of the Veterans Administration Palo Alto Health Care System demonstrate the robotic probe that may help neurosurgeons during delicate brain operations. (Photo courtesy of NASA Ames)

During standard brain surgery, the surgeon uses a magnetic resonance image to guide placement of the probe in the brain. The surgeon samples the tumor by inserting a biopsy probe through an opening in the skull. Since brain tumors have a different density than normal brain tissue, neurosurgeons, with experience, can find the tumor's edge. With the new procedure, the speed and maximum pressure are controlled by a smart computer program that continues to learn as it gains more experience. If it hits an artery, the probe will stop before it penetrates. If the computer stops the probe, the surgeon can decide how to proceed.

The software learns to distinguish tumors from normal brain tissue by remembering the pressure signatures or profiles for each kind of tissue, and then making a model. The probes are much smaller than standard probes, and should reduce potential brain damage. A modified form of the brain surgery probe could be used for other types of surgery.

For more information, contact John Bluck, Ames Research Center, at 415-604-5026.

A low-cost aircraft navigation system developed at NASA Goddard Space Flight Center's Wallops Flight Facility at Wallops Island, VA, is allowing scientists to make precise maps of ice sheets that should produce data on the potential effects of global climate changes.

The system uses an IBM-compatible 486 PC to provide navigational data to the cockpit, allowing pilots to fly flight paths to an accuracy of one foot. The system also can be installed in an aircraft using a laptop computer. This enables scientists on the aircraft to map the icy terrain below to within four inches. In May, NASA and university researchers began their sixth mission since 1991 to map the ice sheets of Greenland, providing a baseline set of measurements to help scientists understand glacial changes due to global climate changes.

A receiver in the aircraft tuned to the Global Positioning System (GPS) of satellites acquires position information and compares the readings to a predetermined flight path. The navigation system generates steering signals that are sent to the autopilot to direct the aircraft towards its optimal path. The total cost of the system is less than $3000.

For more information, contact Wayne Wright, system developer, Wallops Flight Facility, at 804-824-1698.

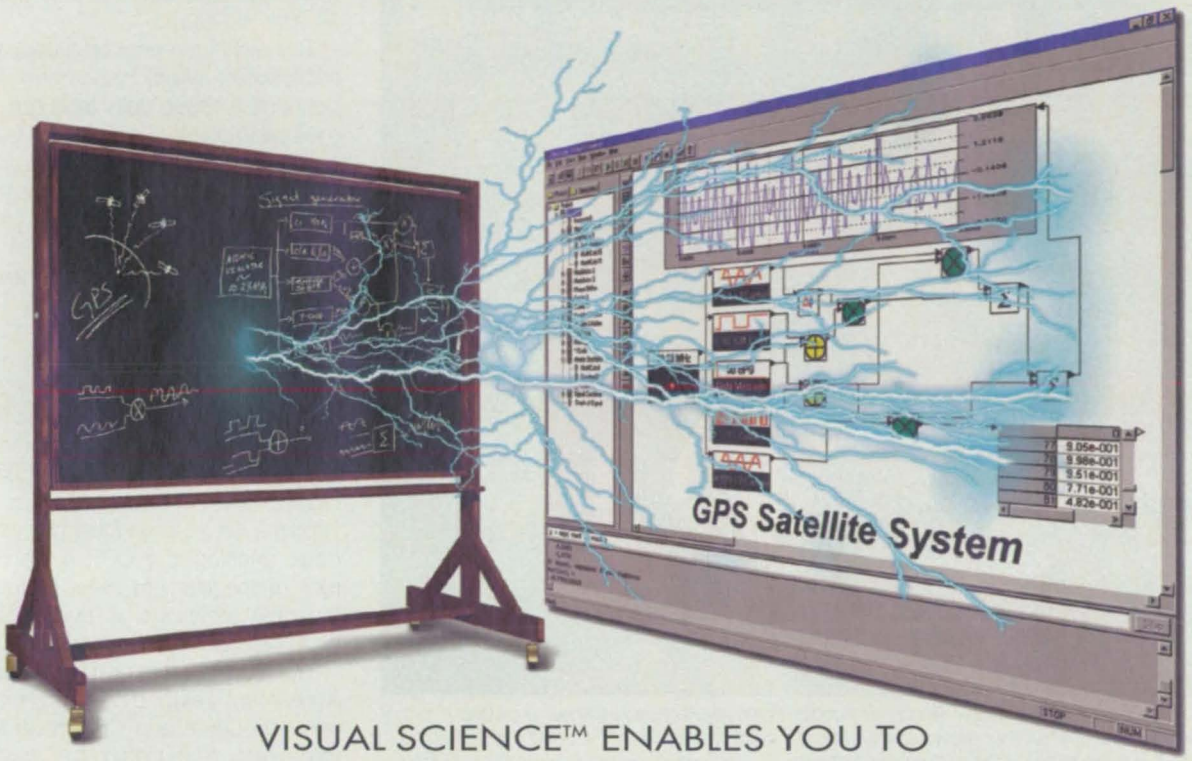
NASA and Montana State University-Bozeman have signed a cooperative agreement establishing a technology transfer center at the university to serve Montana, Idaho, North and South Dakota, and Wyoming. The MSU-NASA TechLink Center is the first technology transfer operation in the NASA system designed to serve the needs of rural states.

The center will concentrate primarily on identifying NASA-supported technologies useful to businesses in the five states served by the facility. Prior to the center's opening, Montana residents had to contact the Mid-Continent Technology Transfer Center (MCTTC) in College Station, TX to find technologies supported by NASA. While the new center will continue to work with the MCTTC, it also will develop its own plan for linking businesses in the area with NASA technology.

For more information, contact Peter Perna, executive director of TechLink Center, at 406-994-6687.

Airplanes that suffer major equipment failures or explosions will be able to land safely using new software developed by NASA's Ames Research Center's Neural Net Group and McDonnell Douglas Corp. (St. Louis, MO). The neural net software will allow the plane's computer, in less than one second, to "relearn" to fly the plane. Serious problems such as partially

GETTING FROM CONCEPT TO APPLICATION JUST GOT EASIER.



VISUAL SCIENCE™ ENABLES YOU TO INTERACTIVELY DESIGN, SIMULATE AND ANALYZE COMPLEX MATHEMATICAL SYSTEMS.

visual science

Windows 95 & Windows NT

$695 Introductory Offer

Visual Science's unique interactive computational model enables you to focus on the results you want to see rather than on the calculations which need to be run. Unlike text-based mathematical software, Visual Science lets you quickly and easily:

- Create a visual model of a mathematical system
- Bring out the important hierarchical structure of the system, hiding unwanted detail
- Gain complete control over executing your mathematical system
- Analyze the system with interactive tools
- Scale from simple problems to complex dynamic systems
- Model systems involving feedback
- Simulate parallel execution
- Navigate through and manage large scale projects

Visual Science features:

- Full interactive control over designing, simulating, analyzing and applying mathematical systems
- A hierarchical block diagram interface together with a traditional command prompt interface
- MathCalc,™ a familiar matrix calculation language
- More than 100 double precision real and complex mathematical functions
- Both numerical and graphical data inspectors
- OLE based publication and annotation capabilities
- Sequential and parallel execution with feedback
- A fully customizable and extensible environment
- **Seamless support for MATLAB® and IDL®**

You've got to see it to believe it.

http://www.acroScience.com

Download the fully-functional trial version!

acroscience corporation

For more information:
acroScience Corporation
1966 13th Street, Suite 250
Boulder, CO 80302 USA
E-Mail: info@acroScience.com
303.541.0089
Fax: 303.541.9056

1.800.600.MATH

The NeuroEngineering Lab Virtual Reality Simulator at Ames Research Center provides a virtual environment point of view that allows researchers to position themselves around a simulated aircraft while it is flying to study the performance of adaptive systems in compensating for in-flight failures. (Photo courtesy of Ames Research Center)

destroyed wings, fuselage holes, and sensor failures affect how an airplane handles and how, or if, the pilot's controls respond.

Charles Jorgensen, the principal investigator for the four-year Intelligent Flight Control Program at Ames, believes that the software also can be used in "power plants, automobiles, and other less complicated systems to avoid disasters after equipment failure." Flight tests are underway at NASA's Dryden Flight Research Center using early versions of the software on a modified F-15 jet fighter.

The airplane sensors can send speed, direction, and force data to the computer program. The plane's computer compares the pattern of what is happening to the plane with a pattern showing how the plane should be flying. If there is a mismatch, the software makes the system work with a new pattern based on a dozen basic aeronautical equations or rules that define how airplanes fly. Said Jorgensen: "If sensor data show that a rule is being violated, and the airplane is turning too abruptly, the airplane's neural network can rapidly learn to assist the pilot in use of the stick, engines, flaps, rudders, and other control surfaces in ways that may be very unconventional, but possibly successful."

For more information, contact Charles Jorgensen of Ames at 415-604-6725 or John Bluck of Ames at 415-604-5026.

Kennedy Space Center engineers have developed a new supersonic cleaning system that will not damage surfaces – and which may be used soon to clean space shuttle hardware and other sensitive structures. The Supersonic Gas-Liquid Cleaning System works by mixing air and water from separate pressurized tanks and ejecting the mixture at supersonic speed from a series of nozzles at the end of a handheld wand. At supersonic speeds, the water droplets have the kinetic energy to remove contaminants.

The system was designed as an environmentally friendly alternative to chlorofluorocarbon (CFC)-based solvents.The low volume of water used means less fluid left after cleaning that must be handled as contaminated waste. The system can be used for cleaning anything from small electronic circuit boards to large buildings.

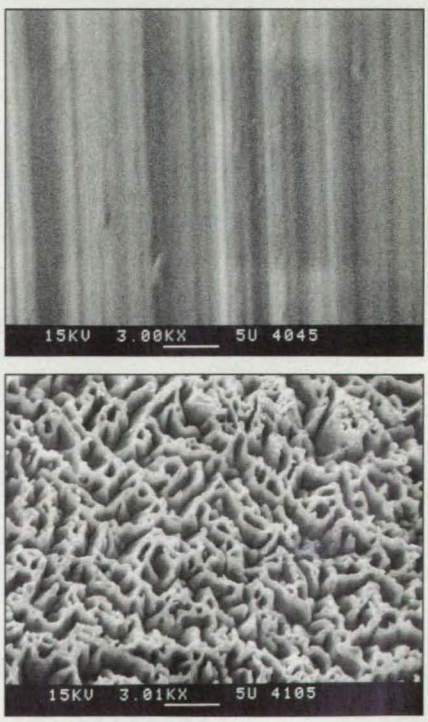
For more information, contact Bill Sheehan, chief of Kennedy Space Center's Technology Programs and Commercialization Office, at 407-867-2544.

A NASA Lewis team – physicist Kenwyn Long of the Electron Beam Technology Branch, and technicians Ken Jensen and Robert Roman of the Test Installations Division – have developed a microtexturing technique that may improve the body's ability to accept biomedical implants. The technique is a spinoff of an ion bombardment technique developed for the Cassini Mission to Saturn.

The technique creates a deeply ridged microtexture which helps bone cells and connective tissue cells take hold of biomedical implants. Long's team built upon the biomedical research conducted for the Cassini mission and successfully textured titanium disks, small-diameter titanium cylinders, and titanium implant screw surfaces using the ion bombardment technique. Dentists Thomas Cowper, D.D.S. and Chris Whitmeyer, D.D.S. of the Department of Dentistry and Maxillofacial Surgery at the Cleveland Clinic Foundation's (CCF) Department of Biomedical Engineering worked with Long to test various microtexturing techniques on screws used for dental implants. Dr. George Muschler, an orthopedic oncologist at CCF, is testing samples of the titanium disks textured with the new technique in conjunction with bone cells and connective tissue growth.

The joint effort is part of a Space Act Agreement signed earlier this year between Lewis and CCF, establishing a three-year relationship for cooperative research.

For more information, contact Kenwyn Long of Lewis Research Center at 216-433-3451.

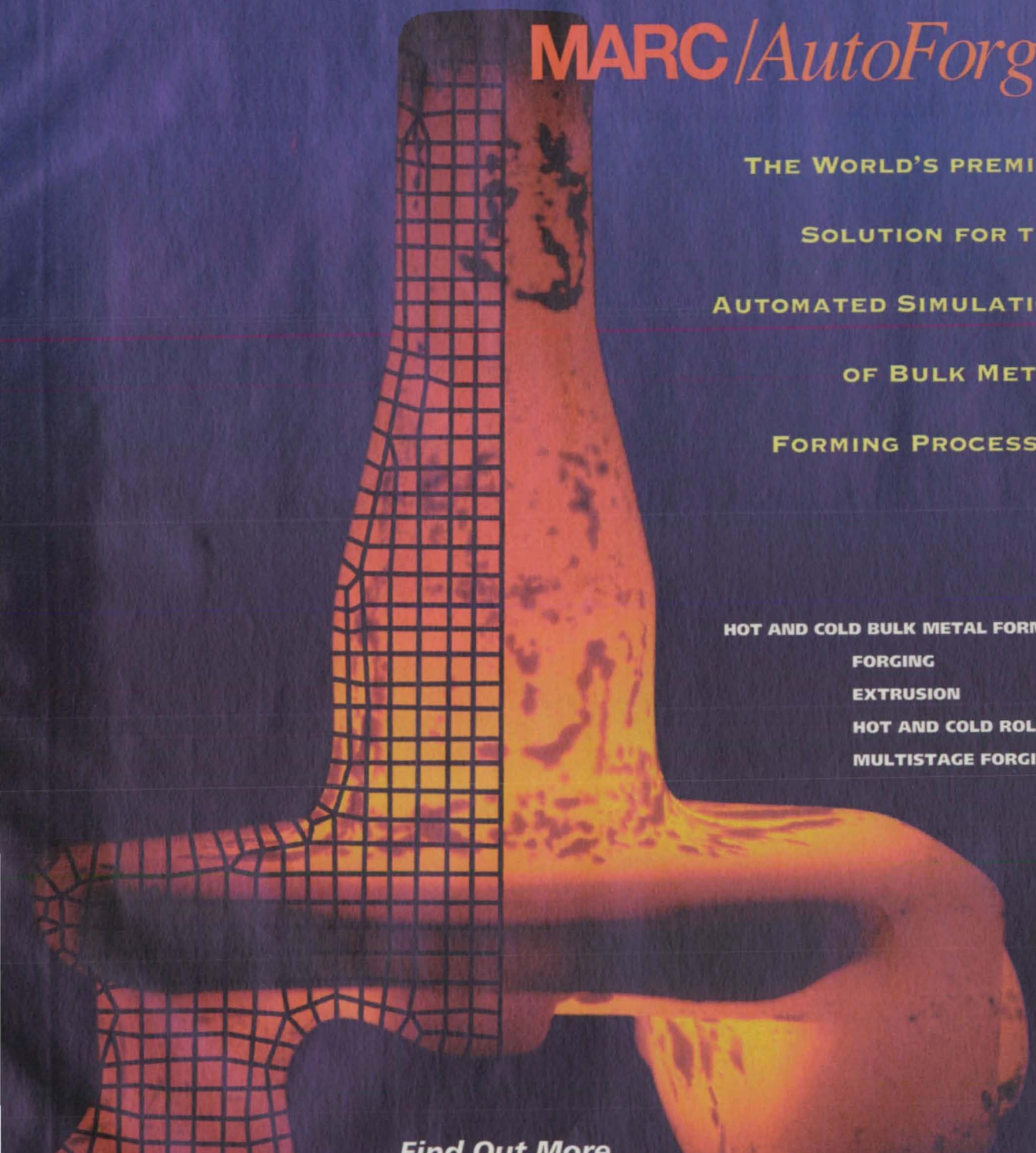


The top photo shows the surface of an untextured titanium implant screw magnified 3,000 times; the surface of a microtextured implant screw magnified 3,000 times is shown above. Bone cells and connective tissues may be able to grow more easily in the deeply ridged texture.

Get the Competitive Advantage

MARC/*AutoForge*™

THE WORLD'S PREMIER SOLUTION FOR THE AUTOMATED SIMULATION OF BULK METAL FORMING PROCESSES

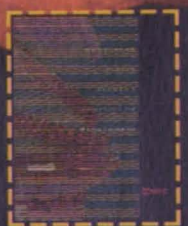


HOT AND COLD BULK METAL FORMING
FORGING
EXTRUSION
HOT AND COLD ROLLING
MULTISTAGE FORGING

Find Out More...

MARC/AutoForge

Virtual Manufacturing



Analysis of Elastomers

Demo CD ROM

Call 1-800-548-4665, web: www.marc.com, or e-mail: marc.com/autoforge

TECHNOLOGY 2006 EXHIBITS PREVIEW

From October 29–31 in the Anaheim, CA Convention Center, government laboratories and agencies, universities, and industry will display hundreds of new inventions and products available for licensing, joint development, or sale. Following are this year's exhibitors (as of July 31).

Aerospatiale 818

Les Mureaux Center, France

The company will describe its role in various European space projects and will exhibit new products and technologies in areas such as thermal protection, magnetic bearings, and HP filament winding.

AGE 122

Kansas City, MO

Air Force Phillips Laboratory 233

Kirtland Air Force Base, NM

The Phillips Laboratory is the Air Force's premier space and missiles R&D center. It has a wide range of technologies available for dual-use applications.

APD Cryogenics 633

Allentown, PA

CRYOTIGER® is a revolutionary closed-cycle refrigeration system for cooling and maintaining temperatures to -203° C, eliminating the need for liquid nitrogen use.

Argonne National Laboratory 635

Brooks Air Force Base, TX

The Lab focuses on human-centered technologies, including ergonomics, computer-based training, simulation/synthetic environments, directed energy bioeffects, medical assistive devices, man-machine interfaces, and environmental remediation/pollution prevention.

Austrian Trade Commission 931

Los Angeles, CA

The Austrian Trade Commission presents a large variety of technologies from Austrian companies, research institutes, and universities.

BF Goodrich Aerospace 418

Vergennes, VT

The company specializes in signal processing for assessing aircraft health, utility subsystem integration, remote interrogation sensor electronics for composite health monitoring, and light-energized sensing for fluid measurement.

BHK 828

Pomona, CA

BHK will present UV and IR light sources and power supplies; electro-optical and opto-mechanical assemblies; low-pressure mercury, zinc, and cadmium lamps; wavelength calibration lamps; and IR filament lamps.

Brookhaven National Laboratory 519

Upton, NY

Brookhaven will feature their new planar optic display using laser light, as well as examples of basic and applied research in the physical, biomedical, and environmental sciences – and in selected energy technologies – for commercialization.

Centro Estero Camere Commercio Piemontes 529

Torino, Italy

The main goal of the Technology Transfer Center is to promote and develop international business relations and high-technology transfers.

College, Industry, Government Technology Transfer (ASEE) 1028

Kennedy Space Center, FL

The College, Industry, Government Technology Transfer Constituent Committee is a newly formed organization which led to a new division of the American Society for Engineering Education (ASEE).

Commercial News USA 1117

New York, NY

The magazine publicizes products and services offered by U.S. firms seeking agents, distributors, joint venture partners, or purchasers abroad. It is distributed by U.S. embassies and consulates in more than 150 countries to buyers of U.S. products.

Crystal Mark 132

Glendale, CA

The company will display ESD-safe Micro Sandblasters for conformal coating removal. The point ionizer (patent pending) neutralizes ESD and special abrasives remove all types of coatings without PCB damage.

Cybernet Systems 219

Ann Arbor, MI

The PER-Force hand controller used for telerobotics, virtual reality, and simulation will be displayed. Cybernet's device produces force-reflection along six degrees of freedom to "virtual" force feed-back.

DECO - Document Engineering Co. California Pavilion

Van Nuys, CA

Since 1958 DECO has been supplying government and industry standards from issuing agencies worldwide. DECO offers same-day shipment on most items, various methods of updating, and competitive rates.

Derwent 800

McLean, VA

Derwent's international patent products are designed for those involved in the engineering process, from identifying new research areas and monitoring competition through improving manufacturing processes.

Dexter Magnetic Materials 333

Fremont, CA

The company performs engineered magnetic component design, fabrication and testing for particle beam control, MHD, Zeeman effect, spectroscopy, plasma control, torque coupling, MR processing, bearings, dampening and clamping.

Federal Aviation Administration Technology Transfer Office 532

Atlantic City, NJ

Information will be available on technologies presently under development/deployment in the FAA, including GPS, aircraft safety, ATC, airport capacity and runways, human factors, surveillance, and radar technology.

FARO Technologies 923

Lake Mary, FL

The FaroArm is a six-axis portable coordinate measuring machine or digitizer, with a three-dimensional articulated arm, and comes bundled with AnthroCAM, an all-in-one reverse engineering and inspection software package.

Federal Highway Administration 417

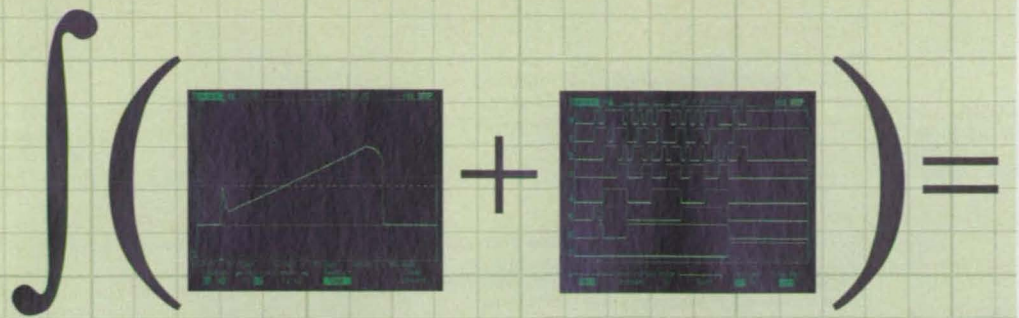
Washington, DC

The technology applications mission of the FHWA is to ensure the timely identification, assessment, and promotion of innovative research results and technology determined to be of potential benefit to the highway community.

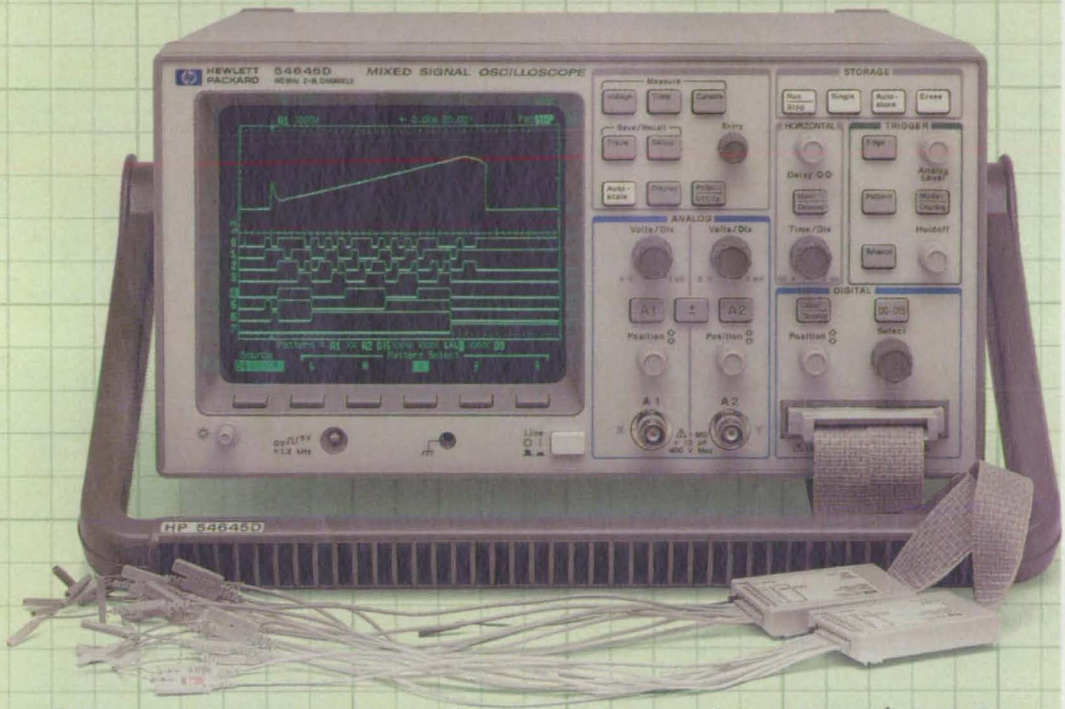
Federal Laboratory Consortium 733

Sequim, WA

The FLC offers access to federal laboratory expertise and capabilities. Seekers of new federal technology, unique facilities, or assistance with technical problems can contact the FLC Regional Coordinator in their area.



Analog Digital



The easiest mixed-signal testing for $4,995.*

The HP 54645D Mixed Signal Oscilloscope (MSO): Finally, seamless integration of real scope and real timing analysis on the same scope screen.

Here's a perfect example of why the whole is greater than the sum of its parts.

The HP 54645D MSO integrates two 100 MHz, 200 MSa/s analog channels with 16 digital channels for easier mixed-signal measurements. So much easier, in fact, you can measure up to 18 channels simultaneously, and trigger on complex timing conditions. Try doing that with a 4-channel scope.

It's still the scope you know and love.

The HP 54645D looks, feels, and runs like a scope. So, just because we've added new logic analysis capability doesn't mean you have to acquire new skills.

It's also the first scope to offer our new HP MegaZoom technology. If you think the name sounds impressive, wait'll you see HP's 54645D MSO pan through its Meg of captured data and zoom in on points of interest.

On second thought, why wait?

Call for your free demo.

Check out this new breed of Mixed Signal Oscilloscope for yourself. For a free demo on CD-ROM or floppy disk, call HP DIRECT at **1-800-452-4844**, Ext. 2078**. Or ask for Ext. 2079 to speak to an on-line engineer.

And discover the most integral part of your mixed-signal testing solution.

Download the demo from our web site at http://www.hp.com/info/mixsig1

Faxback: 1-800-800-5281, Document 10105

There is a better way.

*U.S. list price
**In Canada, call 1-800-276-8661, Dept. 277.

HEWLETT® PACKARD

GCATT (Gulf Coast Alliance for Technology Transfer) 832

Shalimar, FL

GCATT's federal laboratories and universities offer their unique technology and test facility assets representing numerous categories such as environmental, electronics, optics, magnetics, sensors, materials, and human performance.

IMI-Tech Corp. 907

Plano, TX

IMI-Tech's SOLIMIDE® polyimide foams provide excellent thermal and acoustical insulating properties in combination with fire resistance, light weight, and thermal stability from -300°F to +600°F.

Integrated Sensors 228

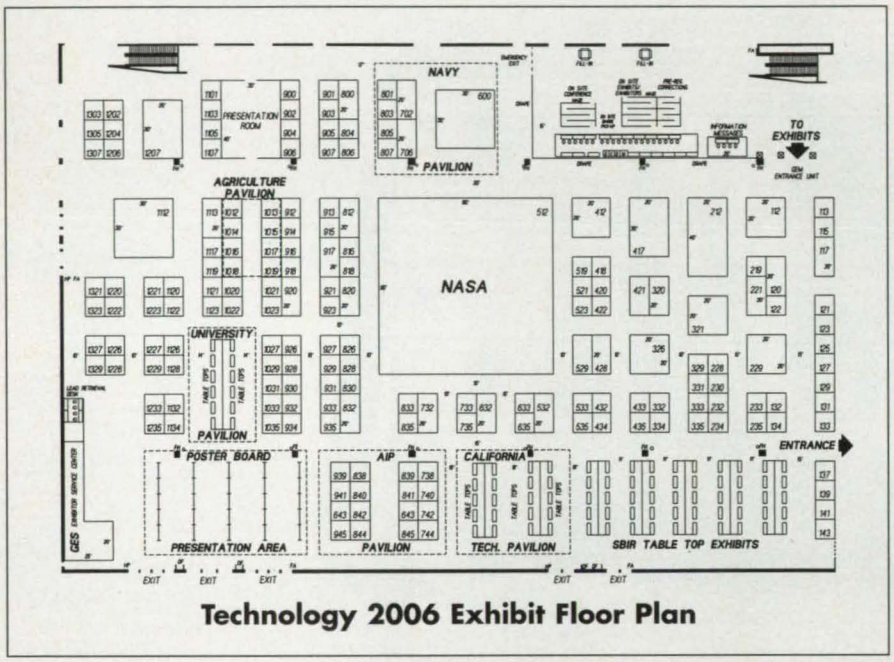
Utica, NY

State-of-the-art motion analysis workstations for use in medical, automotive, manufacturing, and motion picture industries will be exhibited.

Invention Machine Corp. 134

Cambridge, MA

Invention Machine is a suite of software packages designed to meet the complex requirements of engineers, scientists, and inventors who seek creative solutions for developing new technologies.



Technology 2006 Exhibit Floor Plan

Idaho National Engineering Laboratory 428

Idaho Falls, ID

On display will be advanced manufacturing technologies, transportation technologies, remote inspection technologies, and environmental technologies.

Infolytica Corp. 914

Montreal, Quebec, Canada

Infolytica produces software tools for electrical and mechanical engineers. The company will demonstrate a range of applications in electromagnetic design, simulated using magnet gemini.

Ingenieurschule Biel 120

Biel, Switzerland

The company will feature Microspace PC for embedded industrial controlling, CAN-Field bus controlled I/O nodules, and technical applications of nanotechnology.

Innovative Insulation Inc. 806

Arlington, TX

Super R Radiant Barriers reduce heating and cooling costs by reflecting radiating heat. They may be used independently or to increase the performance of conventional insulations.

Integrated Engineering Software 835

Winnipeg, Manitoba, Canada

The company specializes in 2D/3D computer-aided engineering (CAE) software for electromagnetic design and analysis. Programs are based on the Boundary Element Method; no Finite Element Mesh is required.

InVironmental Integrity 420

Minneapolis, MN

The company produces environmental conditioning systems that enhance the comfort and healthiness of buildings and vehicles using patented liquid vaporization systems that release aromas and disinfectants into the HVAC system.

Knowledge Express Data Systems 432

Berwyn, PA

Knowledge Express Data Systems is an online technology commercialization and business development service.

Kollmorgen Motion Technologies Group 535

Radford, VA

Kollmorgen designs and manufactures custom motion control components and systems for the aerospace, defense, industrial, and commercial markets. Products include dc torque motors, brushless motors, electronics, and electromechanical actuators.

Language Systems California Pavilion

Woodland Hills, CA

Exhibits are two voice-to-voice translation systems; a research prototype which translates English to Spanish, Arabic or Russian to English, and a product prototype which translates English to Spanish to English.

Lawrence Berkeley Laboratory 912

Berkeley, CA

LBL wants to form R&D partnerships with industry. The lab has expertise in biotechnology and life sciences, advanced materials, environment, energy, computing, and engineering.

Machida 927

Orangeburg, NY

Machida is a manufacturer of fiber-optic borescopes and related accessories. Machida's product line includes custom instruments as well as a standard line of borescopes, video equipment, light sources, and other accessories.

MicroPatent 804

East Haven, CT

MicroPatent offers various patent information on CD-ROM, hard drives, and Internet. Products include abstract-searching, full text searching, drawings and more.

Moscow Space Club (Russian Space Agency) 229

Moscow, Russia

New technologies produced by leading Russian aerospace companies will be exhibited.

NASA 512

Washington, DC

NASA's R&D mission programs will be highlighted together with a "theater island" describing key technologies resulting from the nation's space program. Spinoffs from aeronautics and space research will be displayed along with new technological advances.

NASA Tech Briefs 1113

New York, NY

NASA Tech Briefs magazine has first publishing rights to new inventions and innovations by NASA and its contractors in electronics, materials science, computer software, mechanics, and other high-tech fields.

NASA Technology Today 1119

New York, NY

Targeted to computer-using technology, science, and math teachers of grades 7-12, *NASA Technology Today* magazine spotlights NASA's major missions, science and technology projects, and discoveries, enabling teachers to share the excitement, adventure, and knowledge of NASA activities with parents and students.

National Institute of Standards and Technology 115

Gaithersburg, MD

National Institute of Standards and Technology has been working with industry for more than 90 years.

National Security Agency 920

Ft. Meade, MD

The agency will highlight advanced technologies involving computing, signal processing, communications and networking, microelectronics, and advanced microelectronics.

Novespace 820

Paris, France

Novespace will describe European technology transfer networks established around Novespace, and will feature various technology catalogs.

We've Been Making Good Ideas Fly For Years.

Dramatic changes in the world's defense environment now allow the US Air force the opportunity to offer business and industry unprecedented access to a treasure chest of 21st century technology and scientific expertise used to develop the most technologically advanced Air Force in the world. The process is called Technology Transfer. Simply stated, it offers advanced technology developed for Air Force requirements to commercial businesses through cooperative research and development agreements.

Many solutions for business and industry don't require starting with a "blank sheet of paper"...the technology may already exist

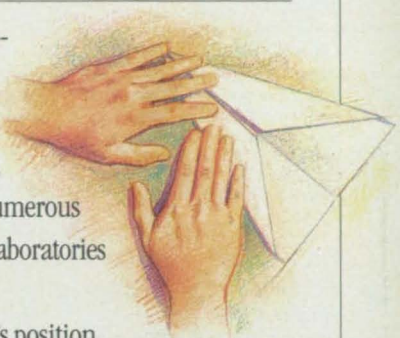
Technology Transfer offers business and industry a partnering environment with the Air Force, featuring a winning combination of scientific expertise, unique facilities and highly sophisticated equipment. Now your business can take advantage of this R&D treasure chest by creating new products, solving technical problems and becoming more competitive in the global marketplace.

SBIR...A Partnership With Small Business and Industry

A key partner with Technology Transfer is the Small Business Innovation Research program or SBIR. This program allows qualified small businesses a chance to compete for government R&D contracts. The SBIR program supports "high risk" research while encouraging small business to commercialize their work.

Products, Solutions...Partnering

Already, companies in automotive design, medical research, environmental sciences, and electronics, to name just a few, are taking advantage of the numerous capabilities that the Air Force Laboratories have to offer.



State-of-the-art facilities can provide businesses with cost-effective solutions...from research to final testing

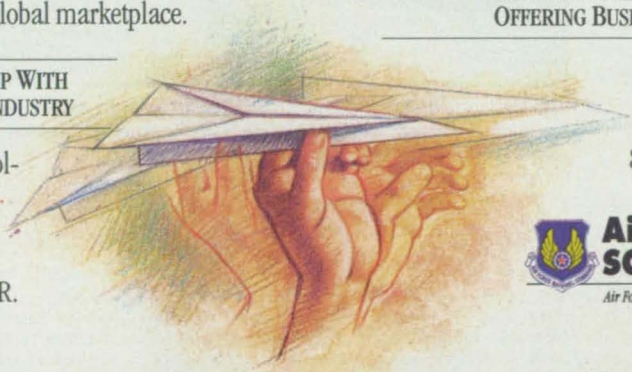
To enhance your company's position in the competitive marketplace give us a call at our "Tech Connect" Hotline and discover Air Force technologies that can help make your good ideas fly.

Air Force Science and Technology – Offering Business New Possibilities.

Talk to us today. Call Air Force "Tech Connect" at 800-203-6451, 8 a.m. to 5 p.m., EST.

Air Force SCIENCE & TECHNOLOGY

Air Force and Industry – Today's Partnership for Tomorrow's Technology



Proven technologies in military applications are increasingly providing solutions in the fields of environmental safety, health care, communications and a host of other industries.

Visit Us at Technology 2006 Booth 212

Oak Ridge Centers for Manufacturing Technology 321

Oak Ridge, TN

The ORCMT is a national industrial resource for applied research demonstration, fabrication, development, prototyping, and education.

Olympus America - IPG 421

Melville, NY

Olympus America's Industrial Products Group manufactures systems and equipment – rigid borescopes, flexible fiberscopes, and video imagescopes with video accessories – used in remote visual inspection inside tubing and piping for weld defects, corrosion, and surface finish.

Orbital Sciences Corp. 434

Dulles, VA

Parametric Technology Corp. 735

Waltham, MA

Patriot Advanced Technologies 830

Citrus Heights, CA

Porrazzo Flat loudspeakers are patented products that allow audio designers and engineers to place a lightweight quality speaker in a minimum of space and to deliver audio performance not currently achievable with cone speakers. The loudspeakers can function simultaneously as a configurable antenna for a variety of applications.

Physical Optics Corporation, Applied Technology Div. 833

Torrance, CA

The company will exhibit a real-time three-dimensional display.

Princeton University Plasma Physics Laboratory 521

Princeton, NJ

PPPL will focus on fusion energy research and plasma science technologies relative to commercialization.

Proto Manufacturing 826

Oldcastle, Ontario, Canada

Proto will display automated nondestructive test systems.

Ragan Technologies 913

Carlsbad, CA

RTI will introduce Zero Shrink Tolerance™ Ceramic and High Shear Compaction™ rare forming technology. Applications include multi-layer substrates used in CRT/F&D flat panel displays, computer disk drives, jet engine turbine blades, solid-state fuel cells, and advanced batteries for electric vehicles.

Sandia National Laboratories 935

Albuquerque, NM

Sandia is announcing two new innovative technologies that have great market potential. Stop by to learn about licensing opportunities for these technologies.

Savannah River Technology Center 1107

Aiken, SC

Savannah River Technology Center is the applied research and development laboratory at DOE's Savannah River Site, with expertise in environmental remediation, waste management, sensors, hydrogen, and robotics.

Soma Research California Pavilion

Corte Madera, CA

A biomedical consulting firm specializing in technical and market research, technology transfer and commercialization partnerships for medical devices.

Sonos Models 234

Huntington Beach, CA

The company is a product design and prototyping service group that provides concept development, ergonomics, product renderings, visual models, engineered prototypes, soft tooling, casting, and short run injection molding.

SRI International 335

Arlington, VA

SRI's Center for Medical Technology will display remote telesurgery as well as innovative technology development for NASA's Space Station (corrosion resistant coatings) and energetic materials.

Storage Concepts California Pavilion

Irvine, CA

Technology Transfer Business Magazine 915

Marietta, GA

"The Magazine for Profitable Partnerships" is published quarterly for senior-level decision-makers who are responsible for commercializing, developing, or securing innovative technologies for their organizations.

Technology Transfer Society 523

Franklin, IN

The Society is a membership organization committed to the professional development of its members. Some services are a monthly newsletter, journal, and technical meetings.

Thiokol Corporation 632

Corimme, UT

Thiokol is displaying technology spinoffs from NASA/DOD programs resulting in commercial products which expand the marketing base of Thiokol and its small business partners.

The Federal Highway Administration will highlight its Sign Management and Retroreflectivity Tracking System (SMARTS) Mobile Sign Retroreflectometer, which is a mobile system used to measure the nighttime brightness of traffic signs.

Sybase 816

Bethesda, MD

Sybase innovations include the first client/server relational database management system (RDBMS); the first open interface that allows systems to include virtually any development tool, application, and data source; the first high-performance transparent gateway; and the first replication technology to distribute data throughout the enterprise.

Technology Access Report 422

Novato, CA

This concise, independent, practical newsletter of analysis and opportunities in technology transfer, commercialization, defense conversion, and policy includes inventions for all industries, contacts, and free information hotline.

Tiodize Co. 320

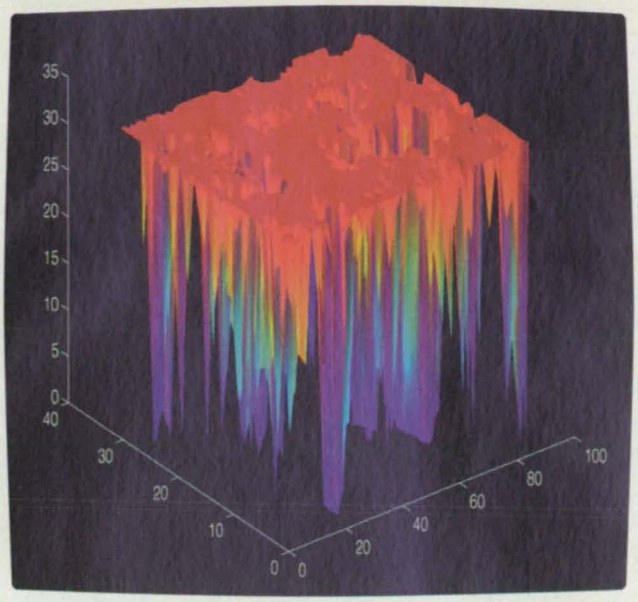
Huntington Beach, CA

Anodizing of titanium and aluminum, fiber/lite composite fastener products, trobo/comp composite bearing material, and various coatings for prevention of friction, wear, and corrosion will be displayed.

Tokue Rubber Industrial Co. (Mitsui USA) 732

Nagoya, Japan

The company will exhibit Sisuner, an adhesiveless joint system with a rubber design and special springs to ensure a tight joint. Its durability, flexibility, and excellent sealing performance allows it to be used for unlimited applications.



This surface plot shows impact damage to a rectangular section of helicopter laminate material. Algorithms developed with the MATLAB Neural Network Toolbox classify echoes from ultrasonic signals to automate non-destructive inspection. Data courtesy of McDonnell Douglas under an AATD contract.

Visualize the Power of Your Programs

Powerful object-oriented graphics offer interactive analysis and dynamic modeling. The extensive visualization functions include 2-D, 3-D, and 4-D plotting, as well as surface lighting and shading.

Develop MATLAB Programs and Standalone Applications

A complete set of GUI development tools lets you tailor the look and feel of your interactive MATLAB applications.

MATLAB
for Engineering

MATLAB
MATLAB Compiler
MATLAB C Math Library
MATLAB C++ Math Library
Application Toolboxes for:
Signal Processing
Control System Design
Financial Engineering
Image Processing
Data Analysis & Modeling

Using MATLAB® to develop algorithms is easy. For producing C code, however, it's automatic.

The Language for Engineers

MATLAB is the best connection between engineering concepts and implementation.

By integrating numeric computation, visualization, and a technical language, MATLAB gives you an environment for data analysis, algorithm design and application development.

Power to Explore Power to Prototype

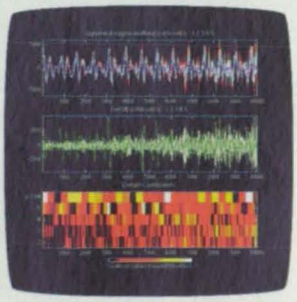
In MATLAB, you create algorithms the way you think, mathematically—without writing a single line of C or FORTRAN.

Hundreds of powerful built-in functions—tuned for efficiency and reliability—are coupled with a powerful, intuitive, and matrix-optimized programming language.

Built-in Expertise through MATLAB Toolboxes

Toolboxes offer a wide choice of optimized functions for data reduction, analysis, modeling, and system design.

Written by recognized experts, MATLAB Toolboxes let you learn proven and leading-edge mathematical techniques, and apply them to real world applications, from helicopters to pagers.



MATLAB Wavelet Toolbox algorithms perform a 5-level decomposition of a voice signal. Data courtesy U. S. Robotics Mobile Communications Corp.

Link MATLAB with your C and FORTRAN programs, incorporate MATLAB Toolboxes, exchange data with other software, and embed MATLAB as an analysis and visualization engine.

With the new MATLAB Compiler and C Math Library you can automatically convert your MATLAB algorithms to standalone programs.

MATLAB Compiler Now Available!

Find Out What's Developing with MATLAB

Call today for a free technical kit about the MATLAB Compiler, C Math Library, and Wavelet Toolbox:

(508) 647-7000

Or fax your request:

(508) 647-7101

Also, don't forget to visit our award-winning web site:

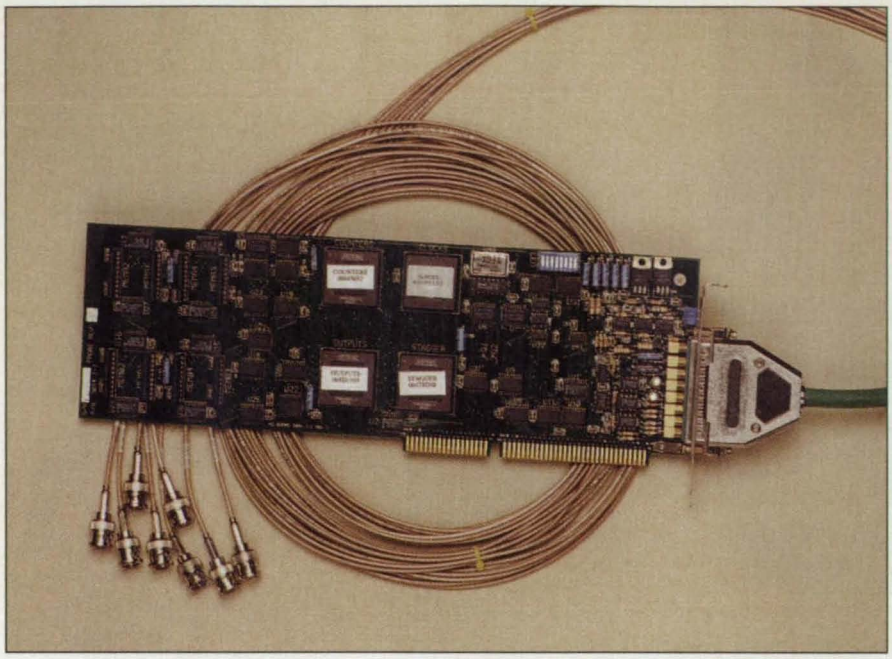
http://matlab.mathworks.com

The MATH WORKS Inc.

The MathWorks, Inc.. • 24 Prime Park Way, Natick, MA 01760 • tel: (508) 647-7000 • fax: (508) 647-7101 • e-mail: info@mathworks.com • http://www.mathworks.com

The MathWorks is represented in the following countries: **Australia:** + 61-2-9922-6311 • **Austria:** + 49-241-470750 • **France:** + 01-41-14-67-14 • **Germany:** + 49-241-470750 • **India:** + 91-80-5-549338 • **Israel:** + 972-3-561-5151 **Italy:** +39-11-24-85-332 • **Japan:** + 81-3-5978-5410 • **Korea:** + 82-2-517-1257 • **Malaysia:** + 65-842-4222 • **Poland:** + 48-12-17-33-48 • **Portugal:** + 34-3-415-49-04 • **Scandinavia:** + 46-8-15-30-22 • **Singapore:** + 65-842-4222 • **Spain:** + 34-93-415-49-04 **Switzerland:** + 41-31-882-0288 • **Taiwan:** + 886-2-501-8787 • **United Kingdom:** + 44-1223-423-200 • In Benelux, call **Cambridge Control, Ltd:** + 44-1223-423-200 or **Scientific Software Group:** + 33-01-41-14-67-14

For More Information Write In No. 606



The Portable Radar or Beacon Emulator (PROBE) circuit board is an air traffic control emulator device that produces all of the normal output signals used in civilian air traffic control radar systems. The Federal Aviation Administration will describe how the system simulates real-time radar systems.

Ultra Tec Mfg. — California Pavilion

Santa Ana, CA

The company manufactures micropositioned saws and polishers for materials research, fiber optics, microsectioning, planar polishing, and polishing of controlled angles. They also are suppliers of diamond blades and microabrasives.

Unisphere — 917

Washington, DC

Unisphere is the NASA Commercialization Network's international venture facilitation program for high-tech firms.

United States Air Force Science and Technology — 212

Wright-Patterson Air Force Base, OH

The latest Air Force technologies with applications in human systems, information management, space, aircraft, and structures, as well as information on technology transition/technology transfer, will be exhibited.

United States Army Domestic Technology Transfer — 329

Adelphi, MD

Various technologies and capabilities available for transfer from U.S. Army laboratories will be highlighted.

United States Army Test & Evaluation Command — 921

Aberdeen Proving Ground, MD

United States Department of Agriculture Agricultural Research Service Office of Tech Transfer — 1013

Beltsville, MD

USDA's Agricultural Research Service, with 113 laboratories nationwide, offers opportunities for small and large corporations. Information on technology transfer programs and research projects is exhibited by the Office of Technology Transfer.

United States Department of Agriculture Forest Service — 1014

Madison, WI

United States Department of Agriculture Natural Resources Conservation Service — 1015

Washington, DC

The USDA Natural Resources Conservation Service will highlight cartographic, GPS, and remote sensing tools used in natural resource management and conservation activities.

United States Department of Agriculture Rural Business Service — 1012

Washington, DC

The USDA Rural Business Service's "Get Connected" partnership initiative has created equal opportunity on-ramps to the Information Superhighway. USDA telecommunication facilities serve 18 million Americans with programs such as the Distance Learning and Medical Link Grants to assist rural communities in medical servicing. The President's Empowerment Zone and Enterprise Communities (EZ/EC) program is connecting the world with other rural communities via the Internet.

United States Department of Energy Kansas City Plant (operated by Allied Signal) — 113

Kansas City, MO

On display will be a wide spectrum of mechanical, electrical/electronics, rubber, and plastic manufacturing capabilities that support prototyping and product development for commercialization.

United States Department of Energy - National Renewable Energy Lab 112

Golden, CO

The display will feature an introduction to the laboratory and its research resources, including information on R&D and partnership opportunities in industrial and utility energy technologies, buildings energy management, alternative fuels, wind systems, and basic energy sciences.

United States Department of Energy - Office of Clean Coal Technology 117

Gaithersburg, MD

The US DOE Clean Coal Technology Demonstration Program is a $7.14 billion cost-shared industry/government technology development effort, demonstrating a new generation of advanced coal-based technologies, moving the most promising into domestic and international marketplaces.

United States Department of Energy - Office of Science and Technology 221

Niles, IL

To address the needs of the US DOE's Environmental Management Program, the Technology Development program researches new and innovative technologies. The program works hand-in-hand with other programs within the DOE, other federal agencies, national laboratories, universities, and the commercial sector to maximize research efforts and ensure safe and efficient cleanup of the nation's nuclear weapons complex.

United States Department of the Interior 412

Reston, VA

The US Department of the Interior seeks partners to develop technologies related to earth sciences, resource extraction, environmental remediation, image processing, geographic information systems, and related fields.

United States Navy Best Manufacturing Practices 807

College Park, MD

The BMP Center operates under a cooperative agreement with the Department of Commerce's National Institute of Standards & Technology and the University of Maryland. It identifies the best practices in US industry and promotes technology transfer and information exchange.

United States Navy Naval Research Lab 706

Washington, DC

The Naval Research Lab will exhibit R&D programs available for licensing in the areas of advanced materials, biomolecular engineering, chemical processing, electronics, optics, sensors, and information technology.

United States Navy Office of Naval Research 600

Fairfax, VA

Laboratories from the following Navy activities will be represented: Naval Air Warfare Center, Naval Civil Engineering Laboratory, Naval Command Control and Ocean Surveillance Center, Naval Medical Research and Development Command, Naval Surface Warfare Center, Naval Undersea Warfare Center, Navy Personnel Research and Development Center, and the Marine Corps Systems Command.

United States Navy SBIR Program 702

Arlington, VA

Supporting 31 science and technology areas, the Navy SBIR program gives small businesses an opportunity to put their ideas to work in Navy/DOD programs.

University of California, Irvine Office of University/Industry Research & Technology 934

Irvine, CA

USBI Company 812

Kennedy Space Center, FL

Convergent Spray Technologies™ is a solventless spray process developed for applying thick, heavily loaded composite coatings through the convergence of liquid binders and dry fillers.

Vector Fields 926

Aurora, IL

The company will exhibit 2D/3D electromagnetic design software, finite-element-based software to optimize design of electrical equipment, and OPERA-3D (TOSCA/ELEKTRA/SOPRANO and SCALA), OPERA 2D, and PC-OPERA.

Daniel H. Wagner Associates Inc. 533

The company offers Melian II Underwater Search Software and technologies for container crane automation.

For More Information Write In No. 404

LITERATURE BOOTH

The following companies will have literature available at the Literature Booth.

Abaris Training Resources

Reno, NV

Literature will be available on 14 different "hands-on" workshops in advanced composite materials, technology such as fabrication & damage repair, tooling, adhesive bonding, manufacturing practices, four engineering courses, and much more.

American Society for Laser Medicine & Surgery

Wausau, WI

Information about the society and upcoming meetings will be available.

Anorad Corp.

Hauppauge, NY

E-Tek Dynamics

San Jose, CA

E-Tek's color Product Profile describes products including optical isolators, couplers, splitters, WDM, combined optics, attenuators, laser source, active/passive components, optical switches, laser amplifiers, controllers, production and test equipment.

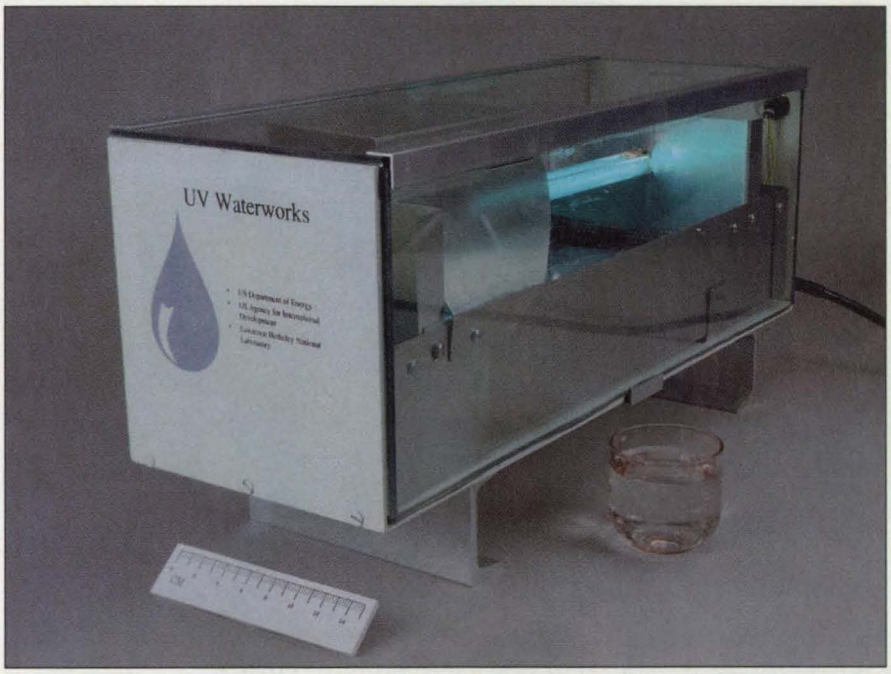
Exciton

Dayton, OH

Geophysical Survey Systems

North Salem, NH

GSSI's ground-penetrating radar systems are used to non-destructively examine the subsurface of the ground or other materials to locate targets like pipes, tanks, buried drums, reinforcing steel, and conduit in concrete, and geological features.



Lawrence Berkeley Laboratory will exhibit its UV Waterworks disinfection system made of rugged stainless steel and aluminum. It requires maintenance only twice a year, and disinfects water for less than two cents per metric ton.

CM Technologies Corp.

Coraopolis, PA

The company offers a catalog of PC-based test instruments and accessories, including a time-domain reflectometer and an impedance analyzer – all PC-based, plug-and-play instruments.

Conoptics

Danbury, CT

On display will be information on laser modulators, modulation systems, broadband modulators, and drivers. Applications include mode-locked pulse selection, pulse shaping, regens, phase shifters, and fast shutters.

Discover Magazine

New York, NY

Discover Magazine is the nation's leading science monthly, where over seven million readers turn and learn today about what will change their lives tomorrow.

Goodfellow Corp.

Berwyn, PA

Goodfellow supplies small quantities of materials for research and development. Their catalog & Web site (http://www.goodfellow.com) detail in excess of 50,000 items, ready for immediate shipment.

I-Cube

Crofton, MD

I-Cube is a reseller and integrator of products used in computer-based image analysis applications including cameras, frame grabbers, and software.

Inframetrics

North Billerica, MA

Literature will be available on the SC1000 ThermaCAM™ radiometer for the thermographic needs of the scientific, research, and development communities.

Irvine Sensors Corp.

Costa Mesa, CA

Irvine Sensors Corporation's family of stacked memory products include DRAM, SRAM and Flash. Also in development are an image processing board and smart sensor module.

Isomet Corp.

Springfield, VA

The company is a manufacturer of standard and custom acousto-optic Bragg cells for UV, VIS and IR wavelengths. Products include modulators, deflectors, scanners, frequency translators, and related RF drive electronics.

JML Optical Industries

Rochester, NY

JML Direct Optics' second edition catalog includes stock optical components, coatings, and multi-element systems. Technical information and custom design specifications also are included.

Lamptronix Co., Ltd.

Crystal Lake, IL

On display will be literature describing the company's miniature and subminiature incandescent lighting for military and commercial aircraft applications.

National Coalition for Advanced Manufacturing

Washington, DC

NACFAM will provide literature on their member plan for federal laboratories, as well as the member plan for advanced manufacturing companies.

NeuralWare

Pittsburgh, PA

The company will provide literature on NeuCOP, an adaptive, multivariable system for controlling, stabilizing, and optimizing complex industrial processes; and NeuralWorks Predict for application engineers, system integrators, and value-added resellers.

Neutrik Cortex Instrumentation

St. Laurent, Quebec, Canada

Literature on the MK1 binaural recording head with built-in DAT recorder and remote control unit, and the RT-1M Rapid Test rack-unit multitone audio analysis system for production tests will be available.

New Technology Week

Washington, DC

New Technology Week covers advanced and emerging technologies in the U.S. and abroad. Reports reveal business opportunities/strategies, federal policy, technology transfer and competitiveness.

Presray Corp.

Pawling, NY

Brochure describes inflatable rubber seals and other special rubber seals for use in various industrial applications including semiconductor and printed circuit board processing equipment, aerospace, and defense.

Research Systems

Boulder, CO

Research Systems distributes literature on IDL, the leading software for data analysis, visualization, and application development.

SEMicro Division

Rockville, MD

SEMicro division manufactures the P.A.T.T.I. line of adhesion testers for measuring the pull-off strength of paints, films and adhesives. The instrument meets ASTM D4541 requirements and is available in three models.

Superior Products International II

Kansas City, MO

Superior Products creates industrial-grade coatings to address the toughest situations imaginable, while working to offer appearance and quality, as well as performance.

SURFCAM by Surfware

Westlake Village, CA

SURFCAM's brochure describes a Windows-based NC programming system with fast and accurate surface modeling and 2- to 5-axis machining.

University College & Extension Services, CA State

Long Beach, CA

For quality training in the latest technologies, pick up UCES' free Science & Technology catalog, which is filled with a variety of programs and courses.

Van Nostrand Reinhold

New York, NY

Van Nostrand Reinhold's 1996 Business Technology Catalog describes the latest offerings in the fields of communications and network management, organizational leadership, project management, and the Internet.

SBIR PAVILION

The following companies have received Small Business Innovation Research (SBIR) program grants from federal laboratories or government agencies to support the development of their technological innovations. These companies will be featured in a special area of the exhibit hall.

Advanced Materials Corp.

Pittsburgh, PA

The Acousto-Optic Tunable Filter Camera was developed for the U.S. Army's Night Vision Directorate. The camera provides target acquisition and identification using "smart" optical preprocessing.

Advanced Modular Power Systems (AMPS)

Ann Arbor, MI

Alkali Metal Thermal to Electric Converter (AMTEC) technology provides efficient direct conversion of heat energy to DC electric power in compact, lightweight cells that operate silently and have no moving parts. Applications include use on the Pluto Express mission scheduled early next century, as well as self-powered home furnaces, electric generators for recreational vehicles and boats, and high-end outdoor power generation.

Advanced Refractory Technologies

Buffalo, NY

The Dylyn® diamond-like nanocomposite coatings technology will be displayed. Dylyn technology provides a revolutionary family of thin film coatings, engineered at the atomic scale, that can be tailored for a broad range of properties.

Aerotech Engineering & Research Corp.

Lawrence, KS

Ultrasonic motors (USMs) based on smart materials provide large displacements and force outputs. Aerotech is developing actuation systems based on USMs for both military and commercial applications such as valves, missile flight control surface actuators, autofocus camera lenses, robotics, toys, medical devices, aerospace, and automotive applications.

Amain Electronics

West Hills, CA

The company is introducing a digital focal plane readout device based on the patented Multiplexed OverSample Analog to Digital (MOSAD) converter technology. It supports detector arrays on 40 micron or larger centers and the readout produces a digital output at each pixel. Applications include surveillance, aircraft landing, inclement weather vision for trucking, and automotive.

Analatom

Sunnyvale, CA

The company seeks to optimize molecular requirements for achieving conductive and nonlinear optical properties. The resulting software allows simulation of industrially important materials properties and satisfies market demand for large molecular systems simulation software.

Crystallume/EDI

Santa Clara, CA

On display will be diamond heat pipes for efficient cooling of high-power-density devices.

Davis Technologies International

Dallas, TX

The compressible fluid suspension system for vehicles was developed for the Naval Surface Warfare Center.

Echelon Industries

Diamond Bar, CA

The Fare Transaction and Vehicle Management System (Faretrans VMS) was developed to make transit operate more efficiently and effectively, make transit systems more responsive to users' needs, and generate more revenue using on-board speech, printing, and large-screen displays. The system incorporates Global Positioning System (GPS) satellites, spread-spectrum communication systems, smart fare cards, and other technologies into one system.

Eltron Research

Boulder, CO

Eltron has developed electrolytic technology for the purification of waste water based on the *in situ* generation of hydrogen peroxide. The technology is part of a class of water purification processes known as Advanced Oxidation Processes. Target industries include semiconductor processing, chemical and pharmaceutical production, and biotechnology processing.

General Reality Co.

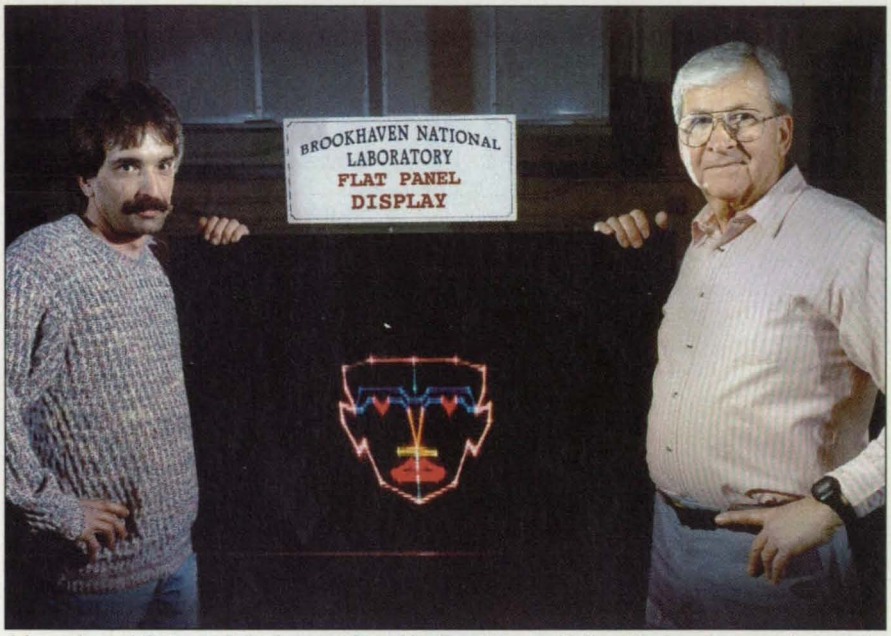
San Jose, CA

The company has developed the Virtual Computer Monitor (VCM) for visually impaired computer users. The VCM combines a head-mounted display, head tracker, and screen enlarger software to fix the enlarged virtual screen of data in space and scan the user's line of sight across the data, instead of scanning the data across the display device.

InterVision Systems

Raleigh, NC

InterVision is developing a wearable, voice-activated video teleconferencing computer system capable of wireless communication of video, voice, and data. It consists of a wearable computer with a head-mounted VGA-resolution display; a head-mounted video camera; a communications module, which supports a variety of video, voice, and data transmission systems; and voice recognition and audio response.



A laser-based flat-panel display developed by Brookhaven National Laboratory can be used in televisions, computers, airplane cockpits, automobiles, and military map displays. Shown are Cyrus Biscardi (left) and Calvin Brewster, who helped James Veligdan develop the screen.

Emcore Corp.

Somerset, NJ

The company has commercialized epitaxy and innovative advances in organometallic vapor phase epitaxy (OMVPE) semiconductor growth technology, and has demonstrated the use of OMVPE for p-HEMT MMIC manufacturing, a component for the rapidly expanding telecommunications market. Emcore will present MOCVD growth and characterization of psuedomorphic HEMTs in a high-speed rotating disk reactor.

FEM Engineering

Los Angeles, CA

Metal Forming Tool Design (MFTD) is an intuitive, expandable, and full-function brake-forming, stretch-forming, and hydroforming tool design software for the sheet metal fabrication processes that produces accurate tooling, produces parts with minimum cost by eliminating handworking, makes parts without variability, uses a uniform tool design concept, and minimizes process time.

IRI Computer Communications Corp.

Tarzana, CA

PLANYST is a network spreadsheet tool to be used as a planner and analyst of telecommunications and computer communications networks. The program configures, sizes, analyzes, tests, and manages computer communications and telecommunications networks and runs complex inter-network configurations.

Lynntech

College Station, TX

The Bacteria Activity Monitor is an automated system which electrochemically monitors the activity of microorganisms in a given sample. Microbially derived products such as organic acids, amino acids, enzymes, antibiotics, and vaccines can be produced more efficiently with on-line monitoring of the organisms which produce them. The monitor provides automated, continuous monitoring for biomass determination.

Ocutech

Chapel Hill, NC

The company offers the VES™ AutoFocus spectacle-mounted telescope which automatically focuses many times per second, providing hands-free improved vision to visually impaired individuals. The unit features 4X magnification power and wide field of view.

Physical Optics Corp.

Torrance, CA

Three different technologies will be exhibited: an autostereoscopic 3D visualization system that does not require eyewear; a compact phase fluorimeter; and a multispectral optical sensor system for detection and identification of low-contrast and camouflaged objects.

Point Research Corp.

Santa Ana, CA

The company will display the PointMan™ Dead-Reckoning Module.

Qualtech Systems

Storrs, CT

Developed for NASA Ames, Multi-Signal Flow Graphs is a technique for modeling complex hierarchical systems; enhancing their testability, reliability, and maintainability; and formulating troubleshooting strategies in the presence of multiple failures. The methodology has been incorporated into the company's QSI Integrated Diagnostics Tool Set.

Raya Systems

Mountain View, CA

The company has created Packy & Marlon™, an interactive video game for the Super Nintendo Entertainment System®, that teaches children ages 8 to 15 to manage diabetes and deal with social situations that confront young people with diabetes. It is an addition to the Health Hero® series of video games for pediatric patient education. In the new game, players help two elephant pals rescue diabetes summer camp and make sure the characters carefully manage their diabetes.

Seidcon

Oceanside, CA

Seidcon is designing an adaptive optimal search technique to provide improved military route planning through complex, hazardous terrain. A route selection algorithm minimizes computational load and resource utilization. The genetic algorithm methodology can be used where optimal routes are desired in short fashion, such as with medical or police vehicles, forest fire fighting, and transportation components.

Sentel Corp.

Alexandria, VA

The Quality Assurance Portable Data Collection (QAPDC) System was developed for NASA's Kennedy Space Center to help re-engineer the manual- and paper-intensive payload and shuttle checkout operations. The system is a handheld pen-based computer platform that inducts a variety of data collection forms, records data against those forms, imprints controlled signature authority, maintains the integrity of the collected data, and relays the data to a computer network for analysis or archiving.

Silicon Mountain Design

Colorado Springs, CO

In a two-phase SBIR program, the company developed a one-million-frames-per-second, high-speed imaging camera capable of storing up to 16 frames of 12-bit imagery with 256 x 256 resolution for military applications such as analysis of ballistics and high-energy kinetic weapons. Also highlighted will be the Phase II product, the SMD-1M60 camera that is designed for automated cytology and radiation oncology. The 1024 x 1024, 12-bit camera is used for various types of medical imaging.

Simula Government Products

Phoenix, AZ

The Cockpit Air Bag System (CABS) supplements existing helicopter safety equipment and features to prevent a majority of the head and upper body injuries sustained in helicopter crashes. CABS consists of two lateral air bags, one or two frontal bags, crash sensor, gas generators, gas generator interfaces, module housings and packaging, and module attachments. The occupant acts as a guide that directs the inflation and shape of the air bags during deployment.

SRICO

Powell, OH

The IPES-2001 is a photonic electric field sensor that can be used for aircraft lightning protection, thunderstorm detection, medical and biological research, electromagnetic compatibility testing, and noncontact probing of high-speed integrated circuits. The product is immersed in the electric field to be measured, and modulates an optical beam that is guided through the product.

Starsys Research

Boulder, CO

Starsys is creating a thin plate heat switch, which is a smart device for passively controlling the temperature of electronics and instrumentation. Two designs are being developed: a miniature heat switch that measures 1.5 cubic inches; and a thin plate heat switch with a surface area customizable to specific applications. Potential applications include reductions in satellite payloads and power requirements, supercomputer cooling, and temperature control of sensitive instruments in harsh environments.

Stress Photonics

Madison, WI

The DeltaTherm 1000 is an array-based thermographic stress measurement system that uses an infrared Focal Plane Array (FPA) detector and high-speed imaging electronics to determine the stress state in dynamically loaded structures and materials. The system can be used for monitoring fatigue crack growth, interrogating prototype automobile parts, or correlating FEA model results from an aircraft component.

Stress Technology

Rochester, NY

Funded by the U.S. Air Force, the Engine Health Management (EHM) System was designed for jet engine life measurement and diagnostic monitoring of critical engine components necessary to improve engine availability, minimize performance degradation, and reduce life cycle costs. The system includes a modular architecture that measures component life, performance, and mechanical diagnostics; sensor validation; trending; and anomaly detection.

Thermacore

Lancaster, PA

A helium-cooled Porous Media Heat Exchanger (PMHX) was designed for cooling Faraday Shields in the International Thermonuclear Experimental Reactor, where it successfully dissipated a heat flux of 4000 W/cm^2. Applications for PMHX products include a porous media radiator for commercial interest in heavy duty vehicle operation in challenging environments; a compact, laminated heat exchanger for mobile refrigeration; and a porous metal semiconductor chip cooler.

UES

Dublin, OH

KI Shell is an open, cross-platform, standards-based workflow package that can span and integrate multiple applications into a cross-functional, heterogenous workflow system. Applications built using KI Shell assist multiple users in collaborating on business functions, managing enterprise-level processes, and automatically capturing performance metrics in real time.

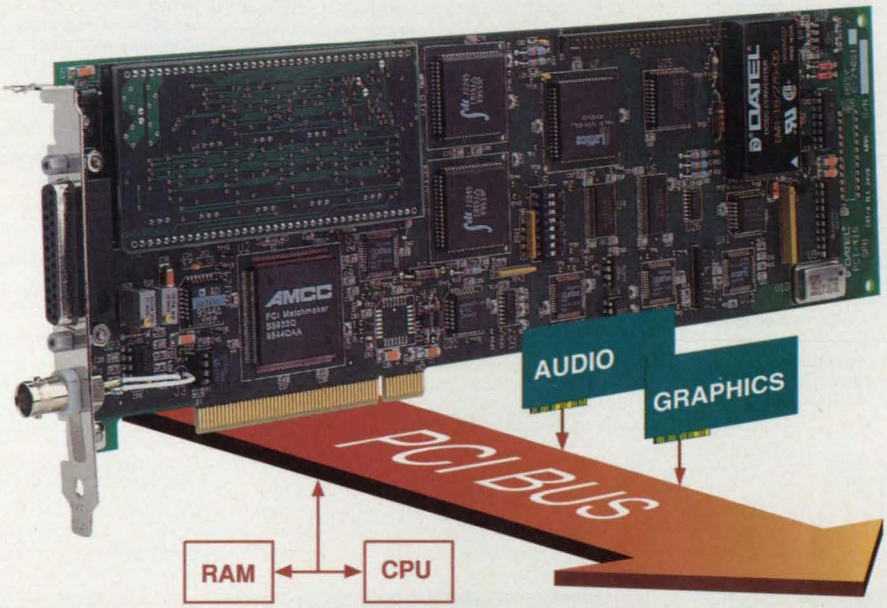
Virtual Computer Corp.

Reseda, CA

A new networkable, high-performance computing system, the Distributed Virtual Computer Reconfigurable Computing Network (DVC/RC Net), computes on data as it was transmitted. The system allows data to be processed as it moves over the network, independent of the host CPU. It can be plugged into current computing systems.

See pages 96–97.

PCI Bus
"Streaming" Data Acquisition



Fill huge host memory with 10MHz "gapless" A/D data

11 Models Starting at $2095

Model	Number of Channels	A/D Resolution	Number of A/D's	Sampling Rate (per Channel)
PCI-416B	4	14 Bits	1	82kHz
PCI-416D	1	12 Bits	1	5MHz
PCI-416E	16SE/8D	12 Bits	1	125kHz
PCI-416F	2 Simul.	12 Bits	2	2MHz
PCI-416G	2 Simul.	14 Bits	2	1 or 2MHz
PCI-416H	1	12 Bits	1	10MHz
PCI-416J	8 Simul.	12 Bits	8	250/380kHz
PCI-416K	2 Simul.	12 Bits	2	5MHz
PCI-416L	16 Simul.	12 Bits	16	190kHz
PCI-416M*	4 Simul.	16 Bits	4	100kHz
PCI-416N*	2 Simul.	14 Bits	2	5MHz

* Preliminary

- **12-16 bit A/D's; Sampling rates to 10MHz**
- **On-board, PCI bus mastering**
- **Quick, 32-bit, PCI-burst DMA transfers**
- **Banked FIFO's move 2 samples per transfer**
- **2-16 channel simultaneous sampling**
- **Pre/post-trigger, gap-free, ring buffering**
- **Low noise/harmonics; Great for DSP/FFT!**
- **The ideal array-processor "front end"**

DATEL's new PCI-416 Data Acquisition Boards, with on-board bus mastering, "stream" high-resolution A/D data directly to host RAM "forever" with no lost samples. We also make board-level products for EISA, ISA, VME and Multibus platforms. Send for our ***NEW*** catalog today!

DATEL, Inc., 11 Cabot Boulevard, Mansfield, MA 02048 Tel: (508) 339-3000
FAX: (508) 339-6356. For immediate assistance 800-233-2765.

ISO 9001 Registered

DATEL
INNOVATION and EXCELLENCE

For More Information Write In No. 530

Special Focus: Data Acquisition & Analysis

page 52

page 52

page 54

page 54

Apparatus Acquires Data on Magnetic Hysteresis

B-versus-*H* curves can be generated automatically.

Goddard Space Flight Center, Greenbelt, Maryland

An automated laboratory apparatus performs measurements from which the magnetic-hysteresis properties of rod specimens can be computed. Heretofore, it was necessary for a technician to acquire magnetic-hysteresis data by a time-consuming manual procedure. Once set up with a given rod specimen, the present apparatus operates unattended, acquiring data on the magnetic induction (*B*) in the rod as a function of an excitatory magnetic field (*H*) generated by a known electric current in an external coil.

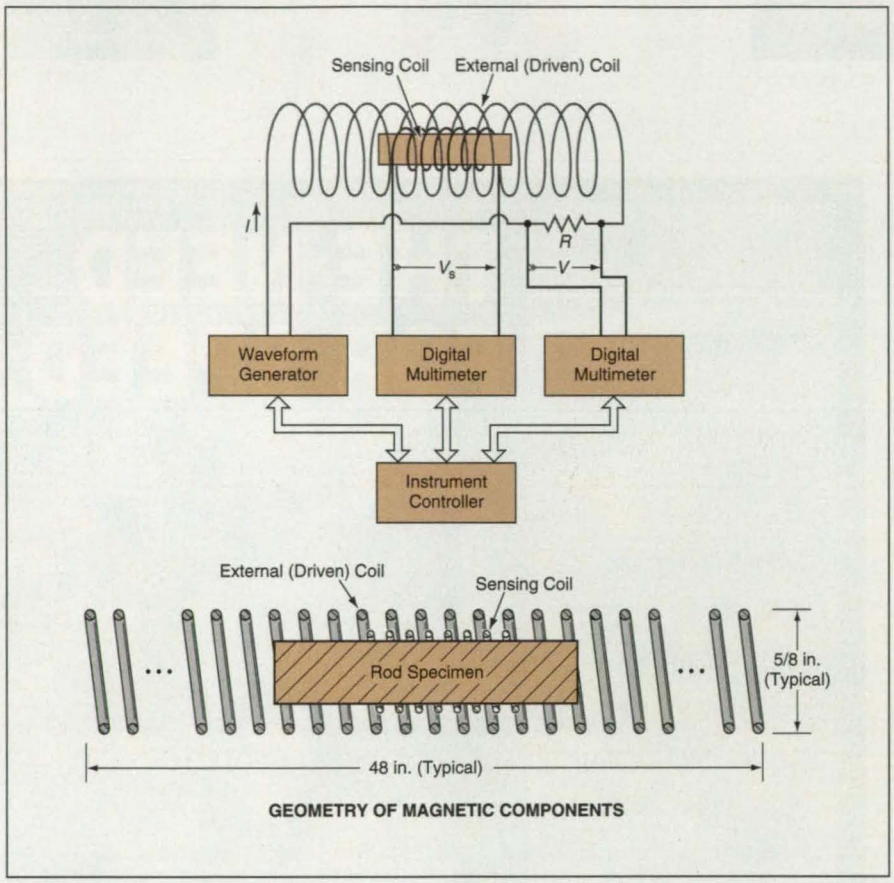


Figure 1. **Measurements of *V* and V_s** are made during excitation with triangular-waveform current *I*. These measurements are processed into *B*-versus-*H* curves.

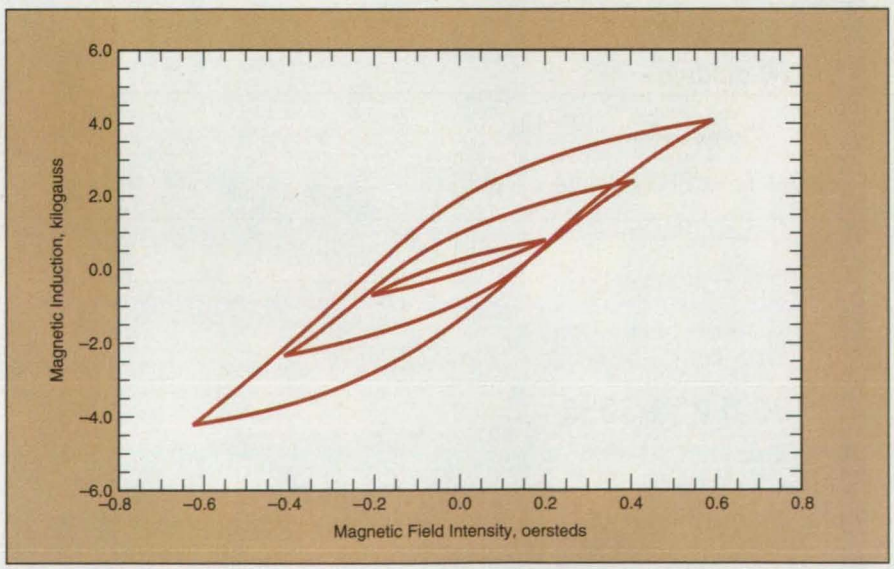


Figure 2. This **Set of Hysteresis Curves** was obtained from a typical rod specimen, using the apparatus described in the text.

In addition to the external coil, the apparatus includes a shorter sensing coil positioned centrally within the external coil, plus several commercially available electronic units (see Figure 1). The length of the rod specimen equals or exceeds the length of the sensing coil. The rod is placed centrally within the sensing coil.

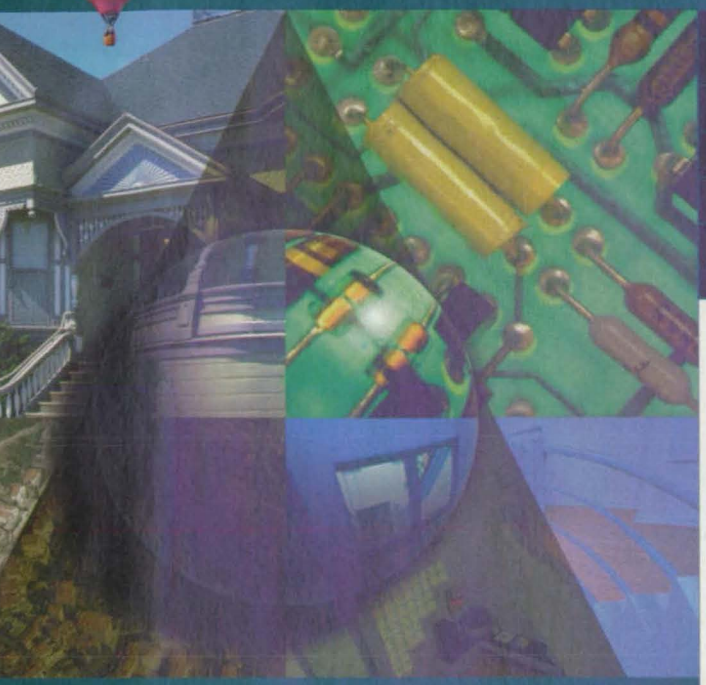
A waveform generator connected via an amplifier drives the external coil with a triangular current waveform at a frequency of 0.005 Hz. A digital multimeter measures the potential drop (*V*) across a precise resistor (R = 10 Ω) in series with the external coil. Another digital multimeter measures the voltage V_s induced in the sensing coil. An instrument controller records the measurements from both multimeters at intervals of one second, giving 200 pairs of data points for each cycle of the triangular waveform.

The potential drop across the series resistor is directly proportional to the current in the external coil and thus to the excitatory magnetic field: this field as a function of time is calculated from $H(t) = NV(t)/LR$ in the rationalized mks system of units, where t is time, N is the number of turns, and L is the length of the external coil. The voltage V_s induced in the sensing coil is measured by another digital multimeter. The rate of change of magnetic induction in the rod is calculated from $dB/dt = V_s/(\pi a^2 N_s)$, where a is the radius of the rod, and N_s is the number of turns in the sensing coil. By use of commercial software, the dB/dt data are integrated in time to obtain $B(t)$. Then cyclic *B*-versus-*H* curves showing hysteresis (see Figure 2) are plotted from the calculated values of $B(t)$ and $H(t)$, and pertinent magnetic-property parameters are extracted from these curves in the customary way.

This work was done by Charles Powers and Henning Leidecker of **Goddard Space Flight Center.** *For further information,* ***write in 54*** *on the TSP Request Card. GSC-13725*

FROM THE MAKERS OF CorelDRAW™

FAST, EFFICIENT 32-BIT DRAFTING & DESIGN



COREL® VISUAL CADD™

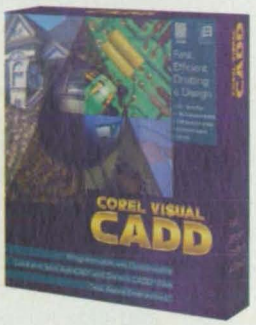
Corel® Visual CADD™ is a highly intuitive, fast and efficient professional design and drafting program that allows both new and experienced users to exploit the full power of Windows® 95 and Windows NT™. Corel Visual CADD will coexist with your current environment by providing seamless integration with AutoCAD's® DWG and DXF and Generic CADD file formats. Whether you are creating architectural drawings, technical schematics or engineering projects, Corel Visual CADD delivers all the tools you need to optimize your productivity at every stage of the design process. Corel Visual CADD provides a cost-effective, CAD solution for any new or existing office.

Fast, Efficient 32-Bit Drafting & Design

Programmable and Customizable

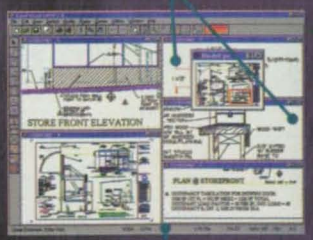
Load and Save AutoCAD® and Generic CADD® Files

Task Aware Environment™

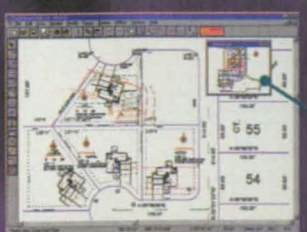


- 200+ House Plans
- 1,900 Architectural Symbols
- 5,000 Mechanical Symbols
- 650 Electrical Symbols
- 120 Fonts

Multiple Viewports enable you to work on several views within the same drawing file or at different magnifications in several sections of a large complex drawing. Plus, when you exit the file, the multiple viewports you've established will be saved automatically.



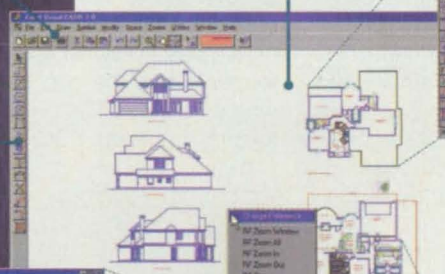
Multiple Dimension Types - Select from ordinate, datum, linear, angular and radial options. Plus, associative dimensions for automatic adjustment of dimension lines.

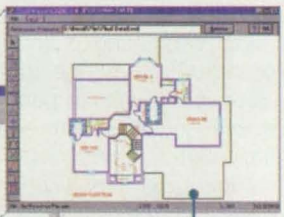


All tool palettes and menu bars are fully customizable.

Quick Commands are logically located on the left-hand palette, so you can access the tool you need with a click of the mouse. Plus, each command has a quick 2-keystroke shortcut to speed the process even further. Spend your time drawing, not searching through tool menus.

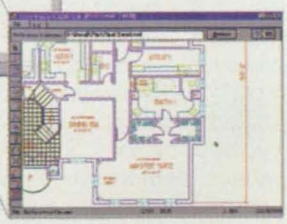
Uniquely large, unobstructed drawing areas allow you to clearly view your design.





Dynamic Reference Frames give you absolute control over your printing layout by allowing you to reference multiple drawings and/or multiple views of the same drawing on your output sheet. You can also seamlessly integrate AutoCAD® xrefs and paper space.

Bird's-Eye View™ allows you to easily reference specific locations within a drawing with a thumbnail sketch.



Task Aware Environment™ is able to keep track of where you are in the design process. Since it incorporates enhanced features such as nested commands, matching tools, speed bar dialogs and a context-sensitive right mouse button, you can count on finishing your work in record time.

Microsoft® Office Compatible

Designed for Microsoft® Windows® 95

COREL

COREL WTA TOUR

Corel: Official World Title Sponsor of the COREL WTA TOUR

COREL

Official Worldwide Sponsor of Bobsleigh

COREL

http://www.corel.com

Call now for faxed literature!

1-613-728-0826 ext. 3080

Document # 1161

KJR-0209-US

Since 1982

ComputAbility

Consumer Electronics

1-800-554-1635

$139.00* Competitive Upgrade CD-ROM Version†

$305.00* Full CD-ROM Version

†For CorelDRAW™, AutoCAD®, Generic CADD®, Corel Visual CADD™, MicroStation®, and CADKEY® *US$ plus applicable taxes and shipping.

For More Information Write In No. 535

Recovering Telemetry Data via Noncausal Processing

Signals are processed, recorded, and reprocessed to recover data that would otherwise be lost.

NASA's Jet Propulsion Laboratory, Pasadena, California

Gap-closure processing (GCP) is a method of noncausal processing of telemetry signals in the radio-receiving system that was the subject of "Buffered Telemetry Demodulator" (NPO-19080), *NASA Tech Briefs*, Vol. 19, No. 11 (November 1995), page 42. As described in that article, the buffered telemetry demodulator (BTD) is a digital signal-processing system designed mainly for recovery of low-rate binary data phase-modulated onto a square-wave subcarrier on a sinusoidal or suppressed sinusoidal carrier signal and received at a low signal-to-noise ratio (SNR). In the BTD, the received signal is not only processed in real time but is also recorded and subsequently reprocessed to recover data that might otherwise be lost. GCP is the non-real-time, noncausal, reprocessing for extracting more information from the received noisy signal than can be extracted by real-time, causal processing alone.

The BTD is implemented in software on a general-purpose multiple-central-processing-unit computer workstation. It acquires and tracks the carrier, subcarrier, and symbols, and performs such monitoring functions as indicating lock or lack of lock on the received signal and estimating symbol SNR. It takes advantage of the multiple central-processing units to perform several processes on different segments of digitally sampled and recorded signals simultaneously. For example, it can process real-time digital-signal samples forward in time and can reprocess any other segment of samples from the past at the same time.

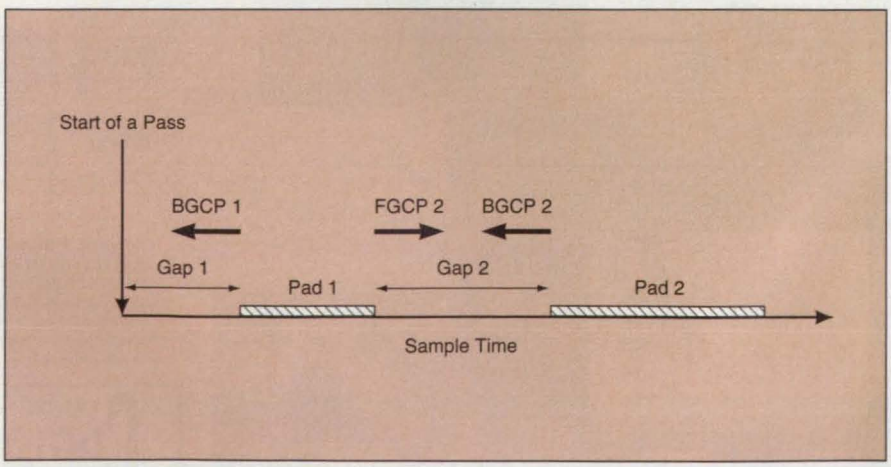
It becomes necessary to reprocess a segment of samples from the past when (1) the out-of-lock indication is detected in the carrier-, subcarrier-, and/or symbol-tracking loop in the BTD, and/or (2) the succeeding decoder fails to extract valid information from the BTD-output symbols; in either or both situations, demodulation has not been performed successfully on the affected segment of samples, and that segment is called a "gap." Typically, gaps are caused by acquisition (or re-acquisition) or cycle slip in one of the three tracking loops. Gaps due to acquisition and reacquisition can be found in the beginning of each pass and may be found at the instants of changes in data rates. Gaps due to cycle slips are usually accompanied by decreases in symbol SNR and can occur at random times. In rare cases, gaps occur when demodulated symbols are mishandled in the flow of data from the BTD to the succeeding decoder. GCP is the processing of a gap to extract any valid information not available when that segment of signal samples was first processed.

During the real-time demodulation process, the BTD keeps a record of its internal states, including the lock-indicator states, the state variables inside loop filters, as well as phases and frequencies of numerically controlled oscillators (NCO) for all three loops. This information is recorded at fixed intervals and is stored as check points for subsequent use as references whenever GCP becomes necessary. For a gap situated inside a pass, it is possible to perform GCP by using the available check-point information from either before or after the gap. The former is denoted forward gap-closure processing (FGCP) because it involves loading the check-point information from before the gap, processing the gap from the beginning towards the end; the latter is denoted backward gap-closure processing (BGCP) because the gap is processed in the order of reversed time. Only FGCP can be performed when the gap is at the end of a pass, only BGCP can be performed when the gap is at the beginning of a pass. The only essential difference between FGCP and BGCP is that the order of signal samples processed is reversed. Because every state variable of every check point is a random variable, it is necessary to use more than one check point to make a good estimate of states at the beginning of GCP.

A segment of signal samples from which all the check points used for a GCP are derived is called a "pad." To ensure reliable check-point information, each pad is chosen to be an interval throughout which the receiver remains in lock. The pad-to-gap size ratio is an important factor in determining the strategy of GCP. The figure schematically illustrates FGCP and BGCP with two gaps and two pads.

GCP can be performed in either a closed-loop or an open-loop configuration. In the closed-loop configuration, the receiving signal processor runs over the gap with some new *a priori* state information pertinent to the starting point. The *a priori* information is typically obtained from check points before the gap in FGCP or after the gap in BGCP. Then using this information, the loop-filter coefficients can be initialized by a method developed previously to eliminate the transient response of a digital phase-locked loop.

In the open-loop configuration, the gap is reprocessed without using a phase-locked loop to adaptively estimate the signal phase; this is feasible, provided that the signal phase is reasonably stable or slowly varying in that gap. In the open-loop configuration,



Information Is Recovered From the Gaps by reprocessing, using information from the pads. Information is recovered in BGCP 1, using check-point information from pad 1. The same check-point information can also support FGCP 2 in reprocessing gap 2. BGCP 2, using check-point information from pad 2, is an alternative for reprocessing of gap 2.

Automotive Component Test.

Application: Simulate a PLC-driven automotive part test system in an R&D environment.

Solution: In one week, a $100,000 test system was emulated at a cost of just over $2,000. A single Keithley MetraByte DAS-1802AO data acquisition board provides stimulus and measures resulting pressure and flow. Using VTX and Visual Basic, the designer got test results in Windows on the first day. The component's design was improved through graphing and analyzing the data.

800-903-1294
Write in No. 670

Process Monitoring of Viscosity.

Application: Develop an instrument capable of accurately determining the viscosity of polymers such as polyesters, nylon and synthetic rubbers.

Solution: User is able to capture samples over a wide dynamic range from 1 RV to 100 RV (relative viscosity) at a resolution and repeatability of 0.1%. Key to this is Keithley MetraByte's DAS-1802HR-DA data acquisition board with 16-bit resolution and programmable gain. The same board also controls hydraulics during the acquisition for unattended operation. **800-903-1294**

Write in No. 671

Data Acquisition Catalog.

For a complete listing of solution driven products, call for Keithley MetraByte's free catalog.
800-903-1294
Write in No. 672

Our Components

Are Solution Driven.

Setting the data acquisition standard.
For ten years Keithley MetraByte has been solving data acquisition needs with boards and software that have helped define the market. Building on years of quality processes, we were first in the industry to attain ISO 9001 certification.

Fast lane to data acquisition.
Choose from a complete range of boards, signal conditioning modules, screw terminals, channel expansion units and cables. Our wide selection means you pay only for what you need. Data acquisition starts at $349.

Accelerate to productivity.
Choose our intuitive software that avoids lengthy learning curves. If you like to program, our VTX Visual Basic software tools are the fastest route to customized solutions, or choose TestPoint which provides a fully-integrated development environment to acquire data with boards or instruments.

FOR APPLICATION SOLUTIONS THAT ARE TRIED AND TESTED, CALL US AT 800-903-1294.
INTERNET: http://www.metrabyte.com

KEITHLEY METRABYTE
We set the standard

Write in No. 673

PC Board Production Test.

Application: Develop a high-throughput, flexible functional test system for programmable thermostat boards.

Solution: A fast, yet easy-to-use and maintain system. TestPoint software controls a two-bay system optimized for high throughput, where one board is tested while the next one is loaded.

Maintenance is simplified because all the I/O is done through a single Keithley MetraByte DAS-1602 data acquisition board with an interface chassis and bed-of-nails fixture. **800-903-1294**

Write in No. 674

the receiver uses an estimated-phase profile as the reference phase. The estimated-phase profile can be obtained from observation of the phase over an adjoining segment of samples wherein the phase has been tracked successfully.

The overall gap-closure strategy involves scheduling of open- and closed-loop GCP to optimize the outcome. The strategy is derived from the observation that the open-loop configuration can outperform the closed-loop configuration for some amount of time into a gap, and then the performance of the open-loop configuration deteriorates rapidly farther into the gap. The optimum time for switching over from the open-loop to the closed-loop configuration is a function of the interval between check points, the number of available check points, the duration of the gap, and the bandwidth of the loop.

This work was done by Haiping Tsou, Robert Lee, Alexander Mileant, and Sami H. Hinedi of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information,* ***write in 52*** *on the TSP Request Card. NPO-19683*

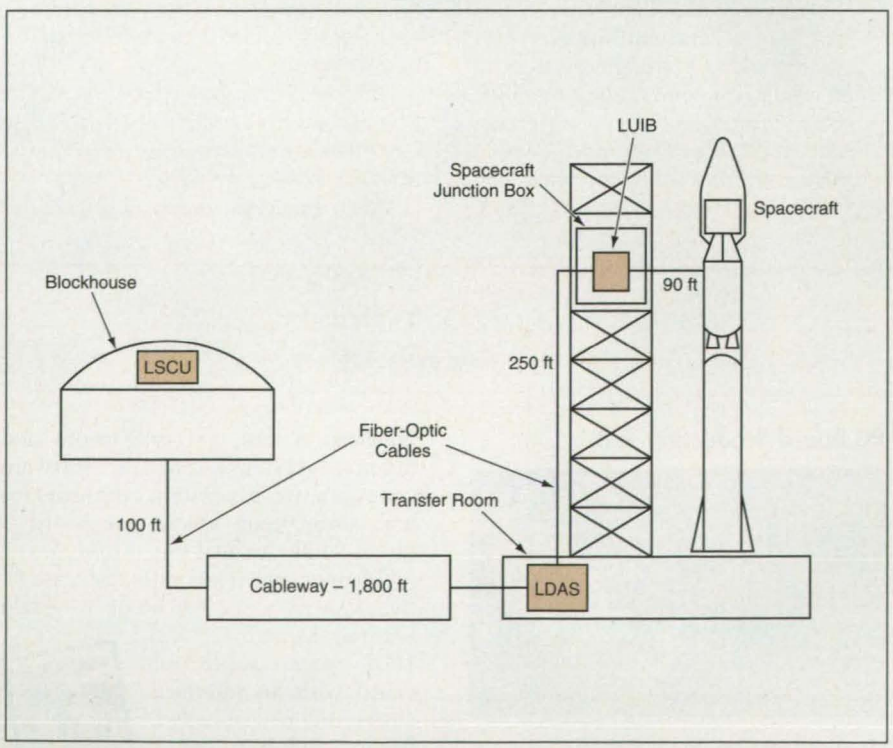
System Measures Electrical Transients Induced by Lightning

Waveforms and peak voltages are digitized and recorded for analysis.

Lewis Research Center, Cleveland, Ohio

The Lightning Transient Measurement System (LTMS) is an electronic data-acquisition system that can operate unattended to provide continuous monitoring of electrical transients induced by lightning in unused wires in a cable. The LTMS is installed at the launch pad at Launch Complex 36B at the Cape Canaveral Air Force Station (see figure); the monitored cable is the umbilical cable between the launch tower and the spacecraft on the launch pad. The LTMS was designed to produce measurement data for comparison with levels specified in the lightning-protection design of the spacecraft and launch pad and to verify that the lightning-induced transients have not exceeded allowable levels. Modified versions of the LTMS might be useful in assessing the hazards posed by lightning-induced transients and verifying lightning-protection schemes in other installations that involve frequent and/or prolonged exposure of people and/or equipment to an outdoor environment.

In the LTMS, lightning-induced transient voltages and currents on six unused wires are sensed by probes located in an LTMS/umbilical interface box (LUIB) at the launch-tower end of the umbilical cable. From the LUIB, the analog probe signals are transmitted via fiber optics to a data-collection subsystem called the "Lightning Data Acquisition System" (LDAS), which is located in a room under the launch pad. The LDAS includes a modular computer automated measurement and control (CAMAC) mainframe, wherein high-frequency digitizers and peak detectors capture the waveforms and maximum voltages. The LDAS is connected, via a fiber-optic cable ("data highway") to the Lightning System Control Unit (LSCU), which is a dedicated control, data-processing, and data-storage subsystem located in a blockhouse near the launch pad. The use of fiber optics for transmission of analog and digital signals, combined with the installation of shields to protect all power cables and with electromagnetic shielding of instruments, makes the LTMS nearly immune to the effects of lightning.

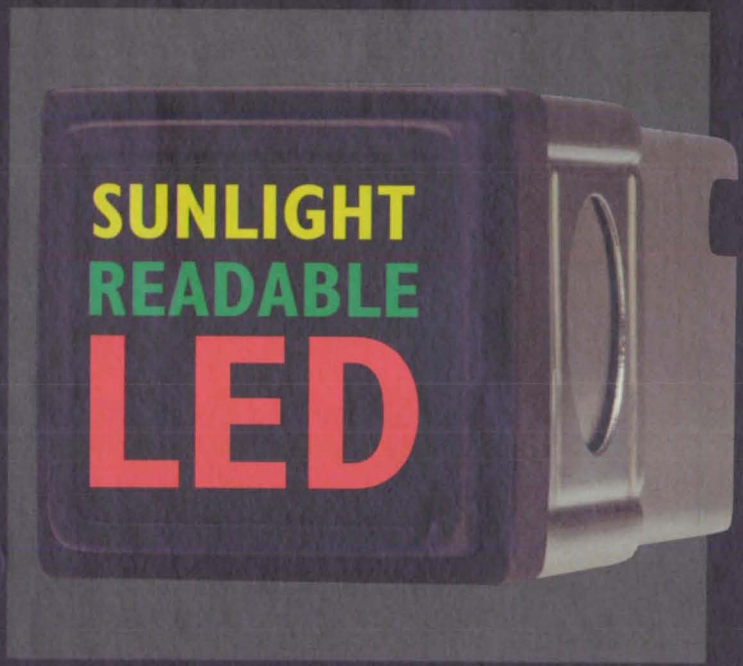


The **Lightning Transient Measurement System** is used to record and analyze lightning-induced transients, yielding data to verify lightning-protection schemes.

The probes are configured to measure common-mode voltages and currents and differential-mode voltages. The system can fully digitize two inputs and can sample four for peak values only. The system is capable of automatic self-test and calibration, remote operation, and transfer of data via telephone modem, and autonomous operation. The system is entirely independent of other data systems at the site and in-cludes its own emergency power supply to enable continuation of monitoring in the event of a loss of ac power supplied via the site.

Software running on the LSCU computer in the blockhouse provides supervision and control of all system functions. Its three main tasks are to configure and arm the data-collection subsystem, receive and store data after the system is triggered by a lightning event, and perform preliminary analysis of each received set of data. A multitasking operating system and

Introducing the VIVISUN LED.



The first LED, Sunlight Readable Switch built to VIVISUN Standards and Mil-Specs*.

Low Power • Low Heat • Solderless Quik-Connect™
Exceptional Lead Times

**Sunlight Readable and NVIS compliant per MIL-S-22885E and MIL-L-85762A.*

VIVISUN LED

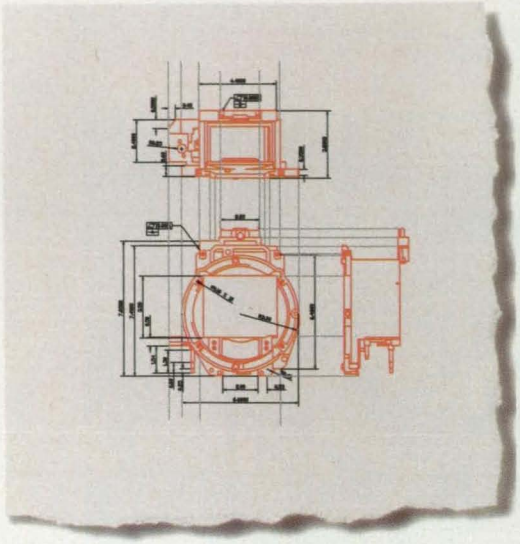
The Complete Switch

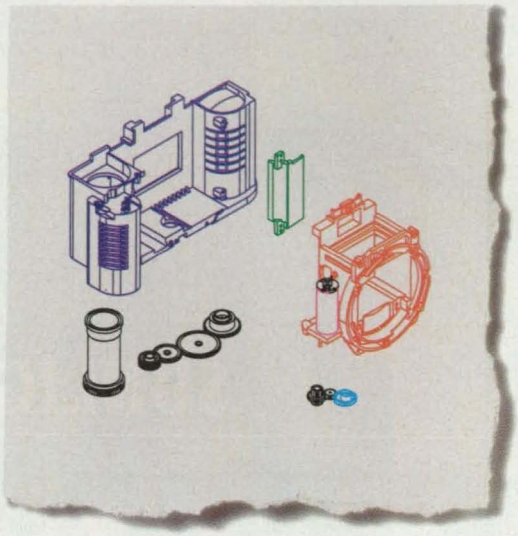
Contact us today:

AEROSPACE OPTICS INC.

Toll Free (888) VIVISUN
Fax: (817) 654-3405
Email: switches@vivisun.com

To anyone who is choosing between designing in 2D or 3D, we offer the following advice.





Don't.

Introducing Autodesk Mechanical Desktop.™ Uniting 2D and 3D.

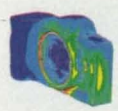
Feature-based, parametric solid modeling
You model with familiar features like tapped holes and chamfers. Mix surfaces and solids to build complex shapes.

Comprehensive assembly modeling
Assemblies are associative. Make a change and see the entire design update.

2D design and drafting
.DWG format ensures compatibility with your existing data, vendors and clients.

Associative drafting
Automatically generate detailed drawings. Full bi-directional associativity updates models and drawings.

With new Autodesk Mechanical Desktop you and your design team can end the debate because everything about it has been designed around your needs. For projects that require 2D drafting, you can be sure the capabilities are there. After all, Mechanical Desktop is built on AutoCAD® software, the unsurpassed 2D drafting standard. For projects that require 3D or a mixture of 2D and 3D, you'll find enhanced feature-based solid modeling to speed design and make change effortless. And users totally new to 3D will easily get up to speed because of their familiarity with AutoCAD. So what you'll have is one tool for a variety of projects from straightforward components to complex assemblies. A tool that's versatile enough to enable you to work in 2D, 3D or a combination. You'll also have a network of training and support centers worldwide. And yes, it's affordable. Sound too good to be true? Call us on it.



Analysis by ANSYS, Inc.

With Mechanical Desktop as a foundation, you can take your projects from design to manufacture. Thanks to the Mechanical Applications Initiative (MAI), you can choose from the best-of-class design through manufacturing applications and know that they'll be fully integrated.

Machined by NC Microproducts.

CALL 1-800-964-6432 AND ASK FOR DEMOPAK S605.

Autodesk. DESIGN YOUR WORLD™

graphical user interface support the LTMS application software. The software provides limited fault tolerance with automatic reconfiguration in some failure situations.

The LTMS is designed as a practical tool for use by payload engineers and launch directors in assessing potential damage to spacecraft by nearby lightning events. Data from the LTMS are also expected to improve understanding of the adequacy of lightning-protection criteria currently imposed on ground support equipment interfaces. The usefulness of the LTMS will ultimately be measured in terms of its ability to assist in making informed go/no-go launch decisions, and by increased knowledge of lightning-induced transient phenomena at the site.

This work was done by Jeffrey C. Brown of **Lewis Research Center**. *For further information,* ***write in 66*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-16095.

A Novel Method To Resolve Doppler and Range Ambiguities

Measurements can be unambiguous even at large ranges and speeds.

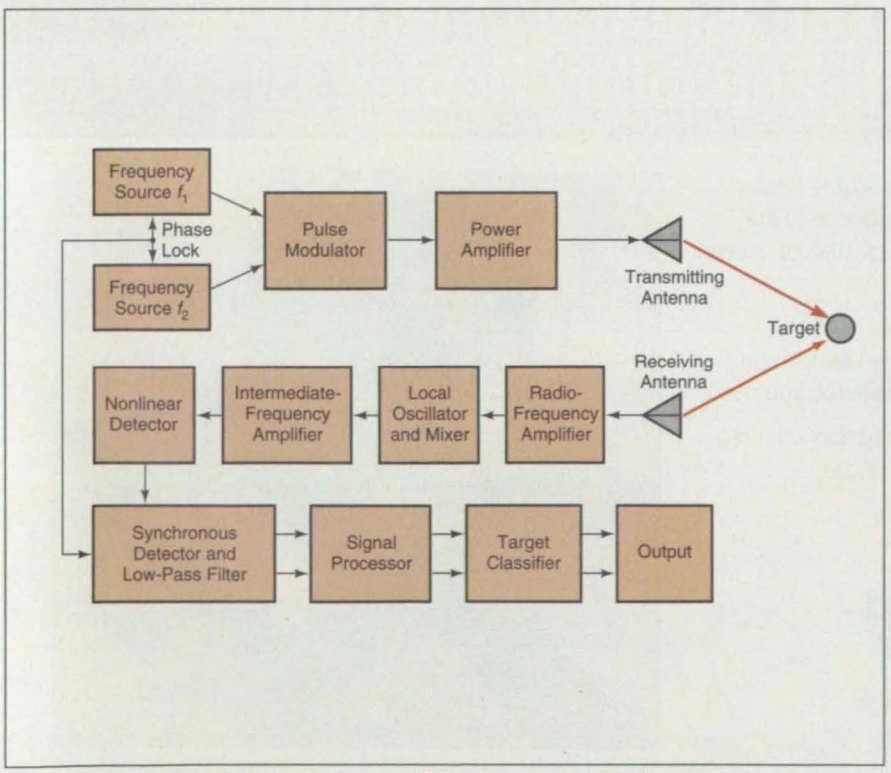
Goddard Space Flight Center, Greenbelt, Maryland

A pulsed radar system makes unambiguous measurements of both range (distance to a target) and Doppler frequency shift (indicative of the speed of approach or recession of the target). The ambiguities are resolved by use of a variation of a two-frequency technique that has been used in interferometric systems to resolve integral-multiple-of-2π phase ambiguities. This technique could also be applied in a pulsed laser ranging system.

Range and Doppler measurements in a conventional pulsed radar system are susceptible to ambiguity when the range and/or speed become(s) large:

- When the pulse-repetition frequency is low enough for unambiguous measurements of range, it could be too low for adequate sampling of a large Doppler shift.
- The angular spread of the radar beam can cause the Doppler spectrum of the return signal to spread beyond the Doppler-ambiguity frequency difference, making the Doppler measurement difficult or impossible.

With the present approach (see figure), two carrier signals at frequencies of f_1 and f_2, respectively, are generated by use of phase-locked oscillators or a double-sideband (suppressed-carrier) modulator to enforce coherence. One of these frequencies can be varied, and the frequencies differ by a suitable amount, e.g., f_1 = 10,000.5 MHz, f_2 = 10,000.0 MHz. The difference frequency, $\Delta f_t = f_1 - f_2$, is measured and used as a reference in processing the return signals as explained below. The f_1 and f_2 signals are combined and amplitude-modulated to form pulses, typically with a duration of 1 μs and a repetition frequency between 100 and 10,000 Hz. The dual-frequency pulsed signal is amplified, typically to a peak power of several kilowatts, and transmitted from an antenna toward the target.



This **Concept Is Based** partly on the use of a two-frequency technique to resolve range and Doppler ambiguities.

The signal returned from the target is received by the same or a separate antenna and processed initially via the usual combination of amplification, mixing with a local-oscillator signal to obtain an intermediate-frequency signal, and detection in a nonlinear circuit. The output of the nonlinear detector is generated from the Doppler-shifted returns of the f_1 and f_2 signals. Therefore, the detector output includes a signal at a difference frequency Δf_r, which differs from Δf_t by a small amount; $\Delta f_r - \Delta f_t = \Delta f_d$ = the differential Doppler shift of the two signals. The differential Doppler shift is given by $\Delta f_d = 2\Delta f_t v/c$, where v is the speed of approach or recession of the target and c is the speed of light.

The Δf_r component of the output of the nonlinear detector is synchronously detected with reference to the original Δf_t signal. The coherence of f_1 and f_2 mentioned above is necessary for the extraction of the instantaneous value of Δf_d; without coherence, the system would behave as though it made two independent radar observations, for which Doppler shifts must be determined and independently averaged at each frequency.

The output of the synchronous detector is an in-phase (I) and a quadrature (Q) signal that is low-pass filtered and fed to a signal processor and a target classifier, which extract speed and other information in a conventional way.

The signal processing includes, among other things, measurement of the phase of the Δf_r signal and the difference between this phase and that of the Δf_t signal. By making Δf_t small enough, one can keep Δf_d small enough so that it can be sampled adequately at the pulse-repetition frequency and so that the spectral width of the Δf_d signal lies within the Doppler-ambiguity frequency difference. Optionally, one could also choose Δf_t small enough to avoid the integral-multiple-of-2π phase ambiguity in the component of phase shift proportional to range.

The version of the approach shown in the figure is suitable for cases in which Δf_t is small enough that the spectra of the pulse-modulated f_1 and f_2 transmitted signals overlap. In other cases, it is preferable to use another version of the system (not shown in the figure), which differs in that the output of the mixer is filtered to separate the returned f_1 and f_2 signals for amplification in separate intermediate-frequency channels.

This work was done by Gerald Heymsfield of **Goddard Space Flight Center** *and Lee Miller, consultant. For further information,* ***write in 36*** *on the TSP Request Card.*

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Goddard Space Flight Center; (301) 286-7351. Refer to GSC-13542.

Ground Receivers for Measuring Flying-Radar Antenna Patterns

Analog data in the form of time-varying audio tones are recorded on magnetic tape.

NASA's Jet Propulsion Laboratory, Pasadena, California

Two relatively inexpensive ground-based receivers have been developed for measuring the directional patterns of signals from remote-sensing radar antennas in flight aboard aircraft and aboard spacecraft in orbit around the Earth. As a flying radar system passes by, one of these receivers records data from which one can compute the intensity of the received radar signal as a function of time (see Figure 1). These data can later be correlated with data on the known positions, orientations, and polarizations of the radar system and receiver antenna as functions of time to

extract data on the directional pattern of the radar antenna.

The two receivers are similar except that one operates in the L-band while the other operates in the C-band (see Figure 2). Both include low-noise input amplifiers, followed by band-pass filters to reduce noise bandwidths. In both receivers, detection takes place in detector logarithmic video amplifiers (DLVA) capable of handling the radar pulses, which typically range in duration from five to several hundred microseconds and typically range in repetition frequency from 100 Hz to 5 kHz. The DLVA provides 50 dB of input dynamic range, converting this whole range to an output potential range of 0 to 2 volts.

The output of the DLVA in each receiver is fed to a video circuit that includes a sample-and-hold circuit with accompanying triggering circuitry and a voltage-to-frequency converter; the net effect of this video circuit is to generate an audio signal with a frequency that is a prescribed function of the instantaneous strength of the received radar signal. This audio signal is recorded on magnetic tape by use of an inexpensive commercial cassette recorder. Subsequently, the audio-frequency analog received-power data signal is played back and digitized for analysis.

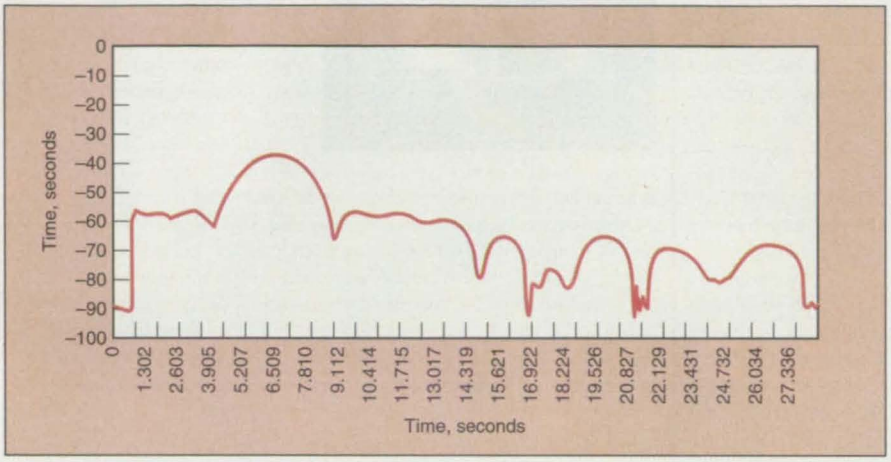


Figure 1. The **Strength of the Signal Received** from an airborne synthetic-aperture radar was recorded as the system flew by.

This work was done by David R. Haub, Gonzalo Romero, and Charles L. Werner of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information,* ***write in 64*** *on the TSP Request Card.*
NPO-19596

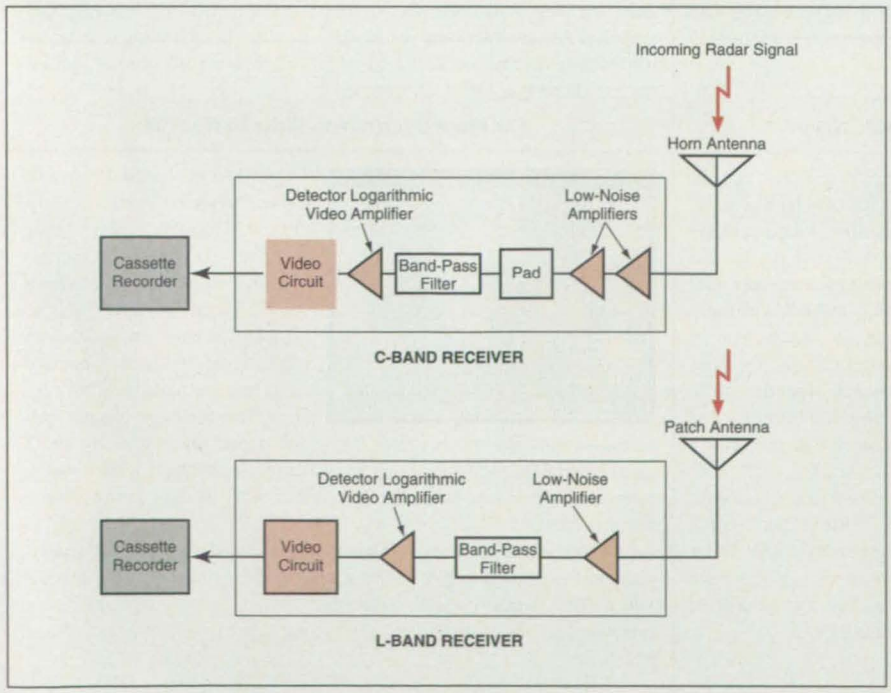


Figure 2. These **Ground Radar Receivers** produce analog audio outputs, the frequencies of which vary with the strengths of the signals they receive.

National Instruments, Austin, TX, has announced a line of VXI-based multifunction **data acquisition instrument modules**, which includes the VXI-MIO-64E-1 and VXI-MIO-64E-10 multifunction analog, digital, and counter/timer modules; the VXI-DIO-128 digital I/O module; the VXI-AO-48XDC analog output and digital I/O module; the VXI-SC-1000 signal conditioning carrier module; the VXI-SC-1102 amplifier/lowpass filter signal conditioning module; and the VXI-SC 1150 fixed excitation signal conditioning module.

All modules include the NI-DAQ® driver software and all modules are compatible with LabVIEW® and LabWindows®/CVI application software products for virtual instrumentation. All modules are compatible with VXI plug-and-play standards; the accompanying software can be used with any VXI plug-and-play-compatible application software, as well as programming environments such as Microsoft Visual C++, Visual Basic, and Borland C++. Module prices range from $995 to $3995.

For More Information Write In No. 700

Nicolet Instrument Technologies, Madison, WI, has announced the Odyssey **data acquisition system**, which records 32 analog and 32 digital channels at 100kS/second for more than 30 minutes continuously. It features a digital signal processor on each channel for real-time measurements, triggering, and data reduction. The system also incorporates a full-function Pentium PC to run other applications while recording.

Other features include records of more than 200 megasamples per channel, VCR-like review, an Ethernet network interface, internal signal conditioning, and the ability to review, freeze, and print waveforms while recording. Windows software provides analysis and report generation with custom page layouts, automatic calculations, and data export in popular formats. The system includes a high-speed SCSI disk drive directly connected to each group of eight acquisition channels. Pricing begins at $20,900.

For More Information Write In No. 702

The CY-8900 and CY-9000 tape drive **data storage subsystems** from Cybernetics, Yorktown, VA, are available with an ESCON serial interface for connection to IBM high-end computers. The CY-9000 half-inch digital tape drive stores 42 GB on a single tape at 12 MB/second, uncompressed; with compression, it can store 210 GB at 40 MB/second. It is available in a single- or multi-drive desktop or rack-mount configuration or as part of an automated tape library capable of storing 7.35 TB.

The CY-8900 tape drive stores 20 GB on a single tape at 3 MB/second. With compression, it can store up to 100 GB at up to 9 MB/second. An optional digital data recorder interface allows users to write data to SCSI devices from analog/digital converters or other instrument recorders, and provides an additional 128 MB of variable rate buffer. An accelerated field access option for UNIX systems allows users to locate a single file on a data cartridge in seconds.

For More Information Write In No. 703

Silicon Graphics, Mountain View, CA, has introduced MineSet™ **data analysis and visual data mining software**, which allows users to extract information from data warehouses, automatically mining it using algorithms and analyzing it through intuitive visual tools. The program integrates server-based data mining algorithms with a client-based visual data mining tool suite, allowing users to analyze and understand models produced by those algorithms. Data can be accessed directly from any Oracle, Informix, or Sybase database, as well as other data sources.

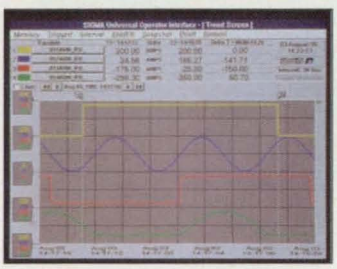
The algorithms and data mining tools include an Association Rule Generator, which automatically analyzes data; the Rule Visualizer, which graphically displays results from the Association Rule Generator; the Tree Visualizer, which displays a 3D landscape for visual analysis of structured data; the Map Visualizer, which enables users to explore data with geographical relationships; and the Scatter Visualizer for analyzing data behavior in many dimensions simultaneously. The program is priced at $15,000 for one client and one server license.

For More Information Write In No. 708

Vulcan Enterprises, Phoenix, AZ, offers the T-Corder Model 512 solid-state **data recorder**, which analyzes analog, pulse, and state signals and stores the information to data files on a removable PCMCIA memory card. It recognizes signals such as voltage, temperature, pressure, strain, rotational speed, pulse counts, and switch positions, and records them to DOS files. Results can be read directly off the card using a PC, or can be downloaded using a serial cable.

The unit operates from an external DC supply and provides an isolated, 5 VDC source for signal conditioning equipment. It measures and records up to 64 12-bit analog channels, eight 10-bit analog channels, four 32-bit rotational or count channels, eight switch positions, and supports eight indicators. The system includes DOS software for real-time communication with the unit and post-processing via a PC. The cost is $2495.

For More Information Write In No. 711



The SIGMA **PC-based data acquisition system** from Reliance Electric, Cleveland, OH, consists of the Universal Operator Interface and the Universal Process Monitor System that integrate data acquisition, supervisory control, and information management into a single operator interface. The real-time system provides sampling for up to 10,000 analog and digital values from the monitored system. It provides pre-emptive multitasking capabilities, allowing more than one task to be executed simultaneously without losing or time-skewing data.

Pushbutton and metering functions are managed via operator screens; computer control and specialized screens provide control of the process. The system operates on IBM-compatible computers and modifications and expansion are incorporated by producing screens with Microsoft Visual Basic.

For More Information Write In No. 705

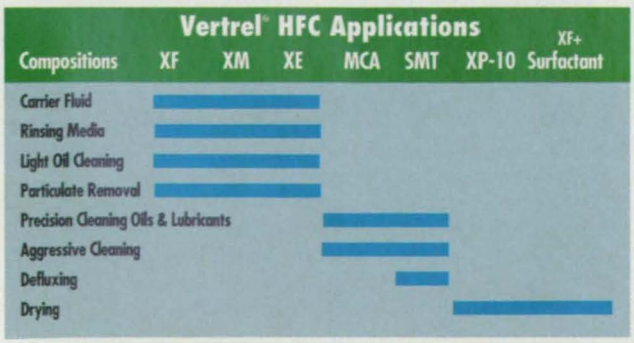
Vertrel®

Clean with confidence.

Vertrel® cleaning agents replace HCFC-141b, PFCs and CFCs so you can clean safely and easily with confidence.

DuPont Vertrel® is specially designed to replace ozone-depleting solvents. You'll use this versatile family of cleaning agents with confidence, thanks to strong performance and ease of conversion in a variety of applications.

Vertrel® cleaning agents deliver the broadest array of cleaning characteristics, facilitating the use of vapor degreaser technology in precision specialty cleaning applications.



Advanced DuPont HFC-4310 technology allows the versatile Vertrel® family of replacement cleaning solvents to offer exceptional cleaning performance in an environmentally acceptable formulation. Vertrel® is safe to use because of its low toxicity and nonflammability.

Vertrel®— the effective and easy-to-implement choice in replacement cleaning agents. To learn more about the DuPont Vertrel® cleaning agent that is right for your application, call **1-800-441-9281**.

DUPONT

Vertrel®

Only by DuPont

Data Acquisition & Analysis

Schenck Pegasus Corp., Troy, MI, has introduced the DA-CAT **data acquisition computer-aided testing system**, which acquires and stores test data such as pressure, flow, motion, torque, and temperature. It measures and monitors up to 256 analog input signals at a rate of 4651 points per second, and a sum sampling rate of 100,000 points per second. It is available in desktop or rack-mounted models.

The unit accommodates a combination of ADIO boards and digital I/O boards that process the analog input signals and provide digital I/Os. Features include AC/DC transducer conditioners, digital inputs and outputs, limit error-checking with programmable action lists, and file storage for system parameters. A high-speed fiber-optic link provides real-time communication between the unit and a PC. The Windows-based applications allow users to set up, start, and stop data acquisition; sample and store data; view, monitor, and control the unit controller remotely from the PC; plot and view real-time data in four formats; and copy test files between the controller and the PC.

For More Information Write In No. 706

DSPower-Block Diagram v2.0 **data acquisition software** from Signalogic, Dallas, TX, offers data acquisition functions presented as a library of blocks in a graphical block diagram user interface. The blocks include continuous multichannel acquire to disk, strip-chart recorder, digital tape recorder, continuous multichannel playback from disk, and continuous function generation. Data acquisition blocks include spectrum analyzer, octave-band analyzer, digital oscilloscope, distortion measurement, 2D contour display with color-encoded or gray-level encoded amplitude, and 3D waterfall display.

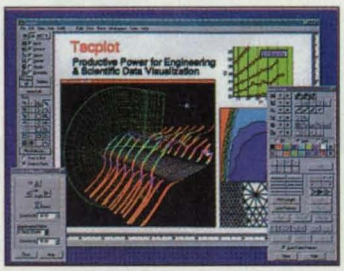
The software allows users to simulate, analyze, debug, and manufacture system and product designs which depend on data acquisition. DSP/math function blocks, display and visualization blocks, and interactive instrument blocks also are available. The user interface offers both simulation and interactive diagram modes. The software operates in Windows 95 or Windows 3.1x with DOS 5.0 or higher, and requires a 33 MHz 80386 machine with 4 MB of memory. It is priced at $795.

For More Information Write In No. 707

The DAS-Scan rack-mounted **data acquisition system** from Keithley MetraByte, Taunton, MA, can multiplex up to 4096 channels from analog and thermocouple measurement devices into a single PC expansion slot. It is designed for quality testing and process monitoring applications on PC-based systems, and may be expanded in 64-channel increments from hundreds to thousands of channels. Software support is available for Windows 3.1, Windows 95, or Windows NT.

The system accommodates up to 896 channels in each 19" rack configuration and up to 448 channels in each half-rack configuration. It multiplexes analog signals into a single differential line that is measured by an analog/digital conversion card. The system scans channels at a rate of 2000 channels per second and comes with Keithley's ASO-SCAN software and Visual Test Extensions, a set of custom controls for Visual Basic. Channel expansion boards are available for non-isolated voltage measurement, voltage with bank isolation, non-isolated TC measurement, and TC with bank isolation. The complete system is priced from $3350; large-channel configurations are priced from $25 per channel for voltage measurement.

For More Information Write In No. 701



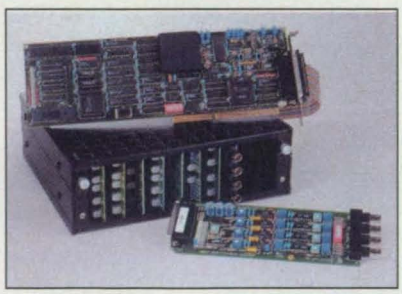
Amtec Engineering, Bellevue, WA, has released version 7.0 of Tecplot **data visualization software**, which features a new graphical user interface, animation, and page layout. Data sets are generated by numerical simulation such as computational fluid dynamics, statistical analysis, data acquisition, and other sources. The program enables users to interactively explore and analyze multidimensional data sets and prepare plots for reports and presentations.

Tecplot offers a variety of viewing options to transform thousands or millions of data points into two- or three-dimensional images. It provides vector fields, light-source shaded plots, XY plots, wire-mesh plots, and contour lines, as well as curvilinear grids, finite-element grids, 3D surface and volumetric modeling, animation, and data manipulation. The software runs on UNIX workstations and on PCs with Windows 3.x, 95, or NT. Pricing begins at $995.

For More Information Write In No. 710

The Data Brick **data acquisition system** from GMH Engineering, Orem, UT, is designed for portable use in demanding environments such as impact recording, machinery monitoring, and aerospace testing. The system features eight self-calibrating differential analog input channels, one trigger input and four counter channels, and is programmed for use with most sensors. It does not require plug-in cards, external signal conditioners, or external excitation voltage supplies. Programmable sample rates are provided from once every 30 seconds to 12,800 samples per second, simultaneously on all channels. Other features include programmable anti-aliasing filters, nonvolatile internal data storage for 524,253 data points, shock tolerance to 100 g's, and a machined aluminum enclosure that weighs 2.86 pounds.

For More Information Write In No. 709



OMEGA Engineering, Stamford, CT, offers the DAQBOARD series of PC/AT-compatible **data acquisition and control boards**. The boards feature A/Ds, D/As, digital I/O, and counter/timers. A range of input types are available with the compact signal conditioning expansion boards, including thermocouples and strain gauges.

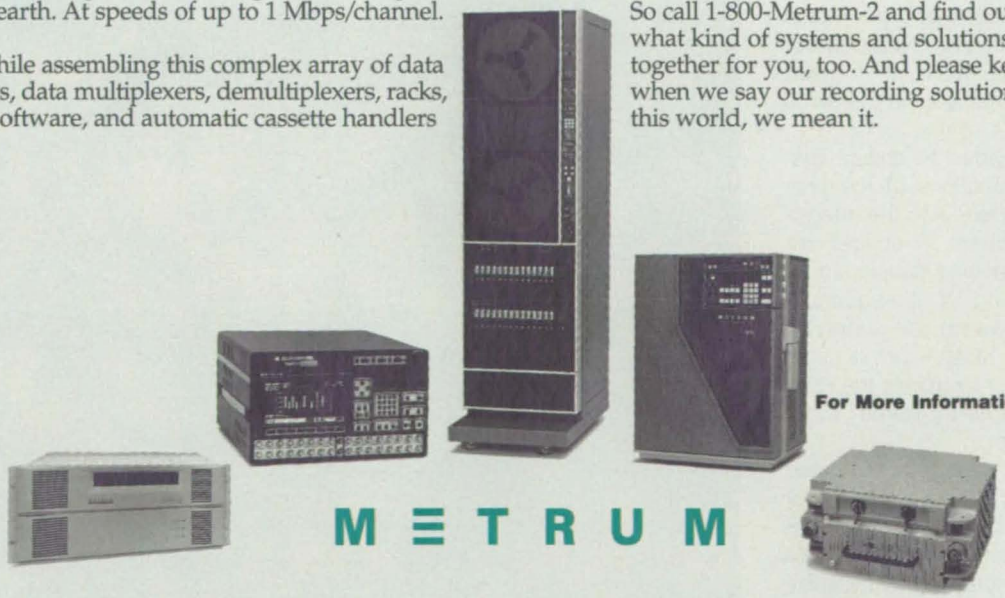
The units may be expanded from 16 built-in channels to 256 inputs. The boards provide maximum sample rate of 100,000 samples per second, even when using expansion panels. Pricing for the basic DAQBOARD-112 is $795.

For More Information Write In No. 704

All over the world, you'll discover Metrum recording system solutions at work. And even out of the world. Today, while the space shuttle floats across the cosmos, up to 24 channels of asynchronous analog and digital data is streaming, and screaming, the miles upon miles back to earth. At speeds of up to 1 Mbps/channel.

Now, while assembling this complex array of data recorders, data multiplexers, demultiplexers, racks, cables, software, and automatic cassette handlers might seem a bit daunting, for NASA it was really quite simple. All they had to do was pick up the telephone and call Metrum. We created and delivered a completely automated, integrated, turnkey system.

So call 1-800-Metrum-2 and find out precisely what kind of systems and solutions we can put together for you, too. And please keep in mind, when we say our recording solutions are out of this world, we mean it.



For More Information Write In No. 620

METRUM

Division of Bell Technologies Inc. • 4800 E. Dry Creek Rd., Littleton, Colorado 80122-3700
(303) 773-4700 • Fax (303) 773-4762 • 1-800-Metrum-2

MEET US AT THE INTERNATIONAL TELEMETERING CONFERENCE-OCT.28-31-SAN DIEGO-BOOTH 164

Interface Circuits for Flight Telemetry

These circuits provide bidirectional interfaces between digital data buses and IRIG telemetry circuits.

Dryden Flight Research Center, Edwards, California

Pulse-code-modulation interface (PCMI) circuits have been designed and built to provide bidirectional interfaces between IRIG telemetry circuits and digital data buses in aircraft. These circuits satisfy a frequently occurring need to merge information from classical instrumentation systems with information carried on aircraft data buses. Usually, the two types of information are acquired asynchronously; despite this, the PCMI circuits make it possible to combine both types of information into a single data stream while maintaining the IRIG telemetry format.

Inasmuch as each flight-research project has unique data requirements, the PCMI circuits were designed to be flexible. Each PCMI circuit can generate its own IRIG telemetry stream or can be slaved to another IRIG stream from virtually any instrumentation system. Several PCMI circuits can be attached in series. Data can be extracted from, or inserted in, an incoming pulse-code-modulation (PCM) stream; a processor attached to a 16-bit data bus in the PCMI circuit can exploit this capability to combine information from flight-data-bus interface circuits and other circuits that provide data on an IRIG PCM stream. The processor can perform computations, then insert results into other time slots in the same PCM stream.

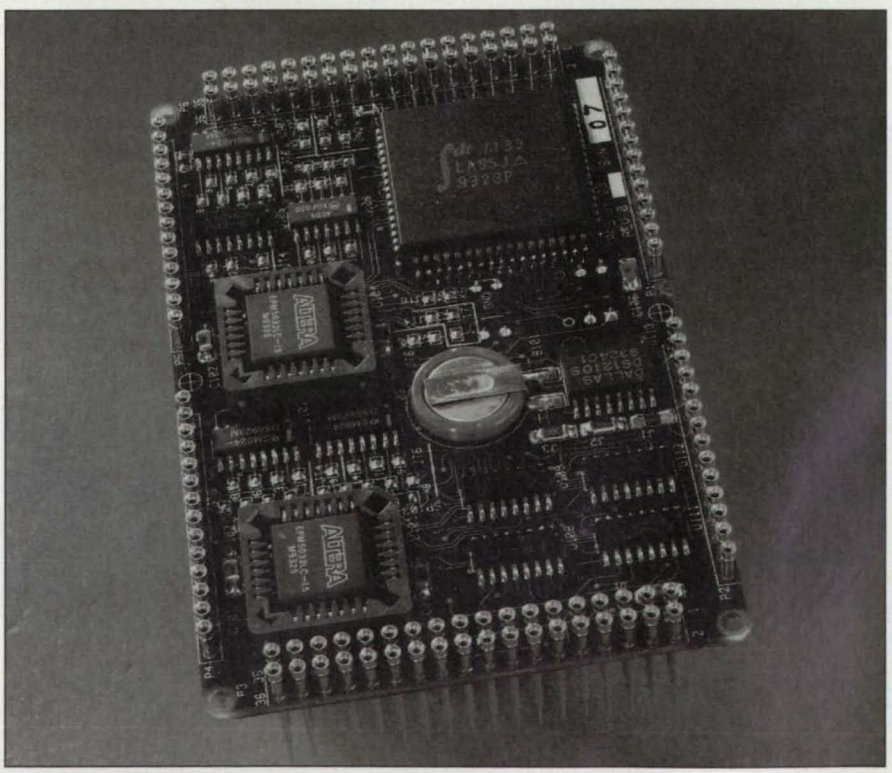
Buffering is provided to ensure that the input/output functions of the processor do not interfere with the integrity of the PCM stream. A special sequencing language was developed to enable programming of a sequencer (described below), which can support a PCM map of 128 Kbits — or a larger map if the processor examines the PCM stream on a frame-by-frame basis through an interrupt.

Whole groups of data can be inserted in the stream, maintaining its group, or packet, integrity. Alternatively, data can be added on a "most recent value" basis when it is more imperative to minimize the number of words added to the PCM stream than it is to maintain packet integrity. In either case, bus data can be decommutated like any other parameter in the PCM stream — without requiring special decoding techniques.

The heart of a PCMI circuit is a sequencer, which allows control over the PCM map down to the bit level. The sequencer uses a static random-access memory (SRAM) with battery backup to ensure nonvolatility. It is programmed via the 16-bit data bus attached to the processor, and can hold as many as four complete sequence maps simultaneously. It can read from or write to the PCM stream at any bit time in groups of 10, 12, or 16 bits. It accepts NRZ-L or RNRZ-L data as input and produces NRZ-L, RNRZ-L, biphase, or DM-M output codes. All input and output is buffered in differential mode to minimize common-mode interference and provide isolation. Single-ended input and output is also possible, but less desirable.

A PCMI circuit is completely controlled via software, so that various techniques can be used without having to remove the circuit from the system in which it is installed. All programmed memory and latches are of the read/write type, so that a complete self-test can be run while the circuit is installed in an operational system.

Each PCMI circuit also contains a frequency synthesizer, so that when it is acting as the master PCM system, its frequency can be programmed between approximately 10 Kb/s and 8 Mb/s. Synchronization bits can be included in the sequencer memory that provides interrupts to the processor or be used as trigger pulses when analyzing the system externally. A 4-KB dual-port random-access memory (DPRAM) is used to pass data to and from the PCM stream. The processor controls one port and the PCMI sequencer controls the other.



An **Entire PCMI Circuit** fits on a circuit board the size of a credit card.

Out-of-the-Box™ Data Acquisition

Acquire data from your PC-based acquisition system as soon as you take it *out-of-the-box*, with IOtech's easy-to-use DaqView™ software – included FREE with our data acquisition products! With DaqView you can effortlessly set up your application, acquire data to disk in real-time, view real-time data in a variety of formats, graphically scroll through acquired data, and transfer data to other Windows™ applications such as Microsoft Excel™.

Portable Parallel-Port Systems

From $1,295

WaveBook/512™ – digitizes at 1 MHz for multichannel, high-bandwidth applications

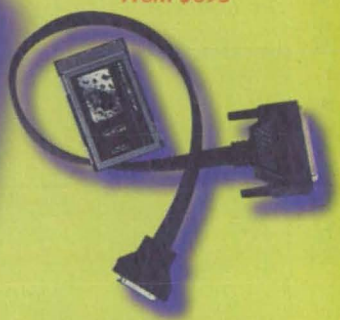
Write in No. 693

Out-of-the-Box Software*

DaqView™ included FREE **Write in No. 694**

Portable PCMCIA Systems

From $695



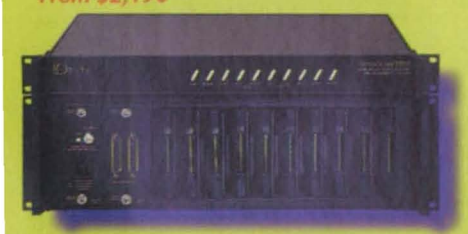
Daq/216B™ – 100-kHz sampling at 16-bit resolution

Write in No. 695

Temperature & Voltage Measurement Systems

with IEEE 488 & serial interfaces

From $2,190



TempScan/1100™ – measures from 32 to 992 temperature or voltage channels

Write in No. 696

Plug-in Multi-Function Boards

From $795

DaqBoard/200A™ – combines 16-bit/100-kHz sampling with waveform D/As & much more **Write in No. 697**

Signal Conditioning & Expansion

From $295

DBK™ products – expand our portable & desktop systems up to 256 channels of voltage & transducer inputs **Write in No. 698**

(For users who prefer to program, we also provide free drivers for LabVIEW®, Visual Basic™, C™, & Pascal®; DASYLab™, Snap-Master™, & Labtech Notebook™ drivers are also available).*

IOTECH WORLDWIDE DISTRIBUTORS:

Australia +61 3.9579.3622; Austria 43 (316) 30700; Belgium +32 2 466 81 99; Canada Montreal (514) 697-3333, Ottawa (613) 596-9300, Toronto (905) 890-2010, Vancouver (604) 988-2195; China +86 (10) 6232-9880; Denmark +45 45 82 7878; Eastern Europe +43 1.54.515.88; Finland +358 0.476 1600; France +33 1.34.89.78.78; Germany +49 711 902-97-0; Hong Kong (+852) 2830-5620; Israel +972 3 649 8538; Italy +39 2 392 66561; Japan +81 3-5688-6800; Korea +82 2 538-4001; Netherlands +31 70 399-6360; New Zealand +64 4.569 4676; Singapore +65 482-5600; South Africa +27 (12) 660-2884; Spain +34 1.597 29 78; Sweden +46 13-31 0140; Switzerland +41 1.825.57.77; Taiwan +886 2.501 7065; United Kingdom +44 (1.296) 397676

Call **1-800-304-8737** today!

IOtech, Inc.
25971 Cannon Road
Cleveland, Ohio 44146
216 439-4091 • Fax: 216 439-4093
http://www.iotech.com

The compactness (see figure) and ruggedness of the PCMI and associated circuits enable placement in a variety of locations on a number of aircraft. PCMI circuits are now in use on several NASA research aircraft, including a B-52, F-18, F-15, SR-71, and F-16XL. The PCMI system (including the processor, the PCMI circuit, and a power supply) fits in a volume 3.5 by 5 by 3.5 in. (8.9 by 12.7 by 8.9 cm) and draws less than 10 W of power.

This work was done by Glenn A. Bever of **Dryden Flight Research Center**. *No further documentation is available. DRC-95-14*

Eliminating a Control Glitch in an Isolated Cuk Converter

The glitch could be eliminated by suitable choice of capacitors and/or a damping network.

NASA's Jet Propulsion Laboratory, Pasadena, California

A theoretical study of the operation of an isolated Cuk converter has led to a proposed method for eliminating a glitch in its control-to-output transfer function. The method involves a suitable choice of capacitors plus the addition of a simple resistance-and-capacitance damping network.

Figure 1 illustrates an isolated Cuk converter. In this circuit, control is effected via pulse-width modulation: for a given switching frequency, the output or load voltage, V_L, is controlled by controlling the duty cycles, (D and D') of the two switches.

The glitch in the control-to-output transfer function is an undesired pair of zeros and poles that are closely spaced in complex frequency. Prior to the theoretical study reported here, it was known that the glitch is associated with the magnetizing inductance of the transformer. Moreover, limited analysis and experimentation had shown that the glitch can be reduced by a sufficiently large increase in the magnetizing inductance. However, the present method was developed from a different approach, in which increasing the magnetizing inductance was considered not to be a design option.

The mathematical model used in the theoretical study was a small-signal, equivalent-circuit approximation of the dynamics of the circuit. The dependence of the glitch on the various circuit parameters (inductances, capacitances, transformer turns ratio, etc.) were determined analytically. It was found that the glitch could be eliminated at a specific operating point (D, V_g, I) by making its zeros and poles coincide in complex frequency, and that this condition could be achieved by choosing the capacitances of the two energy-storage capacitors in a specific ratio. This ratio is given by $C_2/C_1 = (D'/D)\{[1 + D(1 - \alpha)]/(D + \alpha D')\}$, where $\alpha = k(L_2/L_1)^{1/2}$, k is the coefficient of coupling between the primary and secondary transformer windings, and L_1 and L_2 are the primary and secondary inductances as reflected to the primary side and as indicated in the lower part of Figure 1. With this condition satisfied, it was also found that the glitch can remain suppressed over a wide operating range, $D_{min} < D < D_{max}$, by addition of the series combination of r_d , C_d (see Figure 2) as a lightly damping network in parallel with C_1.

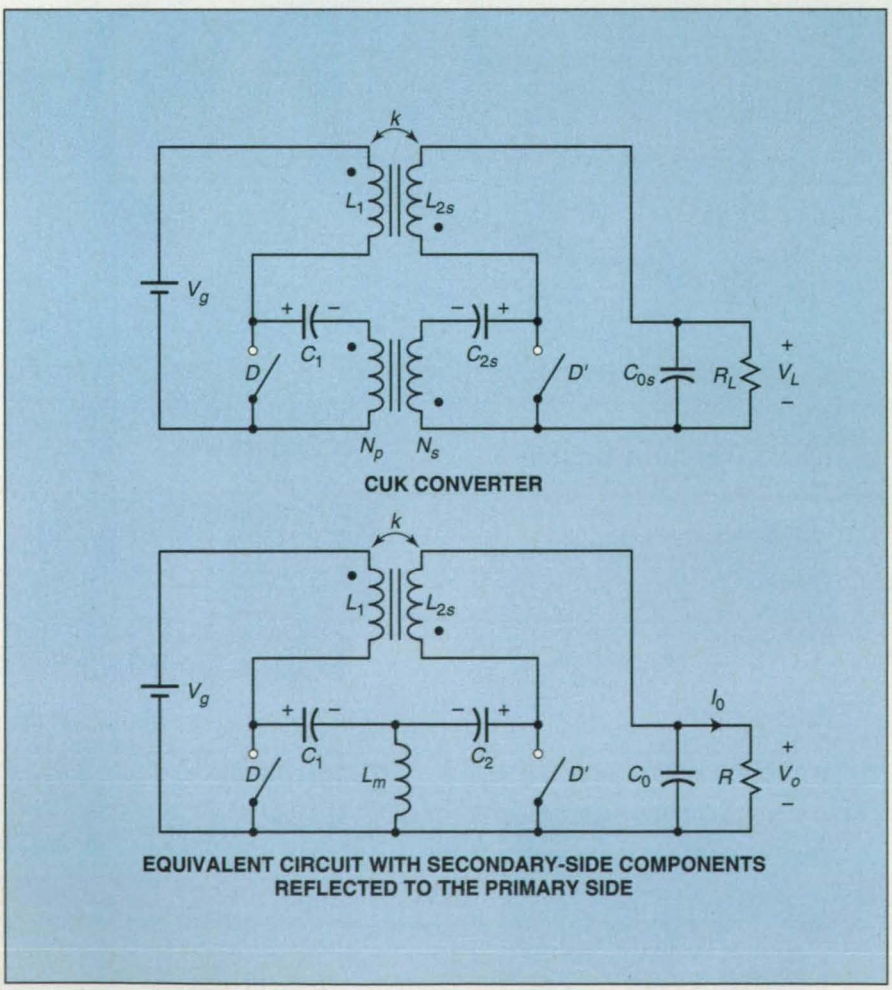


Figure 1. An **Isolated Cuk Converter** is a switching dc-to-dc power-converter circuit.

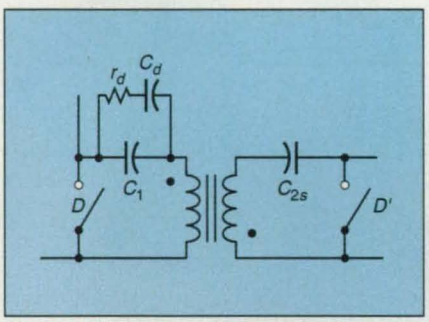
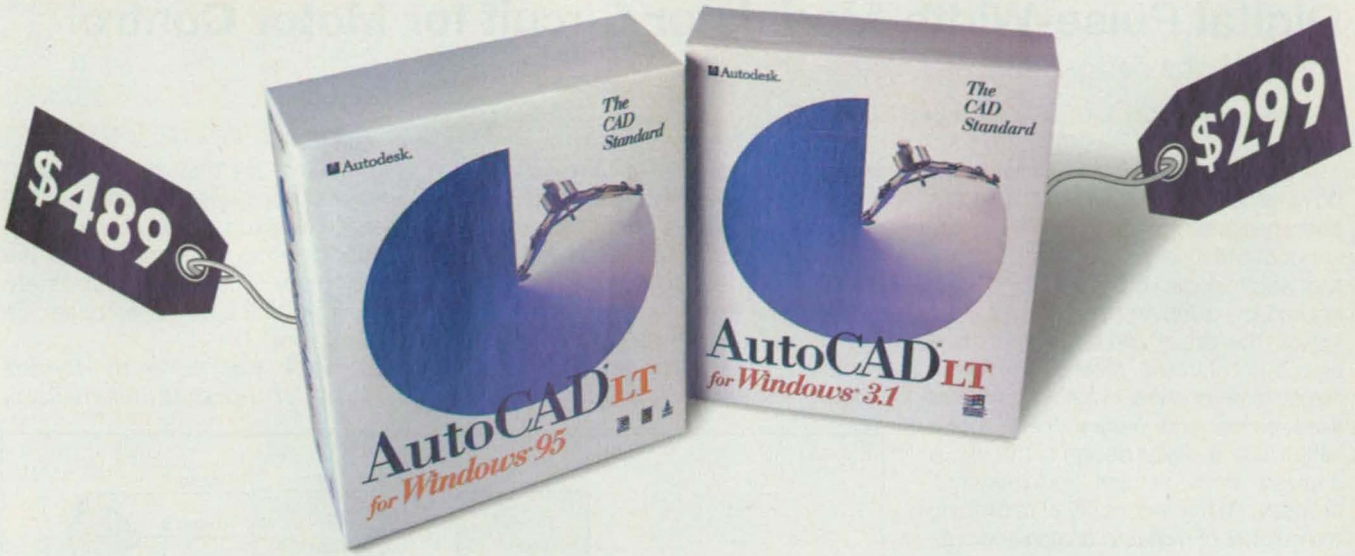


Figure 2. **Light Damping** provided by r_d and C_d could eliminate the glitch over a wide range of operation.

This work was done by Vatché Vorpérian of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information,* ***write in 90*** *on the TSP Request Card. NPO-19459*



Prices include extras money can't buy.

What makes AutoCAD® LT so attractive isn't just the price, it's that it comes with peace of mind built in. Based on the industry standard, AutoCAD,® it's the only one of its kind that allows you to share files quickly and accurately with nearly 1.8 million AutoCAD and AutoCAD LT users worldwide. That means you can communicate ideas and iterations with just about anyone in the industry, whether they're clients, contractors or partners. You can't buy that kind of access, but you can get it free with AutoCAD LT. And when you do, you can rest assured you're investing in a product line that will grow as your business grows. So don't wait. The sooner you put AutoCAD LT to work for you, the sooner you'll see just how invaluable our extras really are.

New AutoCAD LT for Windows® 95

Designed for Microsoft® Windows® 95

Provides all the benefits of Windows 95 and Office™ 95 compliance, including Windows NT™ support. Based on AutoCAD R13. Powerful CAD tools such as NURBS curves, advanced geometry and complex linetypes. Plus set-up wizards, a property painter and real-time pan and zoom make it easier than ever to use.

Microsoft® OFFICE Compatible

AutoCAD LT for Windows® 3.1

If you're not yet ready for the move to Windows 95, you can still reap the benefits of AutoCAD LT for Windows 3.1 (formerly known as AutoCAD LT Release 2) at a new low price. Based on AutoCAD R11 and R12.

True AutoCAD Compatibility

AutoCAD COMPATIBLE

Other CAD packages claim to read and write .DWG, but in reality they can only translate it. AutoCAD LT's native .DWG file format means that you can share files without worry. No long waits as your files load, no ballooning file sizes and no translation errors.

VISIT YOUR LOCAL RETAILER TODAY, OR TO RECEIVE YOUR FREE DEMOPAK, CALL 1-800-228-3601* AND ASK FOR DEMOPAK A142. TO UPGRADE CALL 1-800-435-7771 AND ASK FOR OFFER J28.

Autodesk. DESIGN YOUR WORLD™

Visit our web site for more information about Autodesk products, http://www.autodesk.com. *Outside the U.S. and Canada, fax 206-860-2196. Pricing in U.S. dollars, estimated street price. Certain restrictions may apply. © Autodesk, Inc. Autodesk, the Autodesk logo and AutoCAD are registered trademarks, and Design Your World is a trademark of Autodesk, Inc. Windows 95 and Windows 3.1 are registered trademarks and Office Compatible and Windows NT are registered trademarks of Microsoft Corporation.

Digital Pulse-Width-Modulator Circuit for Motor Control

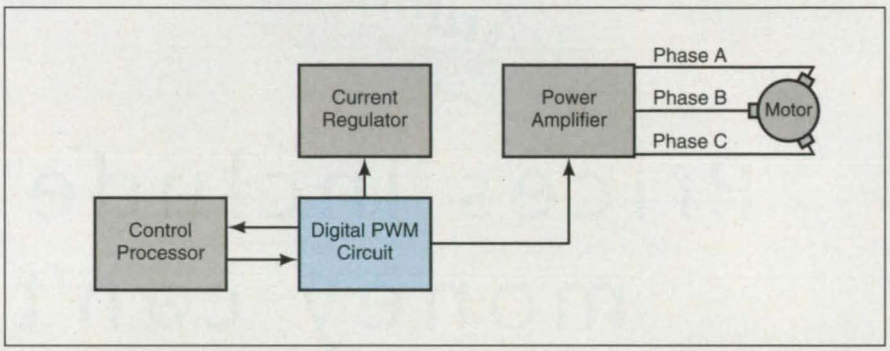
The all-digital design reduces noise.

Lewis Research Center, Cleveland, Ohio

A digital pulse-generator circuit of the pulse-width-modulator (PWM) type has been designed to be part of a processor-controlled servo loop that controls the shaft angle of, and the torque applied by, a three-phase brushless dc motor. This circuit can be characterized as a bus-controlled, externally synchronized, three-channel pulse generator of fixed period and programmable pulse width. The all-digital design of this circuit evolved from several requirements, including (1) the desirability of minimizing the number of digital-to-analog and analog-to-digital conversions in order to minimize the noisy signal components that are generated in such conversions and (2) the requirement that this circuit interact with digital circuits connected to its input and output terminals.

Control of the motor torque and shaft angle requires the generation of three-phase commutation signals and control of the motor current and is effected in terms of the starting times and durations of pulses of current applied to the three phase windings of the motor. The role of the digital PWM circuit in this control scheme (see figure) is that of an interface between a digital control processor and power amplifier that applies the pulses to the motor windings.

The solution of the servo equations for this control scheme results in commutation data in the form of three numbers that represent the relative duty factors of the three motor control phases needed to produce a desired commutation angle. The commutation data are generated by a digital control processor in response to (1) torque and angle commands and (2) the instantaneous shaft angle as measured by a shaft-angle encoder.



The **Digital PWM Circuit** is a programmable three-channel pulse generator that generates control pulses for a power amplifier that applies current pulses to a three-phase dc motor. The digital PWM circuit also generates a synchronizing signal for a current regulator.

The digital PWM circuit receives the commutation data and processes them into control pulses with the required timing characteristics. More specifically, within the digital PWM circuit, the commutation data are loaded in parallel from control processor into three binary counters, one for each phase. A fourth counter is always set for a full count. All four registers are then clocked simultaneously to generate the control pulses. The fixed count in the fourth register governs the frequency of the control cycle. The control pulses are transmitted to the power amplifier via optocouplers.

This work was done by Tomasz Kachelski of Rockwell International Corp. for **Lewis Research Center**. *For further information,* ***write in 91*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-15876.

Universal FPGA-Burn-In Boards

A single design suffices for all FPGAs of the same type.

Goddard Space Flight Center, Greenbelt, Maryland

Circuit boards have been developed to provide enhanced capabilities for post-programming burn-in testing of field-programmable gate arrays (FPGAs). Like programmable read-only memories (PROMs), FPGAs are customized (programmed) for specific applications. Unlike PROMs, FPGAs feature programmable input and output. Also, in comparison with PROMs, FPGAs are more complex and have more contact pins. A single burn-in board suffices for testing all PROMs of a given type, but until now, no such board has been available for testing all FPGAs of a given type. The present burn-in boards accommodate the inherent complexity of FPGAs; a type of burn-in board is designed for use with any unit of a corresponding type of FPGA regardless of its specific program. Each burn-in board exercises an FPGA thoroughly and provides fail-safe connections to all pins.

Each burn-in board includes a set of 35-bit, maximal-length pseudorandom-bit-sequence (PRBS) shift registers for use in stimulating an FPGA via its pins. In the basic configuration of the board, one bit of one of the shift registers is matched with one and only one bit of the FPGA. The number of shift registers needed in a burn-in board of a given type thus depends on the number of input/output pins of the FPGA with which it is designed to be used. For example, it is necessary to include four 35-bit shift registers in a burn-in board for an FPGA that has 140 input/output pins. The connections between the shift-register bit pins and the corresponding FPGA pins are made via current-limiting resistors.

Each PRBS shift register cycles through $2^{35} - 1$ states (all states except 0000. . . 000) before it repeats. For adequate test exercise, the signals on the various pins of stimulating shift registers should be asynchronous; to prevent synchronism, oscillator frequencies for individual shift-register strings are chosen to differ somewhat.

One problem in designing a burn-in board to ensure adequate exercise of an FPGA arises from a combination of properties of PRBSs and of FPGAs. The relevant shift-register property is that half of the runs of consecutive 1's have length 1, one-fourth the runs have length 2, one-eighth have length 3, and so forth. The relevant property of FPGAs and other application-specific integrated circuits (especially those designed for testability) is the inclusion of pins through which counters, registers, state machines, and the like are forced into known states. The combination of these properties would cause an FPGA to return frequently to the "home" state, preventing exercise of all its states.

The solution to this problem is to make provision on each burn-in board for forcing certain control inputs to the inactive states. For example, one might need to tie an asynchronous "clear" pin high to enable a high-speed counter to sequence through all of its states. Typically, there is also a requirement that the board be fail-safe in the sense that an FPGA would not be damaged by an incorrect configuration. These requirements are satisfied by use of a "T" connection in which the relevant shift-register output pin is connected to the corresponding FPGA input pin via two series half-value current-limiting resistors, and the tie point between the two resistors can be connected to either the "hot" side of the power supply or to ground. Ordinarily, only a few such ties are needed for each board configuration. A side benefit is that the tie points on a board can be configured for a static burn-in, radiation, or environmental test, or external signal sources, such as pulse generators or pattern generators, can be safely connected for special tests.

These boards are made of materials designed to withstand extreme environmental conditions, including ionizing radiation and operating temperatures up to 150 °C. The boards include sockets, in which all active devices and current-limiting resistors are mounted. The use of sockets facilitates both testing and replacement of components to refurbish the boards. Power and ground-plane conductors on the boards are laid out for low inductance and generous decoupling for good transient response with many simultaneous switching outputs. Monitoring points are provided. Spare socket locations facilitate the incorporation of special drive circuitry as needed.

This work was done by Richard B. Katz and Kamal A. Soliman of **Goddard Space Flight Center**. *For further information,* ***write in 17*** *on the TSP Request Card. GSC-13726*

Multichannel Spatialization of Audio Signals

Sounds are made to appear to come from multiple sources at various distances and directions.

Ames Research Center, Moffett Field, California

A concept of spatialization of audio signals combines digital electronic signal processing with an extended form of stereophonic and binaural presentation. The audio signals are synthesized and fed to the hearer via a pair of earphones. The nature of the synthesis is such that sounds can be made to appear to come from multiple nearby and/or distant sources at various directions in front, behind, and/or to the side(s) of the listener's head. A system according to this concept includes multiple channels — one for each source to be synthesized.

The basic principle of operation of each channel is straightforward. Within each channel, the source audio signal is processed through a right and a left subchannel to the right and left earphone, respectively (see Figure 1). In any case other than that of a synthetic source directly in front of or behind the listener, the signal in one subchannel is delayed more than in the other subchannel; the difference between the delays is set equal to the difference between the times it would take sound to travel to the two ears from a real source at the apparent position of the synthetic source.

While the perception of direction of a sound entering the ears depends largely on the difference between times of arrival of the sound at the two ears, this perception also depends on differences in amplitude and on modifications of the sound by interactions with nearby surfaces of the head — especially the pinnae of the ears. From these effects, the brain derives additional directional cues. These effects can be quantified in terms of a direction-dependent impulse response that is convolved with the source audio signal on its way to each ear.

Accordingly, to enhance the directional percept, the processing in each subchannel includes convolution with an approximate version of the direction-dependent impulse response. This convolution is effected by a finite-impulse-response (FIR) filter for the direction in question. In practice, the FIR filter is designed to implement a synthetic head-related transfer function (HRTF) with amplitude and phase responses (as functions of frequency) that approximate those of the desired impulse response. The HRTF for each ear can be synthesized or else derived from measurements of the amplitude- and phase-vs.-frequency responses in sound arriving at the ear from the direction in question.

Figure 2 is a block diagram of a system that can produce sounds appearing to come from as many as four sources. Prior to the delay and FIR processing in each channel, the source audio signal is sent through a low-pass filter (LPF) with a typical cutoff frequency of 10 kHz, then digitized at a typical sampling rate of 32 kHz. [This particular choice of cutoff and sampling frequencies facilitates the design of practical low-pass and FIR filters that, together, adequately approximate the desired overall frequency response.] The delay and FIR processing in each channel and subchannel is performed by integrated-circuit digital signal processors in conjunction with programmable read-only memories that store information on the differential delays and FIR filter coefficients. These integrated circuits can be packaged in plug-in units that can easily be inserted and removed to change the apparent position of the source synthesized in each channel.

After digital processing, the signals in the various subchannels are fed to digital-to-analog (D/A) converters. The D/A outputs are smoothed, then fed to left and right summing networks, which sum the signals from all the left and right subchannels, respectively. The outputs of the summing networks are amplified and fed to the corresponding earphones.

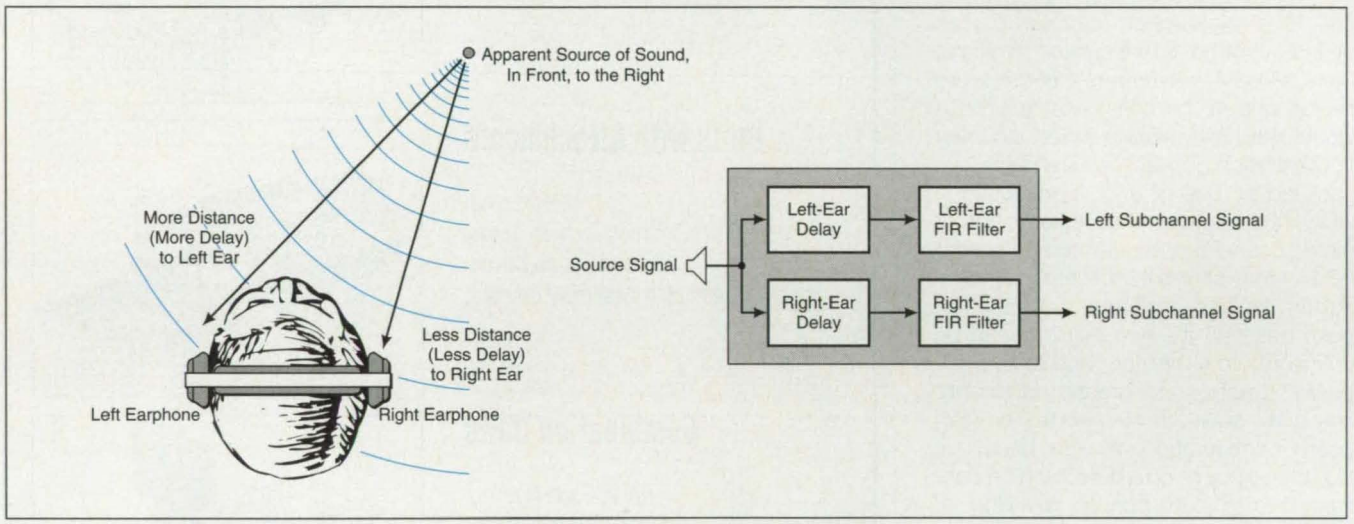
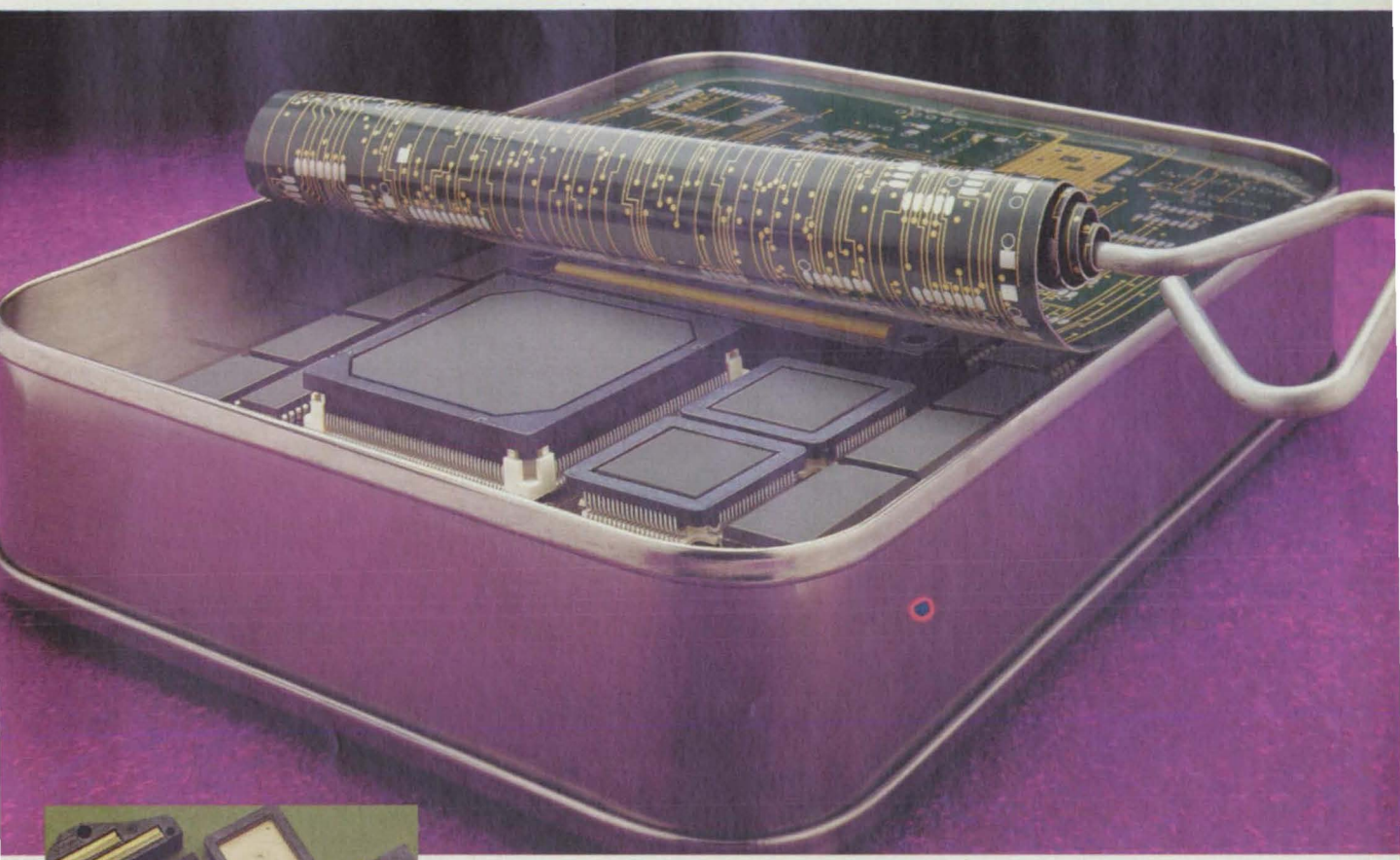


Figure 1. An **Audio Signal is Processed** in right- and left-ear subchannels to give the sensation of sound coming from a source at a specified apparent position.

How to beat the squeeze in today's tight design environments.



AMP fine-pitch solutions are available for many applications.

High-density design is a cramped world. Our interconnect expertise can make life easier.

Because every design is unique, we'll show you all the options. We'll guide you through your choices – while watching system performance, manufacturability and cost.

We'll also offer choices in socketing, I/O, and board-to-board interconnects. From conventional (0.050" and 2mm centers), to sublime (redundant contact on board pads 0.015" wide, on 0.025" centers, with non-critical alignment).

We'll make sure you meet tight electrical characteristics and space limitations. And we provide technical information, literature, and 2D and 3D models of many product lines to shorten design time.

We'll show you how your system will fit successfully into production with packaging help, training and maintenance support.

We also can design and build sub-systems, or even fabricate your entire product. Call today to learn more.

AMP is a trademark.

Connecting at a HIGHER level.™

Product Information Center: 1-800-522-6752 (fax 717-986-7575). AMP Incorporated, Harrisburg, PA 17105-3608. In Canada, call 905-470-4425. On the Internet:http://www.amp.com.

AMP

For More Information Write In No. 638

This work was done by Durand R. Begault of **Ames Research Center**. *For further information,* ***write in 88*** *on the TSP Request Card.*

This invention has been patented by NASA (U.S. Patent No. 5,438,623). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Ames Research Center; (415) 604-5104. Refer to ARC-13381.

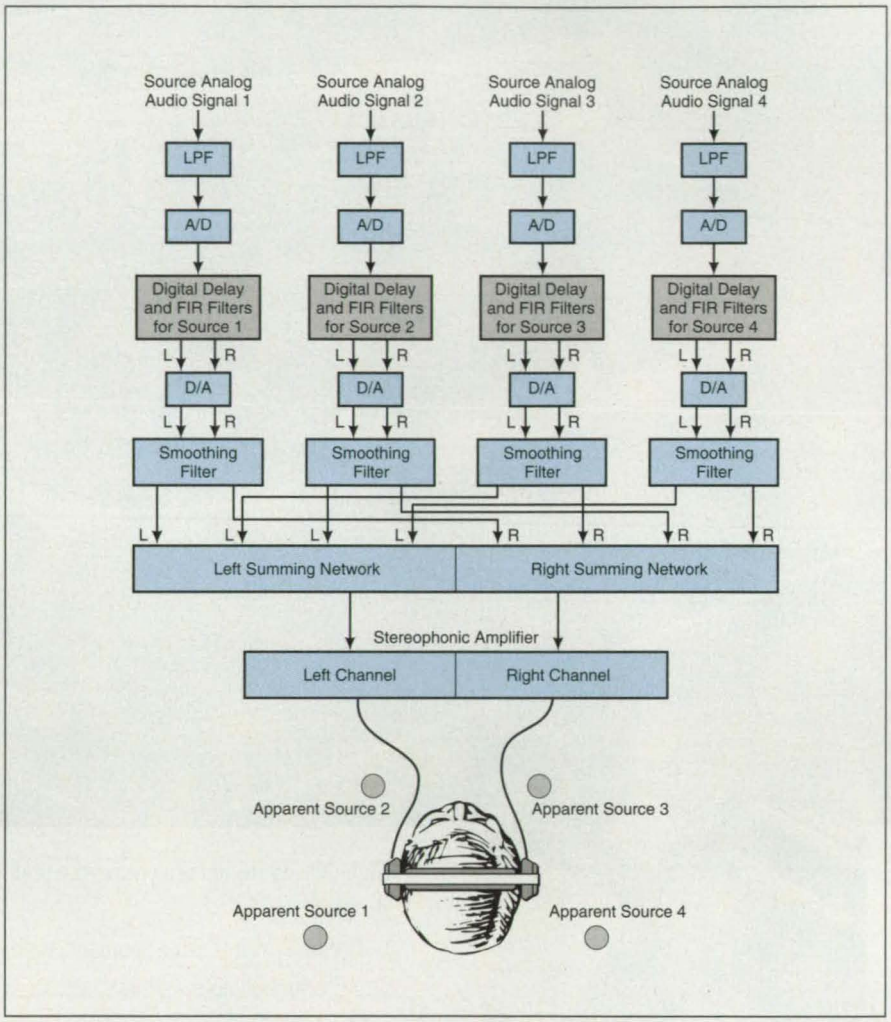


Figure 2. **Synthetic Sounds From Four Apparent Sources** are combined and presented to the listener via earphones.

Adaptive Control for Active Noise-Cancellation System

Marshall Space Flight Center, Alabama

A control subsystem of an active noise-cancellation system is based partly on a high-performance recursive least-squares adaptive-filter algorithm. The antinoise computed by the control subsystem is generated by loudspeakers at various locations in a room to be quieted. The loudspeakers can be rotated, taking advantage of their directional characteristics to provide additional degrees of controllability for more nearly complete cancellation of noise. The implementation of these concepts in conjunction with other noise-cancellation techniques provides cancellation of both quasi-periodic and broadband random noise.

This work was done by Jen-Yi Jong of AI Signal Research, Inc., for **Marshall Space Flight Center.** *For further information,* ***write in 31*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center; (205) 544-0021. Refer to MFS-26317.

New From Astro-Med... World Leader in Chart Recorders

NO CHART!

INTRODUCING AstroDAQ™

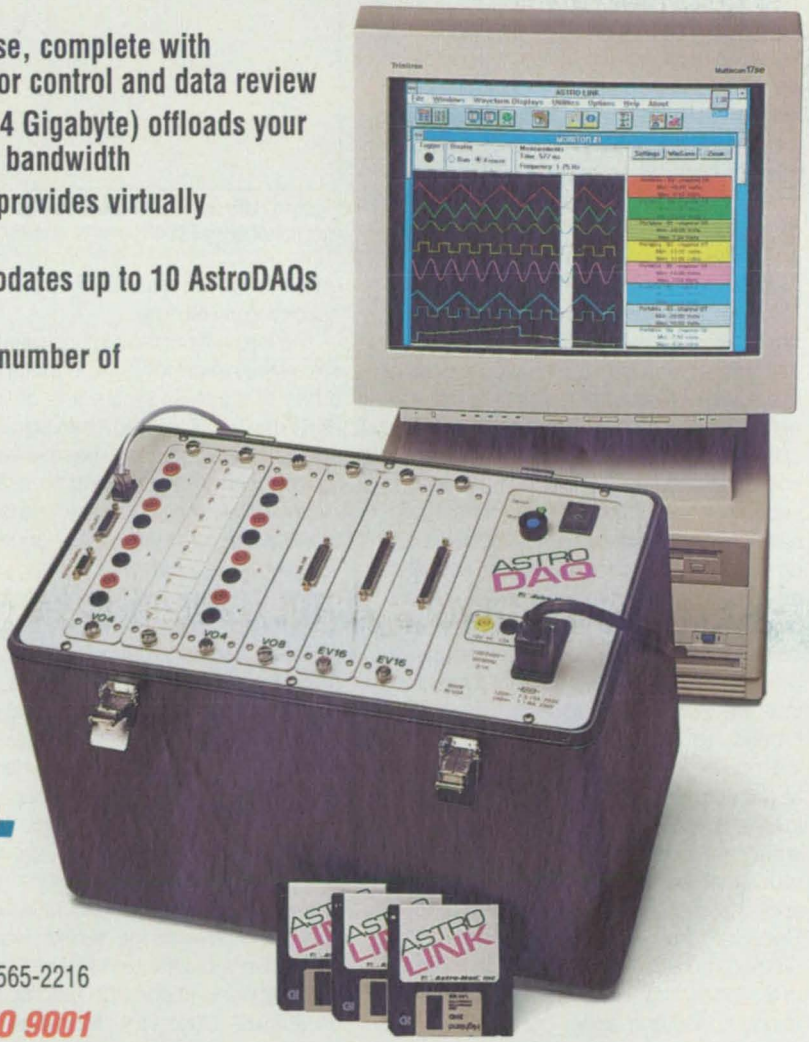
Astro-Med's new AstroDAQ is a complete and *ready-to-use* system for acquiring, conditioning, analyzing, and networking data from a wide variety of applications in industry, aerospace, and science.

Up to 30 channels of data can be acquired by each AstroDAQ and up to 10 AstroDAQ systems can be networked for recording up to 300 channels of information. The data is acquired and conditioned with Astro-Med's advanced DSP-based "front end". The internal hard drive of the AstroDAQ stores the data for immediate or subsequent analysis on a PC.

And, if continuous hard copy is required, a *real-time* recorder featuring Astro-Med's famous direct thermal technology is a convenient option.

- **AstroDAQ is a *total system*, ready-to-use, complete with Windows based AstroLINK™ software for control and data review**
- **Internal sampling and hard drive (1 or 4 Gigabyte) offloads your PC for other duties and guarantees the bandwidth**
- **DSP built into each signal conditioner provides virtually unlimited programmable filtering**
- **High speed network interface accommodates up to 10 AstroDAQs with a total of 300 channels**
- **Sample rate up to 5 kHz unaffected by number of channels acquired**
- **Internal battery comes standard and provides a UPS**
- **Real-time hard copy with optional Astro-Graph® direct thermal recorder**
- **Portable as well as rack mount versions**

Call, fax, or write for brochure today!



Astro-Med, Inc.®

Astro-Med Industrial Park
West Warwick, Rhode Island 02893
Phone: (401) 828-4000 • Toll Free (800) 343-4039
Fax: (401) 822-2430 • In Canada Telephone 1-800-565-2216

Astro-Med is System Certified to ISO 9001

Sales and Service Centers throughout the U.S., Canada and Europe. Dealers located throughout the world.

Using Acoustic Waveguides To Probe Materials Ultrasonically

Properties of surrounding material affect propagation of sound in a waveguide.

Marshall Space Flight Center, Alabama

Figure 1 schematically illustrates a method of ultrasonic measurement of some of the mechanical properties (principally, those related to shear and to attenuation of sound waves) of a material. The measurements are performed by the ultrasonic pulse/echo technique, using two acoustic waveguides: a sensor waveguide partly embedded in the material and a nonembedded reference waveguide. Both waveguides are connected to a piezoelectric transmitting/receiving ultrasonic transducer at one end, while the other ends of both waveguides are free. This method offers two important advantages over other ultrasonic methods: the pulse/echo technique makes it possible to probe the specimen with access to one side only, while the reference waveguide provides comparative measurements that make it possible to compute some properties of the probed material independent of the response of the instrumentation and independent of changes in the temperature of the waveguides.

The method was devised for monitoring changes in shear and loss moduli (also denoted as acoustic-attenuation moduli or shear viscosities) during aging of the rubbery materials that are used as propellants and liners in solid-fuel rocket motors; it should also be applicable to monitoring of such changes during aging of other materials. Embedded acoustic waveguides can be used to measure shear and acoustic-attenuation properties; moreover, embedding waveguides extends the capabilities of conventional ultrasonic techniques by providing *in situ* measurements for regions that are inaccessible to external sensors. Ultrasound propagating in an acoustic waveguide is attenuated by loss of energy to the surrounding material; the amount of loss is a function of the longitudinal and shear velocities of sound and the loss moduli of both the acoustic waveguide and material in which it is embedded. Because the shear and loss moduli change more than does the bulk modulus of a rubbery material of the type in question during curing and aging, the amplitudes of ultrasonic waves transmitted through an embedded waveguide should change accordingly with time.

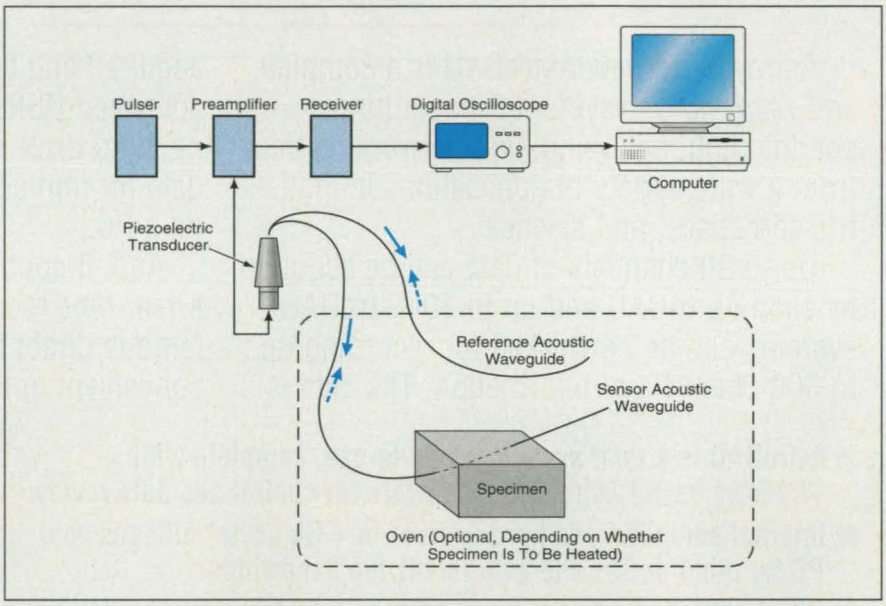


Figure 1. **Ultrasonic Pulse/Echo Measurements** in the two acoustic waveguides can be used to monitor changes in shear and acoustic-attenuation properties of the specimen material.

The feasibility of the method was demonstrated with a prototype apparatus in which a pair of stainless-steel wires of 0.033-in. (0.84-mm) diameter served as the acoustic waveguides. These waveguides were attached at one end to a 300-kHz piezoelectric transducer by use of a urethane adhesive. Part of the length of the sensor waveguide was embedded in a curing specimen of inert propellant that comprised polybutadiene acrylonitrile (PBAN) filled with aluminum, potassium chloride, and iron oxide powders. To prevent overlap of ultrasonic pulse echoes, the reference and sensor waveguides were made of different lengths; namely, 78 and 100 cm, respectively. Comparison of the measurements of ultrasonic pulses in the reference and sensor waveguides yielded quantitative indications of both speed of propagation and attenuation of acoustic waves in the sensor waveguide as functions of time (see Figure 2).

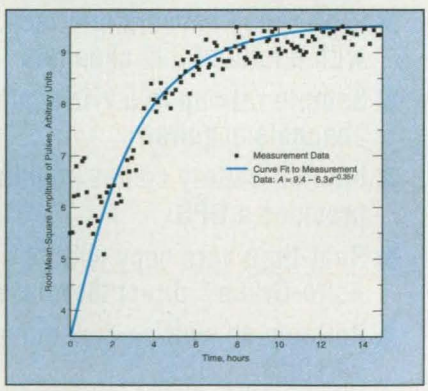
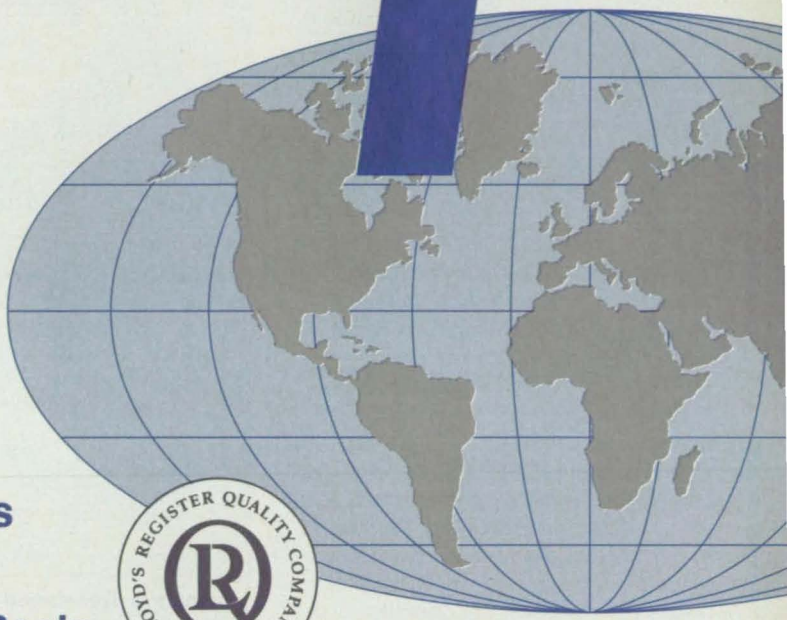


Figure 2. **Amplitudes of Ultrasonic Pulse Echoes** were measured while the specimen was cured for 15 h at a temperature of 200 °F (93 °C). The asymptotic exponential curve fit to the data corresponds to a linear attenuation response. The poor fit between the curve and the measurement data during the first hour is attributed to initial heating of the specimen from ambient temperature.

This work was done by Timothy E. Doyle of Thiokol Corp. for **Marshall Space Flight Center**. *For further information,* ***write in 80*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center; (205) 544-0021. Refer to MFS-31071.

DSM Desotech is 1ST for Custom UV/EB Coatings



1ST Commercial UV Coating for Optical Fiber

1ST EB Curable Coating for Magnetic Media

1ST UV Curable SMC Sealer

1ST Commercial UV Curable Rapid Prototyping Resins

1ST UV Curable Paper Transparentizing Resin

DSM Desotech is always at the forefront of commercializing important advances in ultraviolet light and electron beam cured (UV/EB) coating technology. UV/EB coatings help you increase productivity, enhance product performance and achieve EPA compliance.

DSM Desotech custom formulates and manufactures world famous DeSolite® UV/EB coatings for application on paper, metal, plastic, glass and wood.

For more than 20 years, DSM Desotech has worked closely with customers in developing DeSolite® coatings and binders for a variety of products including compact discs, beverage labels, floor tiles, SMC sealers, galvanized steel pipes and appliance panels.

DSM Desotech is a member of the $5 billion DSM family and offers you manufacturing facilities in the U.S., the Netherlands and Japan. Our global presence assures you that DSM Desotech will quickly and efficiently serve your needs.

Find out more. Call **1-800-223-7191**
Ask for the Formulated Polymer Products Team. Let DSM Desotech solve your special coating challenge.

DSM Desotech Inc. . 1122 St. Charles Street
Elgin, Illinois 60120 . USA
Phone: (847) 468-7721 . Fax: (847) 468-7785
ISO 9001 Certified
DSM Desotech bv . P.O. Box 68
3150 AB Hoek van Holland . The Netherlands
Phone: +31 1743 15544 . Fax: +31 1743 15523
ISO 9002 Certified

DSM Desotech Inc.

DSM

Technology You Can Depend On

Apparatus Monitors Ammonia Content of Process Stream

The ammonia content can be read continuously.

Lyndon B. Johnson Space Center, Houston, Texas

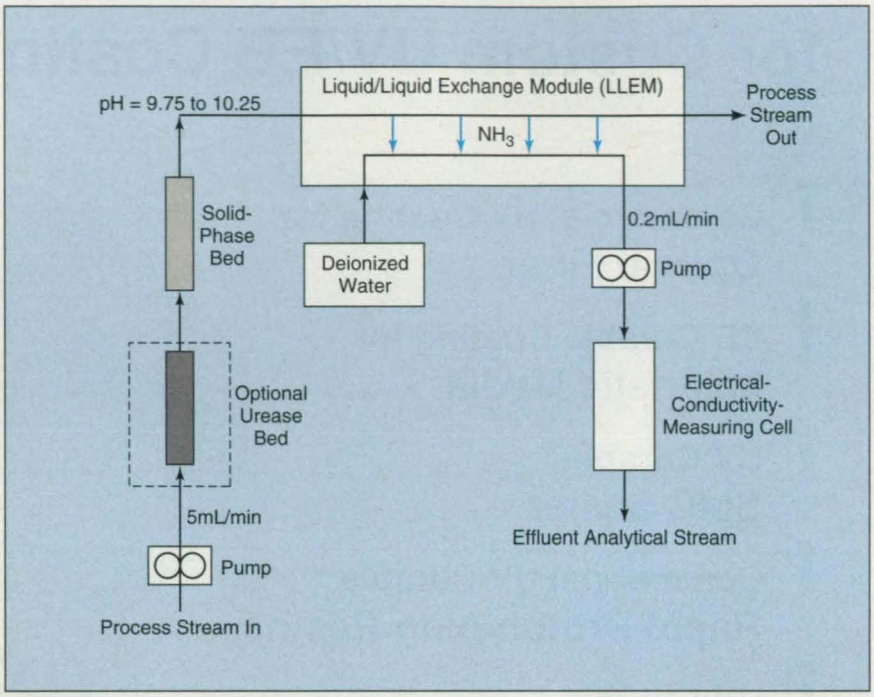
The apparatus shown schematically in the figure is an ammonia monitor. It provides continuous, real-time determination of the concentration of ammonia in an aqueous process stream. The ammonia monitor exhibits predictable response characteristics over a wide dynamic range of concentrations from less than 10 μg/L to 20 mg/L with a response time of eight minutes or less.

Operation requires no reagents because pH is controlled by an in-line solid-phase base (SPB). During operation, ammonia is selectively transported across a membrane from the process stream to an analytical stream under pH control. The specific electrical conductance of the analytical stream is measured and used to determine the concentration of ammonia.

The ammonia analyzer was designed primarily to monitor recycled water in a closed-loop environmental life-support system. Accurate and timely measurement of ammonia in the recycled water is needed to ensure proper operation of the wastewater-reclamation equipment. The monitor can also be adapted to a flow-injection configuration with two parallel distilled-water streams and a flow-injection valve resulting in similar sensitivities and very short response times.

Unique to this instrument is the control of pH in the process stream by proprietary solid-phase technology embodied in the SPB, and optimal ammonia transport using an efficient, hollow fiber liquid/liquid exchange module (LLEM). After passage through the SPB, the pH of the process stream rises to 10.00 ± 0.25, and ammonium ions are converted to ammonia gas. The ammonia-laden alkaline stream then passes through the LLEM, where ammonia is selectively transported to the parallel analytical stream. Selectivity is gained because gaseous speciation of likely amine and acidic interferences is not favored at this pH.

The LLEM contains a gas-permeable membrane composed of hollow fibers made from a hydrophobic, microporous polymer. When this membrane comes in contact with water, gas trapped in pores acts as a barrier to diffusion of non-gaseous species and a channel for gaseous species. The hydrophobicity and small pore size of the polymer stabilizes this gas barrier, which can be overcome only at hydrostatic pressures in excess of 200 psi (1.38 MPa). Rapid transport of gas along these channels is facilitated by the high porosity (40 percent) and thinness of the walls of the hollow fibers.



Ammonia Is Transferred from the process stream to the analytical stream, where its concentration is measured in terms of electrical conductivity.

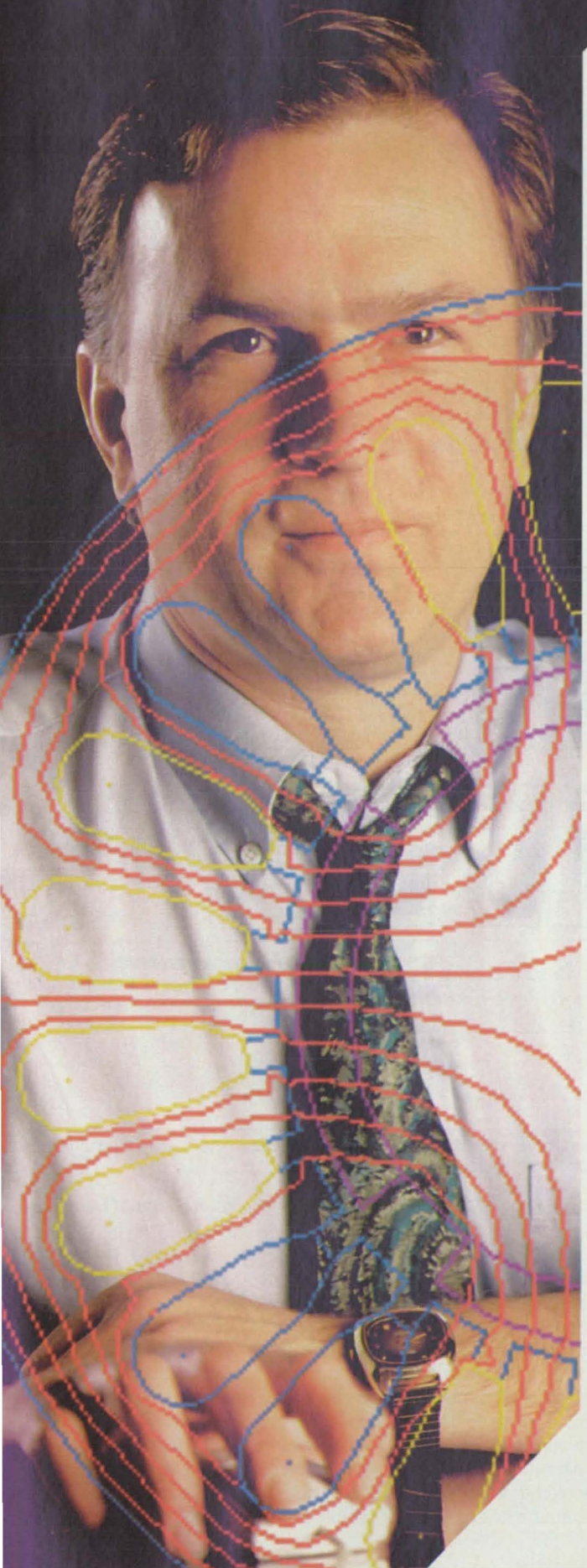
In the alkaline (high-pH) condition produced in the process stream, the chemical potential of ammonia increases and ammonia is pumped across the membrane into the analytical stream. The pH of the analytical stream rises due to the reaction of ammonia with water to form ammonium and hydroxyl ions. The pH continues to rise until the chemical potential of ammonia is equalized across the membrane. The number of conductive ions in the analytical stream depends on total ammonia concentration and the pH of the process stream, and on the equilibration time. As a result, the measurement of specific conductance in the analytical stream provides a simple and reliable method for determining the total concentration of ammonia.

With minor modification, the apparatus can be used to monitor such related chemical species as urea. An additional bed containing immobilized urease upstream of the SPB can catalyze the decomposition of urea to form ammonium and carbonate ions in solution. Ammonia is produced downstream of the SPB and detected as before. Other chemical species that contain nitrogen and are amenable to chemical conversion to ammonia can also be quantitated in this manner.

The use of this apparatus offers obvious advantages over conventional technology, such as continuity and timeliness when compared to discontinuous sampling with attendant time-consuming preparation and analysis of samples. The solid-phase pH control eliminates the need for mechanical injectors and mixers, and for the preparation of pH buffers. Also, the levels of contaminants added by the SPB are low, remaining below the maximum levels allowed by NASA requirements for potable water. The segregation of the analyte from potential interferences also improves the reliability and reduces the complexity of the measurement. Conductivity is measured by use of a simple, robust, drift-free sensor subsystem; this feature enhances the stability of the instrument, especially when the only fluid that makes contact with the sensor is pure water or water containing a minor amount of ammonia.

This work was done by Richard Sauer of **Johnson Space Center** *and James R. Akse, John O. Thompson, and James E. Atwater of Umpqua Research Co. For further information,* ***write in 78*** *on the TSP Request Card. MSC-22270*

DO GOOD WORK. FAST!



Integrated's line of ***electromagnetic*** software, using the boundary element method (BEM) performs effortlessly...so you can analyze, customize and finalize, quickly and easily. You save time and money through:

- immediate productivity
- reduced prototyping costs
- accurate, efficient solutions
- expert technical support.

"Integrated's BEM software provides accurate results and improves motor design cycle time without a complex FEM mesh."

Mark R. Thomas, R&D Engineering Manager,
Prestolite Electric Inc.

We're on the cutting edge of CAE design and analysis, bringing you the ***most advanced electromagnetic software available anywhere.*** Our high powered, user-friendly software enables you to optimize your designs with incredible efficiency.

We provide you with sample problems plus a database of solved industry-specific designs. Also, IGES or DXF geometry translators and ***parametric*** definitions accelerate the synthesis of your own solutions.

"Integrated's software optimizes our high voltage accessory and insulator designs...reducing material cost and enhancing performance."

Tom Bialek, Senior Product Development Engineer,
Raychem Corporation

Count on full technical support, via phone, fax or e-mail, plus you receive ***regular software enhancements*** each year.

Installation time and the "software learning curve" barely form a speed bump on the road to ***doing good work, fast*** with Integrated's software. ***Call today for a 30-day trial.***

Electromagnetic Applications:

- AC/DC motors
- switches & sensors
- low/high voltage systems
- magnetic systems
- actuators
- cables
- other systems

Solution Capabilities:

- electromagnetic fields
- torque & force
- eddy currents & ohmic losses
- skin & proximity effects
- R, L, C, G & Zo
- temperature & heat flow
- trajectories

INTEGRATED
ENGINEERING SOFTWARE

Phone: (204) 632-5636 Fax: (204) 633-7780
e-mail: info@integrated.mb.ca

For More Information Write In No. 607

Real-Time Flush Air-Data Sensing System

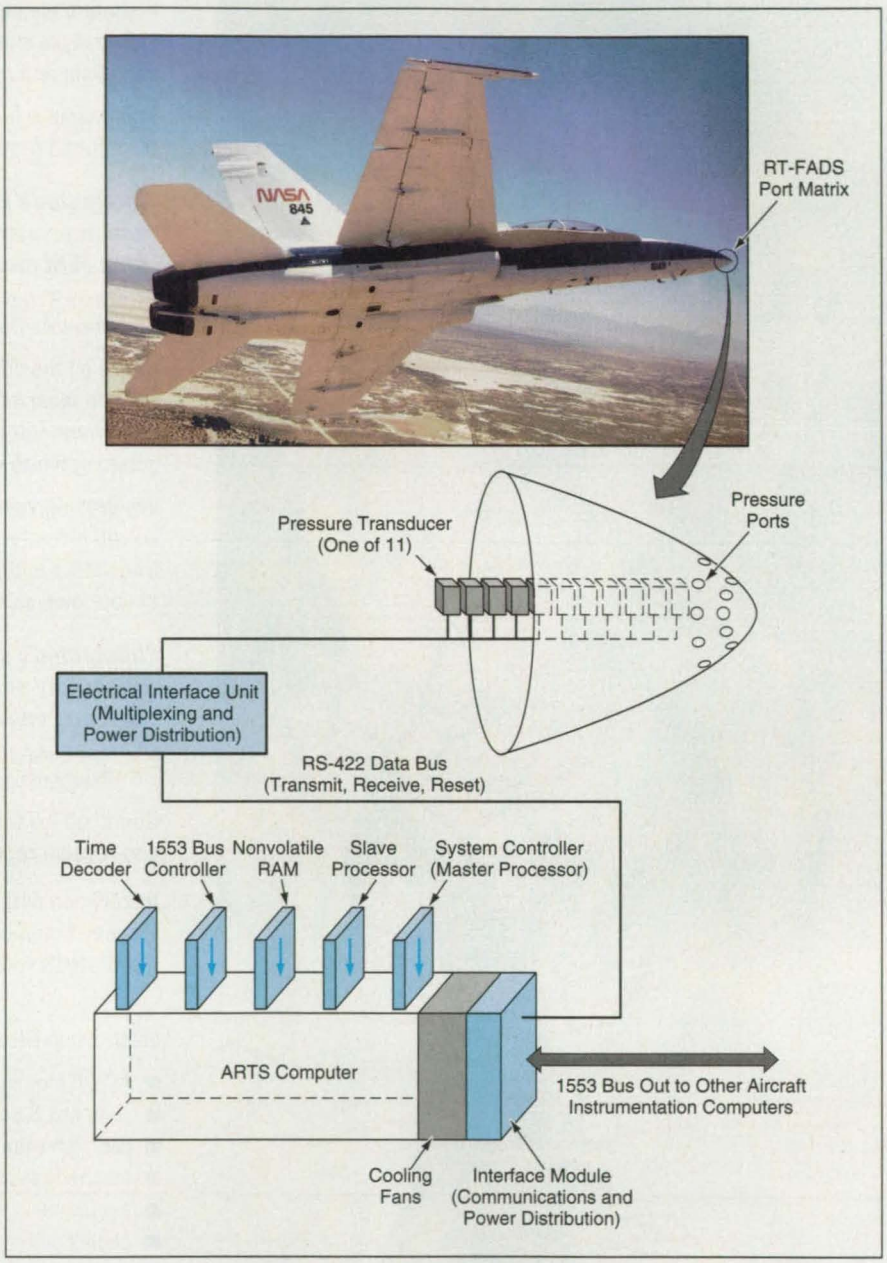
Relatively nonintrusive instrumentation performs measurements for flight control and research.

Dryden Flight Research Center, Edwards, California

The figure schematically illustrates an advanced prototype real-time flush air-data sensing (RT-FADS) system installed in the F-18 Systems Research Aircraft based at NASA Dryden Flight Research Center. This system is the most recent in a series of prototype FADS systems that have been undergoing development since the early 1980s. The RT-FADS system senses pressures at 11 locations in the airflow about the airplane and processes the sensor outputs into air-mass reference data (commonly called "air data" in aeronautical disciplines) in real time for use in research and flight control. Unlike many older air-data instrumentation systems, the RT-FADS system does not include intrusive external booms and pitot tubes that extend beyond the local flow fields, are vulnerable to damage, are sensitive to vibration and misalignment, and can perturb airflows substantially and even degrade aircraft performance. Instead, the RT-FADS system includes an array of 11 small pressure ports molded flush with the outer surface of the aircraft nose cap.

Miniature absolute-pressure transducers based on strain gauges are connected to the pressure ports. The outputs of the sensors are low-pass filtered with a limit frequency of 20 Hz, amplified, and digitized to 20 bits. The resulting data are multiplexed for asynchronous serial transmission to the Airborne Research Test System (ARTS) computer, which is an advanced computer that has been made rugged for high-stress flight environments.

The ARTS architecture links processor circuit boards with multiple functionalities through a backplane by use of a commercially available real-time operating system and provides simultaneous multiprocessor, multifunction capability. Data are collected and processed by two commercially available 68040-based single-board computers in a master/slave relationship. The master processor acts as the system controller and manages the flow of data through the system; it services the slave processor, which communicates with the transducers and calculates the air data from the transducer output data. The master processor communicates with other aircraft instrumentation computers through a 1553 bus controller card and a dedicated 1553 bus. Other cards in the ARTS computer include a nonvolatile random-access memory for storage of programs and data, and a time decoder for data time tags. With the exception of the interfaces to the real-time operating system, all programs are in the C programming language.



Pressure Sensors Connected to Ports Flush with the Surface of the nose cap provide surface pressure data from which air data can be calculated.

In processing the transducer output data, the ARTS uses an algorithm derived from an overdetermined set of equations for the 11 measured pressures in terms of four air-data parameters; namely, the dynamic pressure, static pressure, angle of attack, and angle of sideslip. (Most other air-data quantities of interest can be calculated from these four parameters.) Because the equations are nonlinear (and thus cannot be directly inverted to calculate the air data as functions of the measured pressures), the transducer output data must be used to infer the air data indirectly by use of a nonlinear least-squares regression.

Within each computational cycle, the algorithm is linearized about a starting air-data value for each port. The resulting overdetermined system of perturbation equations is solved by use of a weighted-least-squares technique. At the end of least-squares regression, the resulting perturbation is added to the starting

COMPLEX HEATING SPECIFICATIONS WELCOME.

(ACCEPTING NEW APPLICATIONS ON A DAILY BASIS.)

When you're in need of a heat solution, select the supplier who can help make your product more competitive or your manufacturing process easier. Call Watlow.

Whatever the complexity of your application, Watlow can be your single source supplier for both development and integration of heaters, sensors, and controllers. We've increased heater reliability in a military satellite, reduced component size for a soldering iron used in fiber optic cable splicing and added multi-loop intelligence in circuit board manufacturing. We'll work to meet your design considerations, too.

Get Our New Guide to Selecting the Best Source for Your Heat Solution.

Want proof? We've detailed our solutions to some of our most complex and demanding customer requirements. Call 314-878-7820, ext. 2326, or fax us at 314-878-2369 for your free copy.

WATLOW

http://www.watlow.com

value and the system is relinearized about the resulting update. Typically 2 to 8 cycles of iteration are needed to obtain convergence. The redundancy in the overdetermined system can be exploited to provide robustness in the presence of noise and to eliminate readings from malfunctioning sensors without significant degradation of air-data calculations.

In flight tests of the system, calibrations were performed by use of reference air-data values generated from sources that included measurements from other onboard instrumentation, measurements from the inertial navigation system of the airplane, radar-tracking velocity and position measurements, and rawinsonde weather-balloon sounding data. The calibration parameters were estimated by substituting the reference air data into the equations for the measured pressures and using a nonlinear regression to identify the calibration parameters.

The flight tests included mach numbers as high as 1.6 and angles of attack greater than 45°. The performance of the RT-FADS system was evaluated by comparing the air data computed by the RT-FADS with those from the aircraft air-data computer (ADC) derived from other aircraft instrumentation. Although the ADC outputs are subject to measurement errors similar to those of the RT-FADS system, at least they constitute accepted standards for comparison. The comparisons indicated nominal agreements within approximately 0.003 in mach number and 0.2° in angles of attack and sideslip.

This work was done by Stephen A. Whitmore, Roy J. Davis, and John Michael Fife of **Dryden Flight Research Center.** *For further information,* ***write in 18*** *on the TSP Request Card. DRC-95-33*

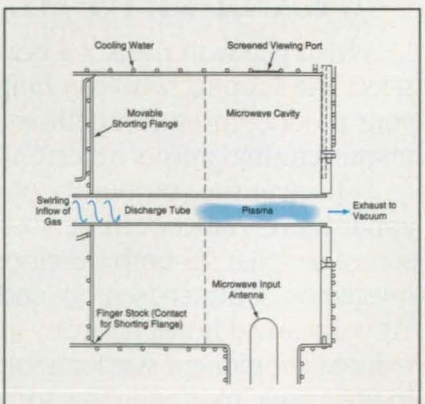
Generating a Stable, Rotating, Free-Floating Plasma

The plasma is formed in an axisymmetric flow of gas through a microwave cavity.

Lewis Research Center, Cleveland, Ohio

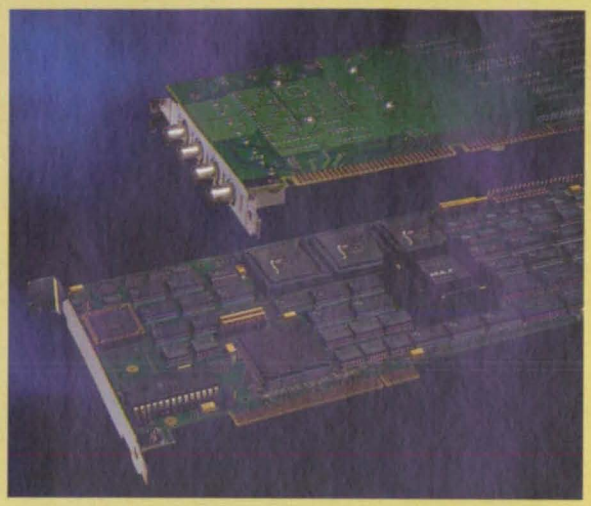
The figure illustrates an apparatus for generating a controlled high-power plasma that could be useful as a pulsating and/or rotating source of electromagnetic radiation and/or ionization. A gas, in which the plasma is to be formed, flows through a cylindrical dielectric discharge tube that extends through a microwave cavity. The cavity is tuned to an electromagnetic-field mode in which the electric-field lines are concentrated along the axis of the cavity and discharge tube.

The gas is injected into the tube in a swirling flow about the cylindrical axis. The flow rate and pressure of the gas and the power of the microwave signal



A **Stable, Rotating Plasma** is formed within the discharge tube, away from the wall.

60 MSPS, 12 Bit A/D on PCI Bus



Product of the Month

CompuScope 6012/PCI

- Up to 60 MSPS, 12 Bit Sampling A/D on PCI Bus
- Up to 100 MB/s Transfer Rate to PC Memory
- Stream A/D Data to PC Memory at 60 MSPS

2 GS/s A/D Card

CompuScope 2125/ETS

2 GS/s Sampling A/D for Repetitive Signals
250 MSPS, 8 Bit Real Time Sampling A/D
Software Driver to Emulate Tek TDS 520

CompuScope ISA Bus Products

60 MSPS, 12 Bit A/D Card -- 61 dB SNR
Up to 16 Meg Memory
LabVIEW VI's Available
Drivers in C, BASIC, Windows DLL,...
Free GageScope Software
Many Other Models Available

CS6012/PCI	PCI BUS	12 bit / 60 MSPS / 512K	$8,995
CS6012	ISA BUS	12 bit / 60 MSPS / 512K	$6,995
CS512	ISA BUS	12 bit / 5 MSPS / 512K	$2,795
CS2125/ETS	ISA BUS	8 bit / 2 GS/s / 256K	$5,495
CS250	ISA BUS	8 bit / 100 MSPS / 32K	$3,500
CSLITE	ISA BUS	8 bit / 40 MSPS /16K	$595

U.S. Prices listed above. International prices may vary

CALL 1-800-567-GAGE

Ask for extension 3406

4 2 4 3

GaGe

GAGE APPLIED SCIENCES (U.S.) INC.
1233 Shelburne Road, Suite 400
South Burlington, VT 05403
Tel : (800) 567-4243. Fax : (800) 780-8411
CompuServe : 73042,346
e-mail: prodinfo@gage-applied.com
web site: http://www.gage-applied.com

From outside the United States, contact Gage Applied Sciences Inc., 5610 Bois Franc, Montreal QC, Canada H4S 1A9 Tel: (514) 337-6893 Fax: (514) 337-8411 BBS: (514) 337-4317

are adjusted to form a plasma discharge in the tube. This plasma forms at the location of the most intense standing-wave electric field in the microwave cavity. As the flow rate, pressure, and microwave power are increased, the shape, location, and rotation of the plasma change. First, the plasma coalesces into a nonaxisymmetric volume, at least one end of which is attached to the inner wall of the discharge tube. Next, the plasma begins to rotate around the cylindrical axis, the rate of rotation increasing with increasing vortical inflow of the gas. Finally, the plasma contracts inward from the inner wall of the discharge tube to a diameter substantially less than that of the tube, becoming a symmetric spike that spins around the cylindrical axis, or another axis close to it, and remains fixed in location.

Once the plasma spike has been established, it can be maintained at any operating point within considerable ranges of absorbed power, flow rate, and pressure; these ranges extend both above and below the levels at which the plasma spikes initially. On increasing the power, the spike becomes elongated along the cylindrical axis and its diameter increases somewhat, while its basic shape, rotation, and axial location remain unchanged. The described phenomena have been observed at absorbed power levels up to 5 kW and pressures up to 1.2 atm in nitrogen, helium, and hydrogen gas flows, and should be generic to other gases.

This work was done by John L. Power of **Lewis Research Center** *and Daniel J. Sullivan of the Ohio Aerospace Institute. For further information,* ***write in 71*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-15802.

Miniature Quadrupole Mass Spectrometers

The main advantages would be small size, low mass, and low power consumption, with no sacrifice in resolution or sensitivity.

NASA's Jet Propulsion Laboratory, Pasadena, California

Quadrupole mass spectrometers containing arrays of micromachined cylindrical electrodes are undergoing development for use in detecting molecular species of interest in the atmosphere. These are miniature, refined versions of larger commercial quadrupole array mass spectrometers, and are meant to be powered by correspondingly miniaturized dc and radio-frequency electronic circuits. The primary goal of the development effort is to reduce power consumption and to achieve masses and volumes a tenth or less of those of the commercial devices. By maintaining dimensional tolerances at the 0.1-percent level, using

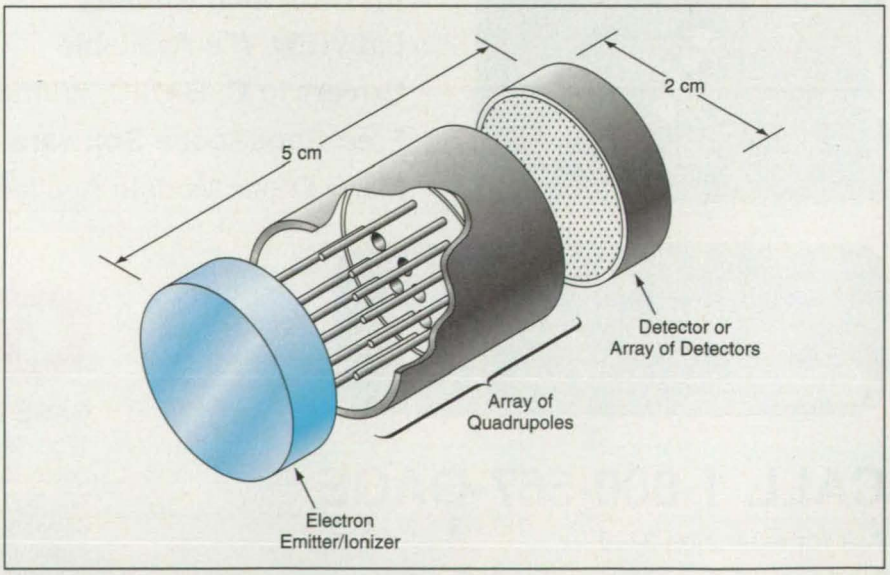


Figure 1. A **Quadrupole Mass Spectrometer Array** could be constructed in this configuration, with a mass < 100 g.

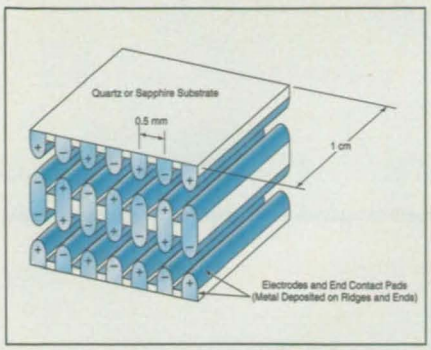


Figure 2. **Planar Arrays of Micromachined Cylindrical Electrodes** with alternating polarity would be stacked to obtain an array of quadrupoles.

higher radio frequencies, and using an array of analyzers, there need be no sacrifice in mass resolution or instrument sensitivity. Large numbers of these devices could be used in NASA manned and unmanned flight missions. They could also be more easily distributed to chemical-waste dumps, chemical-processing plants, and other sites where there is a need to monitor exhaust fumes.

The basic quadrupole mass-spectrometer design calls for an electron emitter/ionizer (or an array of electron emitter/ionizers), an array of cylindrical electrodes in quadrupole configuration, and an array of ion detectors (see Figure 1). A round cylindrical device array is shown in Figure 1. It is convenient for illustrating the basic design, and can be constructed using careful fabrication and alignment techniques. Each rod can be 15 to 25 mm long.

The geometry of another developmental quadrupole mass spectrometer array calls for stacked planar arrays of noncircular cylindrical electrodes, as shown in Figure 2. Fabrication of each planar array of electrodes in the stack would involve micromachining a quartz or sapphire substrate to produce cylindrical ridges of semicircular cross section, followed by masking and vapor deposition to deposit metal along the ridges to form the electrodes. Metal would also be deposited on the edges of the substrates at the ends of the ridges to provide electrode contact pads for connection to external circuits. The interval between successive ridges or valleys would be about 500 μm. Such arrays can also be manufactured by lithographic and electroplating (LIGA) methods. The micromachined arrays (Figure 2) can be as small as 1/100 the length of present commercial models, or rod length of 1.5 mm. To provide a quadrupole electric field, electrodes in successive layers in the stack would be aligned facing each other directly across the gap between them, while successive ridge-end contact pads would be connected to power-supply terminals of alternating polarity.

The array of ion detectors could be a microchannel plate or a charge-coupled-device array, except that for operation at high pressure, a single detector in the form of a Faraday cup would be used. The design could provide for each quadrupole to be registered with its own field-emission electron emitter so that ionization would occur primarily within the field of view of each quadrupole.

This work was done by Ara Chutjian, Michael H. Hecht, and Otto J. Orient of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information,* ***write in 94*** *on the TSP Request Card.*

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Larry Gilbert, Director
Technology Transfer
California Institute of Technology
Mail Code 315 - 6
Pasadena, CA 91125
(818) 395-3288

Refer to NPO-19533, volume and number of this NASA Tech Briefs issue, and the page number.

Room-Temperature Synthesis of Copper Indium Diselenide

This synthesis might be useful in the fabrication of solar cells on polymeric substrates.

Lewis Research Center, Cleveland, Ohio

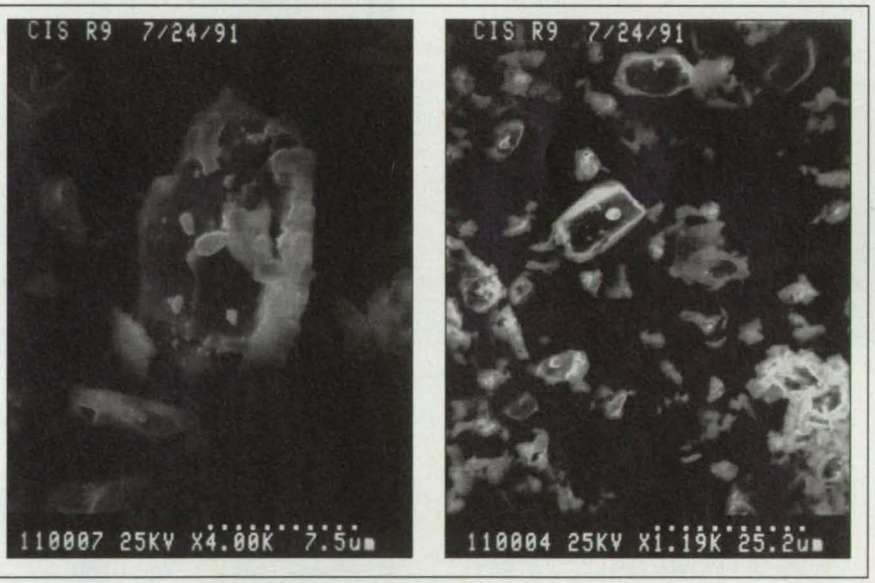
A room-temperature process synthesizes copper indium diselenide ($CuInSe_2$) in microcrystalline form. $CuInSe_2$ has potential utility as a semiconductor material in radiation-resistant, relatively inexpensive thin-film solar photovoltaic arrays with high power-to-weight ratios. However, to achieve the desired high power-to-weight ratios, it will be necessary to deposit the semiconductor films on thin polymeric substrates instead of on the molybdenum-coated glass substrates that have been used until now. Heretofore, $CuInSe_2$ has been synthesized, variously, in bulk and thin-film forms, by processes that involve temperatures ≥ 350 °C; polymeric substrates cannot survive these temperatures. The present room-temperature process is a subject of continuing research in the effort to develop a method of depositing $CuInSe_2$ on substrates that cannot withstand higher processing temperatures.

In an experimental room-temperature synthesis, 0.17 g (0.548 millimole) of tris (cyclopentadienyl)indium was mixed with 0.20 g (0.9706 millimole) of Cu_2Se in 15 mL of methylpyridine. The mixture was kept at a temperature of 25 °C and stirred for 5 days, during which time the color of the solution gradually changed from faint pink to dark purple. The mixture was filtered and dried under vacuum for 14 hours, yielding 0.07 g of a black powder that consisted mostly of $CuInSe_2$ crystallites with sizes of the order of 10 μm (see figure).

The basic concept of the room-temperature process — conversion of a solid-state reagent into another solid-state compound by use of an organometallic reagent — is not limited to the synthesis of $CuInSe_2$. With suitable modifications, the process might be applicable to the low-temperature synthesis of other solid-state compounds for electronic devices.

This work was done by Aloysius F. Hepp, and Sheila G. Bailey of **Lewis Research Center**, *Stan A. Duraj of Cleveland State University, and Maria T. Andras of the National Research Council. For further information,* ***write in 72*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-15792.



These **Crystallites of $CuInSe_2$** were synthesized by the method described in the text. They are shown at two different magnifications of a scanning electron microscope to illustrate the range of sizes and shapes.

Durable High-Emissivity Coatings for Solar-Energy Systems

These materials withstand high temperatures for long times.

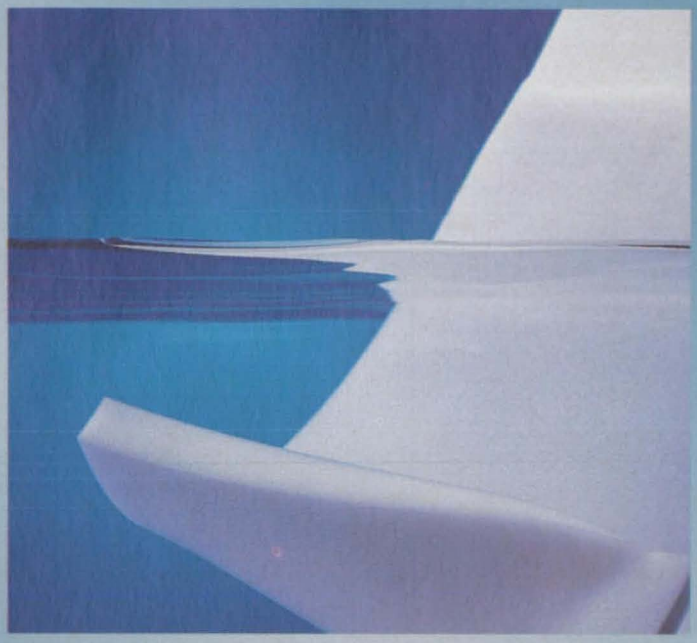
Lewis Research Center, Cleveland, Ohio

Mixtures of alumina and titania can be used to form high-temperature-durable, emissivity-enhancing surface layers on components of solar thermal-energy receivers and heat radiators. Depending on the specific component and application, enhancement of emissivity can provide either or both of two benefits: redistribution of heat away from local hot spots (with consequent increase in service life) and/or reduction in the size of a radiator surface necessary to radiate a given thermal power (with consequent reduction of weight).

Alumina-and-titania surface layers have been applied to the interior of the solar-heat-receiver, canisters made of Haynes 188 alloy, and to a stainless-steel parasitic-heat-load radiator. The surfaces of these components were prepared by grit blasting, then the surfaces were coated with the alumina/titania mixtures in a detonation-gun process.

In testing conducted by NASA LeRC in a vacuum at a temperature of 827 °C,

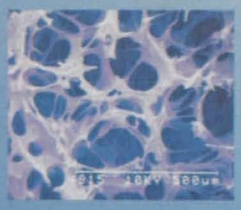
Product Designers . . . put absorption power in your hands with a new, super PVA.



Use it to absorb, dry, coat or spread water, organic solvents, oils, gasoline, bases and most acids.

Introducing PVA—a synthetic, hydrophilic material of polyvinyl alcohol manufactured by a patented process.

PVA has outstanding absorption properties and chemical compatibility and is extremely durable. Its open-celled structure (magnified image at right) delivers superior absorption in liquid applications. Independent tests prove PVA greatly out-absorbs other natural and synthetic materials in speed and volume.



PVA versatility—custom-specified shapes, colors, porosities and hardness levels can be produced to your requirements. Powders can be impregnated into PVA or secondary operations executed to alter or enhance performance. It's also chemically resistant. A wide range of sizes can be manufactured in sheet, block, tube/roller and custom forms.

Numerous application ideas—for cleaning, wiping, spreading or drying in liquid environments. Many applications already exist. Example—In a ceramic capacitor line, the PVA roller applies a release agent solution onto a casting belt. Coating all irregular surfaces, the applicator roller spreads solution evenly and consistently. It's also proven to be durable and long lasting.

Let your imagination roam!

We'll tell you how PVA works in liquid environments to help you develop ideas...using PVA in your products, devices, machines and systems.

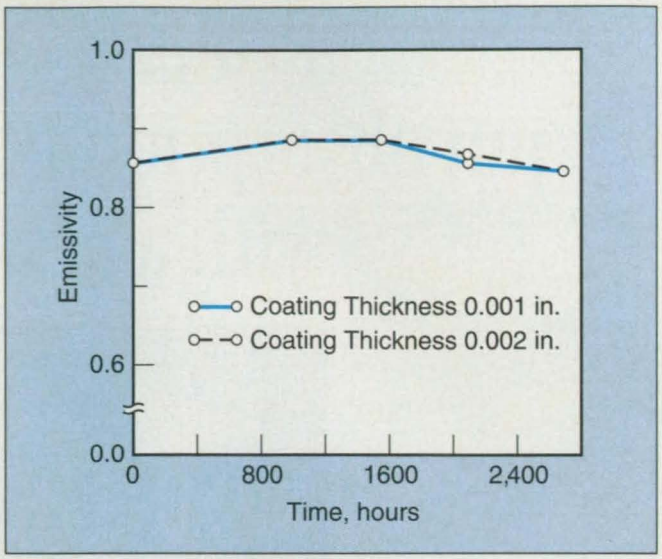
Ask for our sample kit and specifications. Use our Fax For Facts and get your information fast or call for personal attention.

KANEBO PVA MATERIALS

Sales Division of Shima American Corp.
485 East Lies Road, Carol Stream, Illinois 60188

FREE Sample Kit and OEM Specs . . . Fax For Facts 630-871-4152 . . . Fone For Facts 630-871-8900

Kanebo



Al_2O_3-and-TiO_2 Surface Layers on Haynes 188 alloy retained high emissivities for a long time when heated to a temperature of 827 °C in a vacuum of residual pressure $<10^{-6}$ torr ($\leq 10^{-4}$ Pa).

coatings with thicknesses of 0.001 in. (0.025 mm) and 0.002 in. (0.050 mm) on Haynes 188 alloy provided emissivity >0.8 for more than 2,600 hours (see figure). The test was conducted in a vacuum because the original application was expected to be in outer space, but these coatings may be suitable for terrestrial use.

This work was done by Kim K. deGroh and Richard K. Shaltens of **Lewis Research Center** *and Dilipkumar R. Shah of Allied-Signal, Inc. For further information,* ***write in 65*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-15949.

Foam Metal Painted Black Exhibits High Emissivity

A thin layer can be applied to increase radiation of heat.

Goddard Space Flight Center, Greenbelt, Maryland

One way to increase the radiative transfer of heat from an object is by use of a surface layer of black metal foam. Objects that might be advantageously treated in this way include heat-radiating shrouds in vacuum chambers, parts of furnaces, and cooling fins on powerplants.

Typically, the foam is 3-percent-dense copper with a reticulated cellular structure. A thin layer is bonded to the surface in question, then spray-painted black. The added mass and cost are small, and the surface layer is rugged.

Typically, black paints have total hemispherical emissivities of about 0.88 at room temperature, decreasing to about 0.83 at 100 K. The cavities of the foam structure decrease the reflectivity, thereby increasing the emissivity, especially at the longer wavelengths that predominate at lower temperatures. In one experiment, copper foam painted black exhibited an emissivity of 0.93 at room temperature.

This work was done by Chuck Rasbach and Jeff Hayden of Martin Marietta Corp. for **Goddard Space Flight Center**. *No further documentation is available. GSC-13484*

CFD2000

You'll be amazed at the ways you can use it.

Once you get to know the versatility of CFD2000, you'll accept no substitute in computational fluid dynamics software.

Of course CFD2000 is a number-crunching powerhouse. But it's also much more. While other CFD products move you awkwardly through the analysis cycle, CFD2000 utilizes powerful 3D graphics and intelligent menus to guide you every step of the way.

CFD2000 is fully compatible across supercomputer, workstation, and PC platforms. So everyone can work together.

If you need to add unique material properties, boundary conditions, or advanced physical models, CFD2000 shows you how.

At Adaptive Research, our 20-year investment in CFD2000 is only the beginning. To us, expert technical support is just as important as great product. And we deliver both.

CFD2000. It's where utility, convenience, functionality, and form come together. Simply the best. Call 1-888-4-CFD2000 today for a free CFD2000 demonstration CD.

adaptive RESEARCH

"Adapt or die."

Computer Programs

COSMIC: Transferring NASA Software

COSMIC, NASA'S Computer Software Management and Information Center, distributes software developed with NASA funding to industry, other government agencies and academia.

COSMIC's inventory is updated regularly; new programs are reported in *Tech Briefs*. For additional information on any of the programs described here, send in the Information Request Form or contact COSMIC directly.

If you don't find a program in this issue that meets your needs, visit the COSMIC World Wide Web pages to browse the catalog for programs in your area of interest. The COSMIC Software Catalog is available in print and free of charge on diskette, on-line, by E-mail, or FTP.

COSMIC is part of NASA's Technology Transfer Network.

COSMIC® —
The University of Georgia
Athens, GA 30602-4272
T.L. Peacock, Director
(706) 542-3265;
FAX (706) 542-4807
service@cosmic.uga.edu
http://www.cosmic.uga.edu

Mathematics and Information Sciences

Software for Automated Handling of Messages

The Automated Message Handling System (AMHS) computer program was developed for government agencies that use AUTODIN for transmitting messages. AMHS processes messages as they are received from AUTODIN and automatically disseminates them to the intended recipients via their desktop computers. It has been implemented on many computers and operating systems and uses a variety of data bases. It reduces the time and cost of distributing messages, relative to a manual message-distribution system that it replaces. AMHS was developed to tie different previously available programs together and give the user access to them through a single screen. One of the programs incorporated into AMHS is the commercially available text-search engine Verify TOPIC. The tie between TOPIC and the rest of AMHS is established by functional code that is not available commercially. In addition to standard distribution of messages to specific ad-dressees, AMHS can distribute a message to a nonspecific addressee at an office address by searching the text of the message to determine who should receive it. A user can enter the data bases to perform a search based on key words; for example, to look at all messages on a given subject.

This program was written by Dawn Hartley, Edmund H. Johnson, and Maurice Roe of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information,* ***write in 5*** *on the TSP Request Card. NPO-19768*

Physical Sciences

SIRC CEOSREADER

SIR-C is an Earth-observing spacecraft mission that has collected scientific data as embodied in synthetic-aperture-radar (SAR) signals. The SAR data are processed into imagery of the Earth; the image data are distributed in two forms that are denoted "Survey data products" and "Standard data products." The Standard data products are recorded on 8-mm tapes in a format that conforms to the tape-format guidelines set forth by the Committee on Earth Observing Systems (CEOS). The SIR-C CEOS Reader/Decompression software has been created to assist scientists in analyzing these data.

The CEOS Reader software is capable of reading a SIR-C CEOS tape, gaining access to its individual files, converting scientific data associated with each data product into readable text format, and copying parameter and image files from tape to disk. Each SIR-C CEOS tape contains five types of files. The Volume Directory File identifies and specifies the structure related to the tape data volume. The SAR Leader File contains auxiliary information corresponding to the SAR data in the image data file; for example, map-projection data, platform-position data, attitude data, radiometric data, data-quality summary, digital elevation model, processing parameters, and calibration data. The Imagery Options File contains the SAR image data. The SAR Trailer File for SIR-C contains the null file descriptor record. The Null Volume Directory File contains the null volume descriptor record to indicate the end of the tape data volume.

SIR-C image data come in three different formats: single-look complex, multilook complex, and multilook detected. Depending on the data-acquisition mode and the processing performed, SIR-C may be of single polarization, two polarizations, or all four linear polarizations. The three different formats of data accommodate the different modes. The data-decompression software provides for (1) the decompression of data to floating-point numbers that give the radar-signal σ_0 and (2) averaging down the data and making byte images.

SIRC CEOSREADER is written in FORTRAN and C language. Two machine versions are available from COSMIC. The UNIX version (NPO-19463) has been successfully compiled on a Sun4-series computer running Solaris 2.3, an SGI Indigo2 computer running IRIX 5.2, and a DEC ALPHA AXP 4000 computer running OSF/1. The VAX VMS version (NPO-19543) has been successfully compiled on a DEC MicroVAX 3600 computer running VMS 5.5. Both an ANSI FORTRAN and an ANSI C compiler are required to build the executable codes. Makefiles and ".com" files for compiling and linking are included on the respective distribution media for each version. SIR-C data are provided free of charge from the Radar Outreach Program at the Jet Propulsion Laboratory (fax: 818-393-2640). The standard distribution medium for the UNIX version of SIRC CEOSREADER is a 0.25-in. (6.35-mm) streaming-magnetic-tape cartridge (Sun QIC-24) in UNIX tar format. The standard distribution medium for the VAX VMS version is a TK50 tape cartridge in DEC VAX BACKUP format. Alternate distribution media and formats are available upon request. SIRC CEOSREADER was released to COSMIC in 1995 and is a copyrighted work with all copyright vested in NASA.

This program was written by Cynthia L. Wong, Patti Barrett, Christina Vuu, and Bruce Chapman of Caltech for **NASA's Jet Propulsion Laboratory.**

For further information on NPO-19463, ***write in 6*** *on the TSP Request Card.*

For further information on NPO-19543, ***write in 7*** *on the TSP Request Card.*

NPO-19463/543

Apparatus Aids Evaluation of Threaded Fasteners

Fasteners can be evaluated with respect to strength, friction, and ductility.

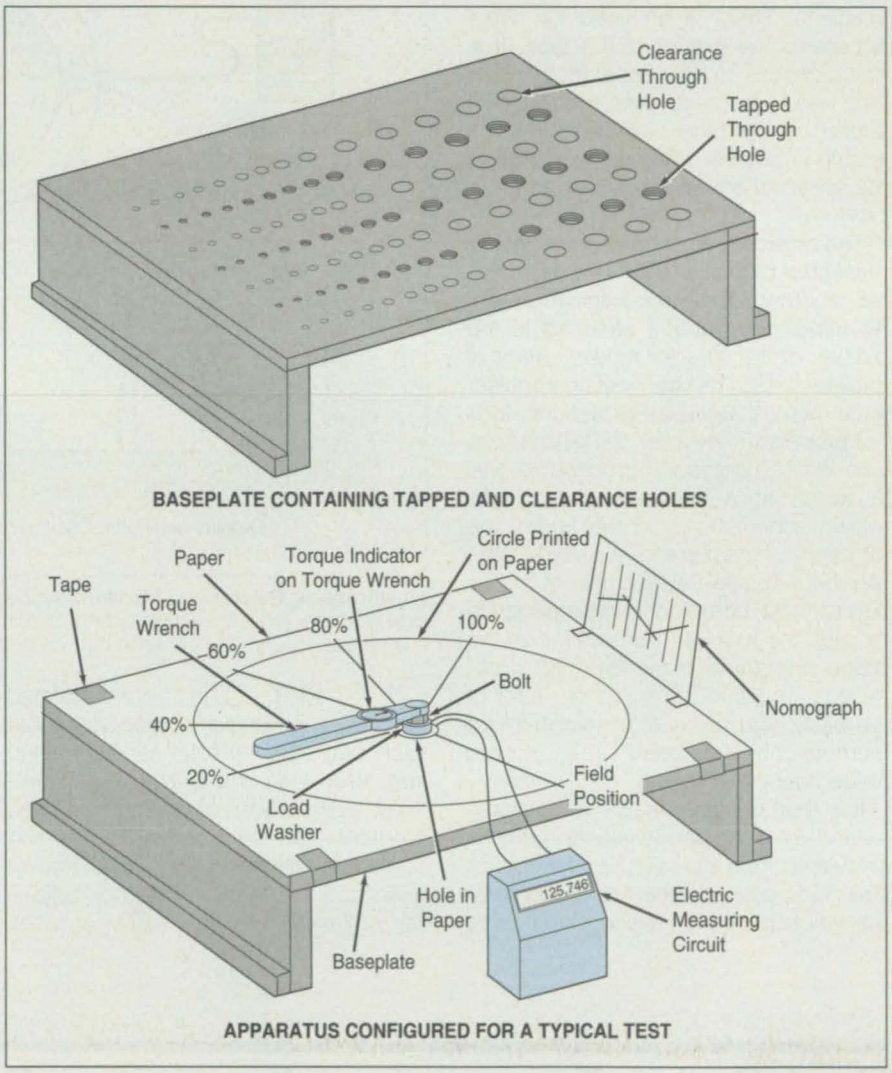
Goddard Space Flight Center, Greenbelt, Maryland

The figure illustrates an apparatus for testing nuts, bolts, and threaded inserts in a variety of sizes and materials. In comparison with most other equipment designed for the same purpose, this apparatus is relatively inexpensive. Because it is portable, it can be used to test fasteners in the field.

The apparatus can be configured for a variety of destructive and nondestructive tests; typically, the tests would be performed on a representative few samples of a large lot of nuts and bolts to determine whether they have the rated strength and are therefore safe to install. It can be used to evaluate such phenomena as ductility and the modification of frictional effects by lubricants and washers. It can also serve as a training tool to instruct engineers and technicians in proper techniques for tightening of threaded fasteners.

As shown in the upper part of the figure, the apparatus includes a baseplate full of both tapped (that is, threaded) and clearance (unthreaded) through holes in various sizes. Some holes could contain threaded inserts, depending on what specific tests are required. The lower part of the figure shows a typical test configuration in which a bolt is tested in engagement with either a threaded hole in the baseplate or a nut underneath the baseplate (not shown) that is restrained against rotation by use of a wrench against a simple mechanical stop. A torque wrench is used to apply and measure tightening torque on the bolt, while a load washer between the bolthead and the baseplate measures the clamping force. The output of the load washer is fed to an electronic measuring circuit, which can also perform simple calculations related to the measurements.

A piece of paper with a hole to accommodate the bolt and load washer is taped to the baseplate. The hole is concentric with the bolt. A circle concentric with the hole and bolt is printed on the paper. As the bolt is tightened, the technician marks the circle at the angular positions of the torque wrench where the applied torque attains various preset percentages (e.g., increments of 20 percent) of the rated maximum torque on the bolt.



The **Nut and Bolt Evaluator** is a simple, inexpensive, portable apparatus that can be configured for a variety of tests of threaded fasteners.

One of the quantities that can be determined from this test is the coefficient of friction, K, which is automatically computed by the electronic bolt evaluator. This evaluator can also compute torque, the compressive force, the diameter of the bolt, and the tensile stress in the bolt. In most cases, the nominal diameter of the bolt is known as well as the allowed stress. By torquing up on a bolt with a known diameter and allowable stress, the rest of the unknowns can be read on the bolt evaluator. Further, the bolt evaluator can calculate the variables in the equation $T = KDF$ (where T is the measured torque, D is the diameter of the bolt, and F is the measured clamping force produced by that torque) and the equation, Stress = F/(Stress area).

This work was done by James Kerley, Raymond Burkhardt, and Steven White of **Goddard Space Flight Center**. *For further information,* ***write in 62*** *on the TSP Request Card. GSC-13468*

Measuring Thickness of a Pipe Wall by Caliper and Ultrasound

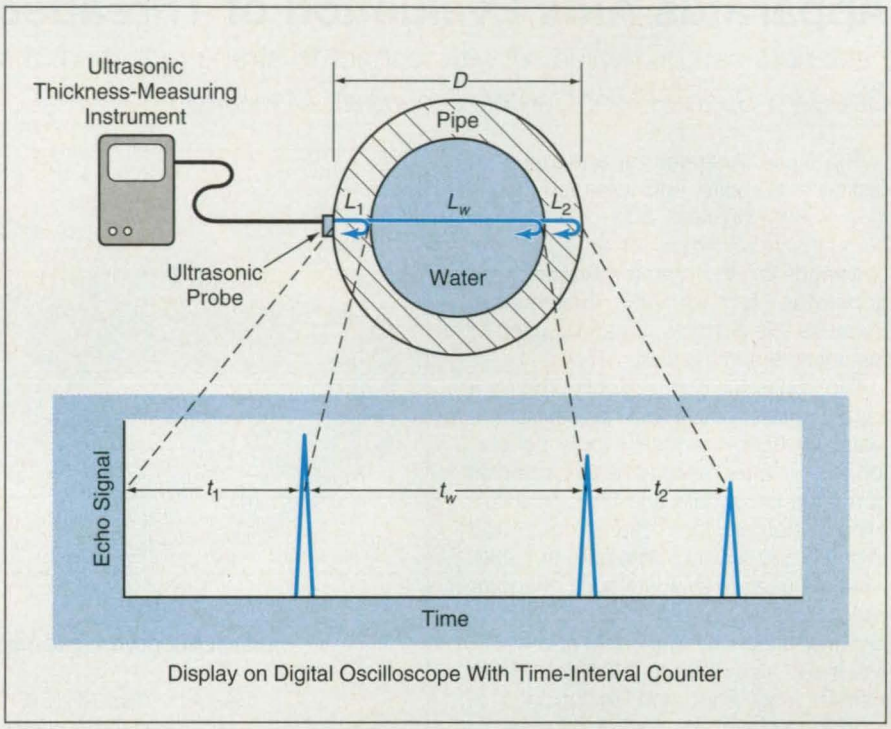
The speed of sound in the wall need not be known a priori.

Goddard Space Flight Center, Greenbelt, Maryland

A technique for determining the thicknesses of a pipe wall at two diametrically opposing locations involves straightforward exterior caliper and ultrasonic measurements followed by simple calculations. There is no need for direct access to the interior of the pipe. It is not necessary to know what material the pipe wall is made of. Even the speed of sound in the pipe wall need not be known in advance; this technique gives the speed of sound in the wall as a by-product.

The outside diameter (D) of the pipe is measured by use of a caliper, micrometer, or other simple mechanical device. An ultrasonic probe is attached to the outside of the pipe for measurement of thickness by the conventional pulse/echo method. Because ultrasound does not propagate well in air, the pipe is filled with water; ultrasound propagates well in water, at a known speed v_w. As shown schematically in the figure, the ultrasonic measurement yields the round-trip pulse-travel times of t_1, t_w, and t_2: these correspond to propagation through the wall (of thickness L_1) on the probe side, through the water (of thickness L_w, equal to the inside diameter of the pipe), and the wall (of thickness L_2) diametrically opposite the probe, respectively.

It is then a simple matter to calculate L_1 and L_2. First, the inside diameter is calculated from $L_w = v_w t_w/2$. The sum of wall thicknesses is then obtained from the simple geometric relationship $L_1 + L_2 = D - L_w$. Next, L_1 and L_2 are calculated from $L_1 + L_2$ and the proportion that each bears to the total as determined from $t_1/(t_1 + t_2)$ and $t_2/(t_1 + t_2)$, respectively. Optionally, all of the foregoing calculations can be combined into two equations that contain only known quantities; namely, $L_1 = [t_1/(t_1 + t_2)][D - (v_w t_w/2)]$ and $L_2 = [t_2/(t_1 + t_2)][D - (v_w t_w/2)]$.



An **Ultrasonic Pulse/Echo Measurement** and an ordinary mechanical measurement of outside diameter provide enough data to determine L1, L2, and the speed of sound in the wall. It is not necessary to know what the wall is made of.

Finally, as the by-product, one can calculate the speed of sound, v_m, in the wall material from $v_m = 2(L_1 + L_2)/(t_1 + t_2)$.

This work was done by E. James Chern of **Goddard Space Flight Center.** *For further information,* ***write in 13*** *on the TSP Request Card. GSC-13628*

Dual-Collet, Temperature-Insensitive Collimator Mounts

Collimators would be kept within arc seconds of the required alignment.

NASA's Jet Propulsion Laboratory, Pasadena, California

Dual-collet, temperature-insensitive mounts have been proposed to secure collimators in their specified positions and orientations. The alignment of each mount would be defined and enforced by two holes bounded by precise conical surfaces bored into opposite faces of a rigid, boxlike aluminum structure. The axes of the two conical surfaces would coincide with the optical axis of the collimator, and the apices of the two conical surfaces coincide (see figure).

The mount would include two tempered three-finger steel collets with opposing threads joined via a threaded outer sleeve, which would be turned to pull the collets axially together or push them axially apart in turnbuckle fashion. The collets would have conical outer surfaces at their ends that would mate with the conical holes, and inner cylindrical surfaces that would fit the outer cylindrical surface of the stainless-steel tube of the collimator.

The collet assembly would be mounted loosely in the holes, the collimator would be inserted in the collet assembly, then the sleeve would be turned to draw the collets toward each other, thereby simultaneously tightening the collets in the holes and pressing the collets tightly against the cylindrical outer surface of the collimator. This would ensure the aim of the collima-

If a 170 lb. engineer

is asked by 3 project leaders to model the same problem with 50 different parameters in 1 day using a scientific calculator, find the time required for the calculator to hit the ground once it's been thrown out the window.

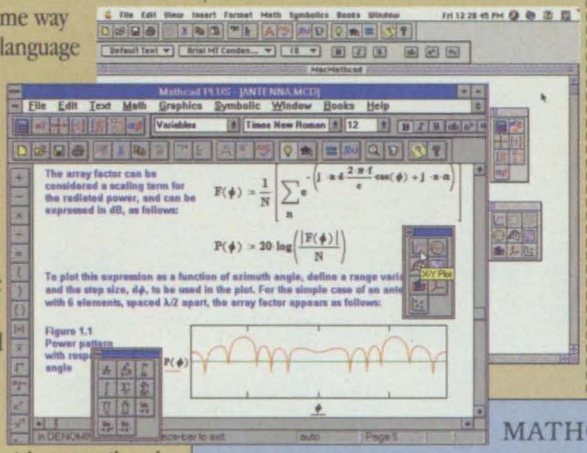
Most technical professionals face the same problem every day: the need to do (and re-do) complex calculations. Quickly. Armed with limiting graphing calculators and typical, hard-to-learn math software, what's a (normally) mild-mannered engineer to do?

The answer is Mathcad PLUS 6. The only calculation software that does math the same way you do. In your language (math). At your speed (light). Mathcad turns your computer screen into a live worksheet. Allowing you to perform numeric and symbolic calculations, add graphics and annotate text wherever you want -- just like with a pencil and scratchpad. (Only 1.7 zillion times faster!) And if you change a variable, Mathcad recalculates the results instantly.

This free-form, interactive environment makes Mathcad perfect for formulating models, setting up problems, and evolving solutions. With hundreds of operators and built-in functions, you can solve linear and non-linear equations, and perform derivatives and integrals, advanced vector and matrix operations, statistical analysis – all the calculations you do many times a week.

Want to see more? Mathcad offers 2-D and 3-D graphing, multivariate curve fitting, data smoothing and locking, and animation capabilities. You can also build your own functional programs using procedural operators, and create function libraries for analysis you perform frequently.

Mathcad 6 solves the most complex problems, from start to finish, with an intuitive, highly usable interface.



And since technical people are human too, Mathcad has a Desktop Reference and Sampler filled with standard formulas and physical constants – lest you forget one. And QuickSheets – with example worksheets you can drag and copy onto your own worksheet. As if all this didn't promote enough office harmony, Mathcad lets you share and discuss data and results through professional-looking documents, e-mail, and the World Wide Web.

To get Mathcad, go to your favorite software retailer, call 1-800-MATHCAD, or visit our website for more information. It can solve your toughest technical problems. And maybe even a few personal ones.

http://www.mathsoft.com

MATHCAD PLUS 6 FEATURES

Numeric Calculation
- Derivatives, integrals, summations and products
- Wavelet & Fast Fourier Transforms
- Automatic engineering unit assignment
- Root of Polynomial finder
- Differential Equation solvers
- Simultaneous equation solving

Advanced Matrix Functions
- Matrix decomposition & multidimensional matrixes
- Linear system solvers

Symbolic Calculations
- Symbolic integration and differentiation
- Symbolic algebra and calculus

Visualization
- Polar, contour and parametric plots
- Animation

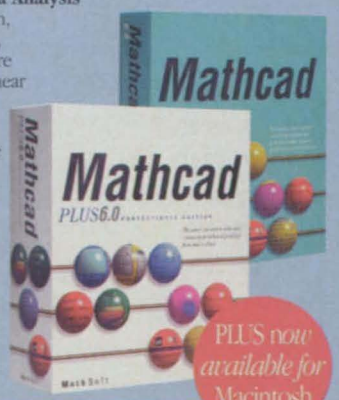
Statistics and Data Analysis
- Includes: Gaussian, Binomial, Weibull, Poisson, Chi-square
- Linear and non-linear regression

Programming
- Operators include branches, loops, recursion

Usability and Interoperability
- Drag between documents

Document Preparation
- WYSIWYG
- presentation-quality output
- Technical spell-checker

Collaboration
- World Wide Web link built in

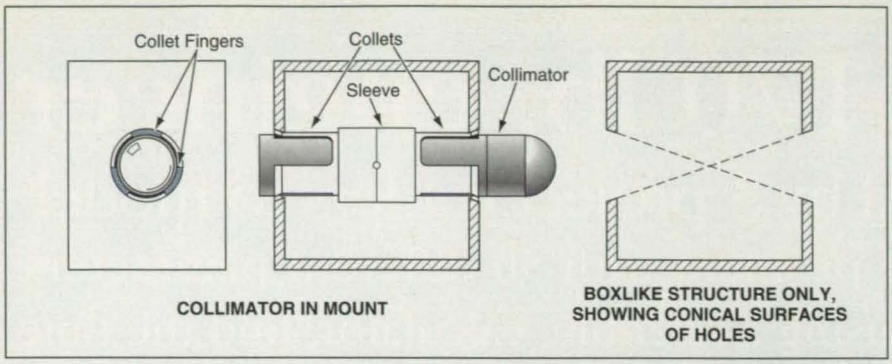


MathSoft, Inc., 101 Main Street, Cambridge, MA 02142 USA • Phone: 617-577-1017 • Fax: 617-577-8829

MathSoft International, Knightway House, Park Street, Bagshot, Surrey GU19 5AQ UK Tel:+44(0)1276 452299 • Fax:+44(0)1276 451224

New Mathcad SE and PLUS 6 are available for Windows NT, 3.1 and '95. Mathcad PLUS 6 now available for Macintosh. PLUS exclusively available at Egghead and Microcenter.

MICRO CENTER · COMPUSA · COMPUTER CITY · EGGHEAD SOFTWARE



This **Dual-Collet, Temperature-Insensitive Mount** would include two oppositely threaded collets connected by a mating threaded sleeve. Rotation of the sleeve would pull the collets toward each other, producing a clamping force. The coincidence of the vertices of the cones would make differential thermal expansion occur along the conical interfaces.

tor within a few arc seconds of the required direction.

Because of the coincidence of the apices of both cones, any differential thermal expansion between the collets and the boxlike structure would manifest itself in slippage along the conical surfaces. Thus, the collets would be neither tightened nor loosened in the holes, and so alignment would be maintained despite changes in temperature.

This work was done by Lawrence J. Steimle of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information,* ***write in 25*** *on the TSP Request Card. NPO-19391*

First-Order Reliability Method for Semistatic Structures

Probabilistic and deterministic elements are combined.

Marshall Space Flight Center, Alabama

A universal first-order reliability method has been proposed for application to the design and the analysis of reliability of semistatic structures. This method has evolved from the confluence of a statistical-based approach with the traditional "deterministic" approach (which is somewhat misnamed in that it involves an element of subjectivity). In simplest terms, this method incorporates some elements of statistics to overcome some of the deficiencies of the deterministic approach without incurring the complexity of a fully probabilistic approach. In comparison with fully probabilistic methods, this method is more compatible with widely accepted deterministic design practices.

Previous stages in the evolution of this method were represented in two articles in *NASA Tech Briefs*; namely, "Study of Structural-Load Safety Factors" (MFS-27285), Vol. 18, No. 1 (January, 1994), page 74, and "Improved Selection of Structural-Load Safety Factors" (MFS-28825), Vol. 19, No. 3 (March, 1995), page 86. One of the principal concepts expressed in the second-mentioned article is that of the relationship between the reliability of a structural component and a safety index, Z, that combines a generalized version of the traditional deterministic safety factor with statistical information pertinent to loading and failure of components. The measure of reliability, R, of a

Why constantly reinvent the wheel?

(and the cylinder, and the gauge, and the clamp...)

Instead, try PartSpec FREE for 60 days!

Tired of redrawing standard parts from manufacturer catalogs? Now, with PartSpec™ from Autodesk Data Publishing, hundreds of thousands of accurate, up-to-date, pre-drawn parts can be yours. They're all ready to insert (in native .DWG format) right into your AutoCAD® drawings — with a single mouse-click.

PartSpec is one of two titles in the Autodesk® Mechanical Library available to you today by subscription. Semi-annual updates bring growing numbers of parts drawings from an ever-increasing number of manufacturers to your computer desktop on convenient CD-ROMs.

So now you can stop reinventing the wheel... Try PartSpec FREE for 60 days — but hurry, supplies are limited. Call today for your FREE trial, or subscribe now for only $149.

AUTODESK PARTSPEC

300,000 Pre-Drawn Parts: *Stop redrawing from catalogs! View and insert parts from over 50 major manufacturers — Parker Hannifin, Square D, Timken, Thomson, Boston Gear, Bimba and many more!*

Attached Attributes: *Draw with intelligence! All DWGs are vendor-prepared for accuracy, and retain attributes such as part number and manufacturer after single-click insertion into AutoCAD.*

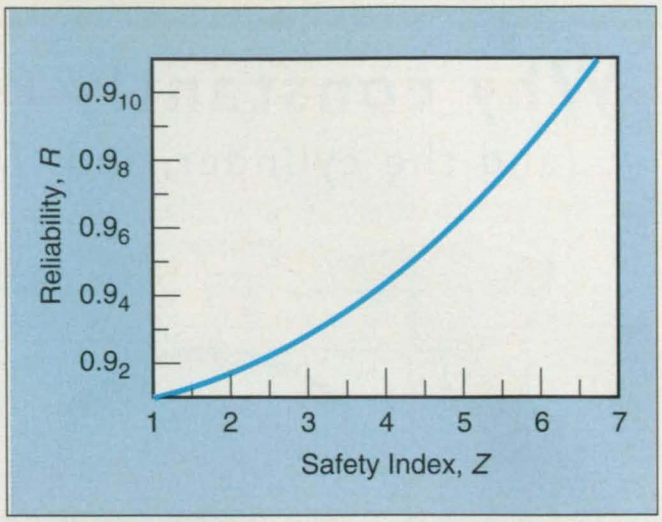
FREE Semi-Annual Update CDs: *Stay current! PartSpec and the entire Autodesk Mechanical Library are subscription services. Your free semi-annual update contains new manufacturers, and even more parts.*

CALL 1-800-228-3601

ASK FOR OFFER NO. P679

http://www.data.autodesk.com

Autodesk. DESIGN YOUR WORLD™



The **Reliability of a Structural Component** is typically expressed as a cumulative normal distribution function of the safety index.

structural component is defined as the probability that the stress applied to the component will not exceed the ultimate tensile stress that the component material can withstand. *R* is typically a cumulative normal distribution function of *Z* (see figure).

In general, *Z* is a function of (a) mean and standard deviation of resistive stress (typically, the applicable resistive stress is the ultimate tensile strength), (b) mean and standard deviations of applied stress, (c) a safety factor analogous to the conventional deterministic safety factor, and (d) other parameters that depend on the specific application. In the present first-order reliability method, one can choose from among several alternative equations for *Z*, each suited to a different purpose; e.g., calculating a maximum allowable applied stress, calculating the reliability of an existing structure, optimizing the design of a structure, designing a structure for a specified reliability, or verifying reliability through experiments.

This work was done by Vincent Verderaime of **Marshall Space Flight Center.** *For further information,* ***write in 20*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center; (205) 544-0021. Refer to MFS-31034.

Portable Leak-Checking Device

Lewis Research Center, Cleveland, Ohio

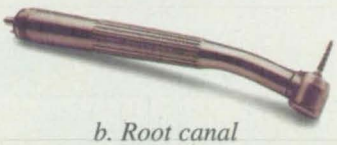
An inexpensive, compact, portable device is designed for detecting leaks in pipes, pressure vessels, and plumbing systems in general. The device includes a valve, a pressure gauge, a hand pump, and a pipe or tubing adapter for connection to the system to be tested. The device is used to detect leaks by the intuitive pressure-decay technique: after connection to the system, the hand pump is operated to pressurize the system to a desired level, the valve is closed, and the gauge is monitored for any pressure drop that would indicate a leak.

This work was done by Roger C. Forsgren of **Lewis Research Center**. *For further information,* ***write in 92*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-15884.

THINGS THAT SEEM TO LAST AN ETERNITY.

a. Fruitcake



b. Root canal

c. Opera

d. Parts lubricated with Krytox®

In grueling NASCAR events, Krytox® provides unbeatable protection for components.

Why do components with DuPont Krytox® last practically forever?

For starters, Krytox® lubricants are based on our exclusive space-age fluoropolymer technology. So you get long-lasting lubrication over the broadest range of temperatures (-70°F to 650°F) in even the most extreme conditions. Available in oil, grease and new dry film, Krytox® is compatible with metals, elastomers, engineering plastics — and all chemicals including oxygen — which means it's nonflammable, chemically inert and insoluble in solvents and water. It's clean, white, and it stays put, with virtually no change in physical properties over time. Whether your application is automotive, aerospace, small motors, paper making or chemical processing, you just can't get a longer-lasting lubricant than Krytox®.

For more information, call 1-800-424-7502.

Krytox®. Lubrication beyond your highest expectations.

DUPONT®

Krytox®
Only by DuPont

For More Information Write In No. 551

Stirling-Cycle Refrigerator Would Reach 4 K

Novel features include a counterflow regenerator and tailored compression and expansion volume waveforms.

NASA's Jet Propulsion Laboratory, Pasadena, California

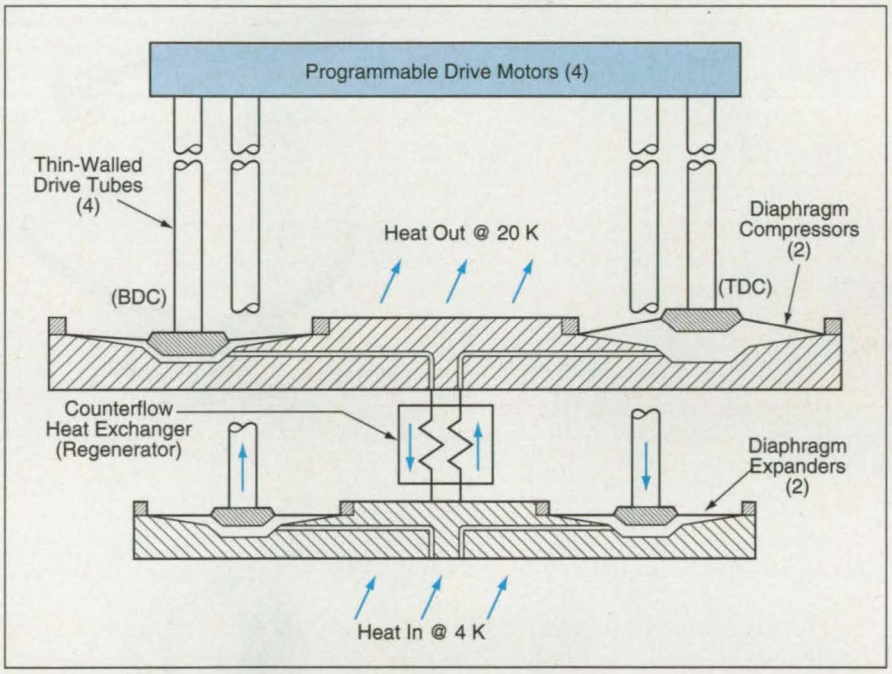
A high-efficiency Stirling-cycle refrigerator has been designed to provide 200 mW of net cooling at a temperature of 4 K, rejecting heat at 20 K to a relatively conventional high-pressure cryogenic refrigerator. This cryogenic system could be used to provide the cold environment needed for proper functioning of a small experimental apparatus; for example, a superconducting device or a sensitive infrared detector. At the time of submission of the information for this article, the Stirling-cycle refrigerator had been partially constructed.

The Stirling-cycle refrigerator uses helium working fluid at 0.5 bar charge pressure to minimize the effects of nonideal gas behavior and employs a counterflow regeneration scheme to reach 4 K. Heretofore, refrigeration at temperatures below about 10 K has been beyond the capabilities of devices based on highly efficient regenerative thermodynamic cycles because the heat capacities of regenerator matrices decline sharply with decreasing temperature below approximately 20 K. The design of the present system incorporates three major features to overcome this limitation.

The first feature is the counterflow regeneration scheme, which comprises three essential elements. The first element of this scheme is the use of two identical and independent Stirling-cycle coolers of compressor and expander, or alpha, configuration. The second element is that the two coolers are synchronized to operate 180° out of phase with each other. The third element is that instead of using a separate regenerator for each cooler, both coolers share a plate-type heat exchanger. The displacement helium streams of the two coolers flow in opposite directions through alternating channels, providing counterflow heat exchange (see figure). Thus, regeneration by direct transfer of heat between the two gas streams is substituted for the more conventional regeneration by transfer of heat between the working gas and a solid matrix. The counterflow heat exchanger of the experimental refrigerator features gas flow channels 0.03 millimeters thick defined by stainless-steel plates also 0.03 millimeters thick.

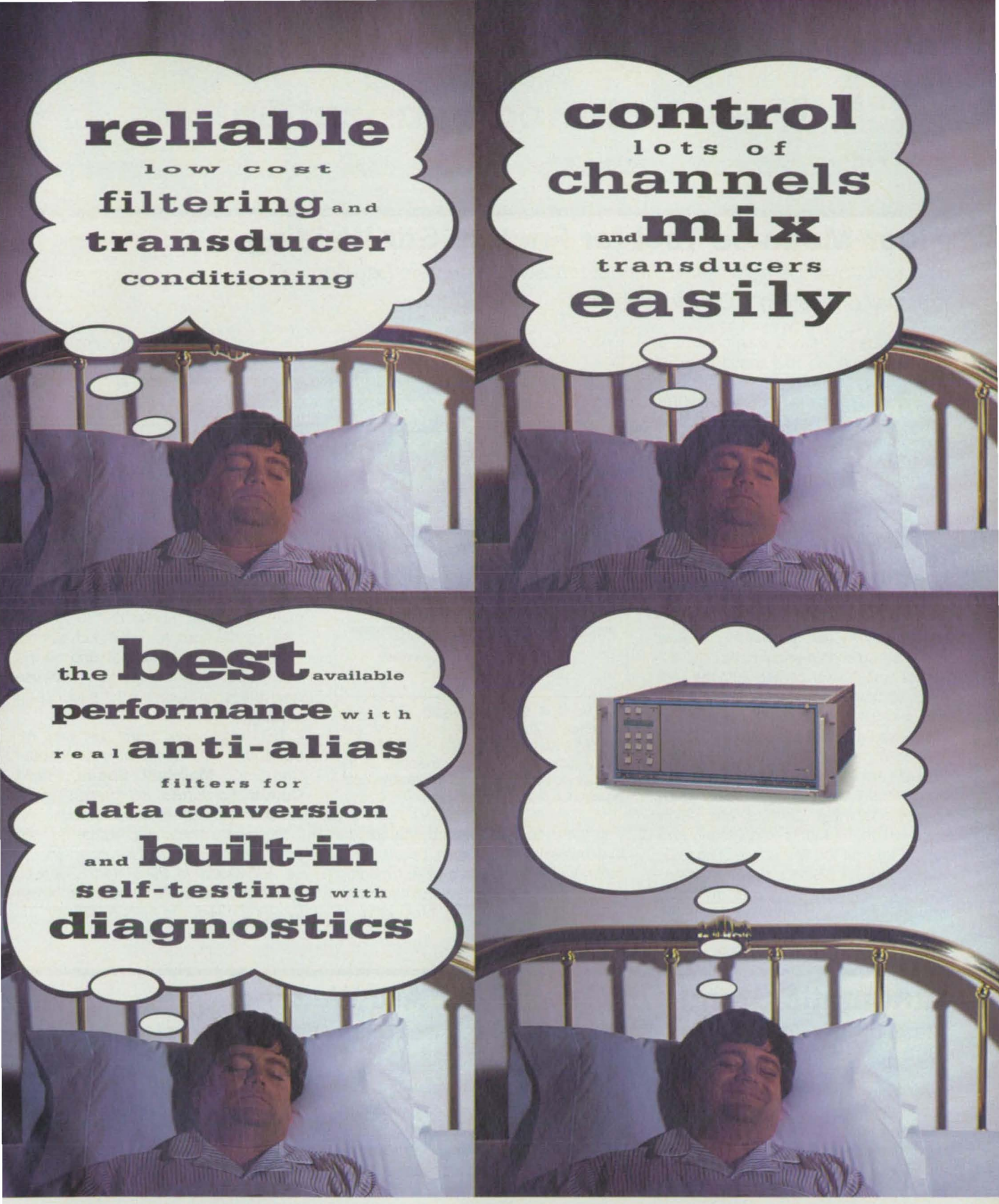
The second major feature of the design of this system is the deliberate use of nonsinusoidal waveforms for the expander and/or compressor volumes of the two Stirling-cycle coolers. Conventional sinusoidal volume waveforms produce a cycle of regenerator mass flow and heat flux which are nonsymmetric and would reduce the effectiveness of the counterflow regeneration scheme. In the subject invention, the drive control circuitry is programmed to provide distorted volumetric waveforms tailored to symmetrize the mass flow and heat flux waveforms in the regenerator. The instantaneous flux of heat from (or to) one of the two gas streams in the regenerator is thus equal to the instantaneous flux of heat to (or from) the other gas stream in the regenerator so that the regenerator is thermally unloaded throughout the cycle. In this way, perfect gas-to-gas regeneration is achieved without reliance on matrix heat capacity.

The third major feature of the design is the use of elastic metal diaphragms to form the positive displacement compressor and expander volumes. The diaphragms define, seal, and displace the working volumes. This feature is chosen primarily because it would provide expansion and compression processes very close to those of the ideal isothermal processes that would grace the Stirling cycle with efficiency approaching that of the Carnot cycle in the limit. Moreover, as a practical matter, diaphragms also serve as reciprocating bearings and seals, providing a nonwearing mechanism with high reliability and potential for long life.



Two Stirling-Cycle Coolers synchronized in opposition to each other would share a single regenerator in the form of a counterflow heat exchanger.

This work was done by W. Dodd Stacy and John A. McCormick of Creare, Inc., for **NASA's Jet Propulsion Laboratory**. *For further information, contact Dodd Stacy, Creare Inc., P.O. Box 71, Hanover, NH 03755, (603) 643-3800. NPO-30016*



INTRODUCING THE PRECISION 27000 UNIVERSAL FILTERING AND TRANSDUCER CONDITIONING SYSTEM. THE DREAM MACHINE.

No matter what kind of a signal conditioning system you're longing for, the Precision 27000 is a dream come true.

Control 1,000+ channels and mix strain, charge, voltage and other transducers. Verify performance easily with built-in self-testing.

Got bigger dreams? Performance, reliability, low cost per channel, GUI operation, anti-alias filters, intelligent control algorithms and more — it's all here.

Let us help you turn your dreams into reality. Call (607) 277-3550. Fax (607) 277-4466. Or write Precision Filters, Inc., 240 Cherry St., Ithaca, NY 14850.

PRECISION FILTERS, INC.
CONDITIONERS • SWITCHES • DATA ACQUISITION • SYSTEMS

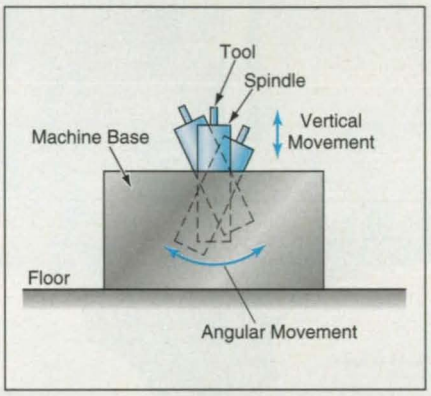
Floor-Mounted Tool for Friction Stir Welding

The tool could be held rigidly without massive, expensive fixtures.

Marshall Space Flight Center, Alabama

A proposed method of mounting a friction-stir-welding tool would make it unnecessary to use massive, expensive tooling to press the tool against the workpiece with a large force. In the proposed method, the tool would be positioned and oriented to utilize the weight of the workpiece. In a typical case in which the workpiece was a tank 32 ft (9.8 m) in diameter, the cost of tooling in the current method would lie between $15 million and $20 million, whereas in the proposed method, the tooling would cost between $2 million and $3 million.

Currently, friction stir welding is done on a computer-numerical-control (CNC) vertical machining center with the tool held vertically, point downward. The tool and the spindle that holds the tool must exert a force of about 3,000 lb (13 kN) downward, as well as an indeterminable side force as the tool translates across the workpiece. Also, CNC horizontal-machining centers are being used where the tool is held laterally and forced against the workpiece. The taller the part to be welded, the more massive the machine and tooling must be to eliminate separation of the machine tool to the part being welded. In the face of such large forces, tooling must be massive to be able to maintain the necessary rigidity.



The **Vertical Spindle Would Be Solidly Attached** to the floor instead of being suspended by overhead tooling. Means for limited vertical and angular movement of the spindle would be provided for flexible welding control.

In the proposed method, the spindle that holds the tool would be mounted rigidly in the floor or in a table mounted on the floor, with the tool pointing vertically upward (see figure). Most or all of the necessary force between the tool and the workpiece would be supplied by the weight of the workpiece and associated tooling and would be regulated by small vertical movements of the spindle. The workpiece, no matter how large, would be accurately translated under CNC over the tool on slides. The same machine could be used for workpieces of widely different sizes and shapes; it would be unnecessary to build separate, expensive machines.

A further benefit of the proposed method is that unlike in the current method, oil from an overhead spindle holding the tool would not drip on the workpiece. This is important because cleanliness is essential to success in welding.

This work was done by Leo M. DeLangis of Rockwell International Corp. for **Marshall Space Flight Center**. *For further information,* ***write in 46*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center; (205) 544-0021. Refer to MFS-30120.

Automatic Stand-Off Control for Arc Welding

Stand-off distance is controlled more directly than in the automatic-voltage-control method.

Marshall Space Flight Center, Alabama

Automatic stand-off control (ASOC) is an improved method for controlling the stand-off distance in variable-polarity plasma arc welding and gas tungsten arc welding. The stand-off distance is the distance between the tip of the welding torch and the workpiece and thus, changes in standoff cause corresponding changes in arc length. The stand-off distance must be controlled to truly control arc length, which significantly affects the quality of the weld.

Heretofore, it has been common practice to attempt to control the arc length by a method called "automatic voltage control" (AVC), which is based on the assumption that the arc voltage is proportional to the arc length. In AVC, a motor drive is commanded to move the welding torch toward or away from the workpiece in response to a voltage that is measured at convenient points in the welding-current circuit and is assumed to equal the arc voltage. Unfortunately, the measured voltage can differ significantly from the arc voltage because it is affected by voltage drops across all intervening resistances in the welding-current circuit; these voltage drops depend on several factors, including temperatures, contact resistances, the sizes and lengths of cables, positions of components, and the electrical characteristics of the welding power supply. Moreover, the arc voltage depends on other weld parameters such as the welding current (which often is varied during the welding process) and plasma gas flow rate. Thus, AVC undesirably varies the stand-off distance and thus the arc length in response to variations in other process parameters.

In ASOC, the stand-off distance is controlled more directly, without regard

for arc voltage or current. Very little new equipment is necessary because the existing AVC circuitry can be used. The major difference between AVC and ASOC is that in ASOC, the approximate-arc-voltage feedback signal is replaced by a sensor output signal more closely related to the stand-off distance, thereby maintaining better control of the true arc length.

Two versions of ASOC have been tested in experiments: In one version, the stand-off distance was measured directly by use of a linear variable-differential transformer (LVDT), one end of which was attached to a welding torch and the other end of which was equipped with a metal wheel so that it could roll along the surface of the workpiece. The LVDT provided measurements of standoff as the torch moved along a weld; initially intended only to monitor standoff, it worked so well that part way through a second set of experiments, the weld station was modified to provide closed-loop control of standoff based on the output of the LVDT, which improved weld quality and repeatability drastically.

The other version of ASOC involved the use of a filler-wire guide mounted on a motor drive for adjustment of its height to a commanded level with respect to the welding torch. This height, in effect, established the stand-off distance. The wire guide was instrumented to measure the contact force between the filler wire and the workpiece. The output of the contact-force sensor was used as the feedback signal to the AVC controller; that is, the entire welding-torch assembly (torch and motorized wire guide) was moved closer to or farther from the workpiece to increase or decrease the contact force, respectively, in the effort to maintain the contact force at a nominal value [8 oz. (2 N)]. In this arrangement, the stand-off distance could be changed by commanding the motor drive to set the wire guide to a different height, in which case the contact-force-feedback control subsystem would adjust the height of the welding-torch assembly to maintain the nominal contact force at the new stand-off distance.

This work was done by Stephen S. Gordon of Nichols Research Corp. for **Marshall Space Flight Center**. *For further information,* ***write in 34*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center; (205) 544-0021. Refer to MFS-26294.

Anodizing Aluminum for Uniform Thermal-Radiation Properties

Agitation of the anodizing solution is necessary for uniform coating.

Marshall Space Flight Center, Alabama

An improved anodizing process imparts fixed, spatially uniform solar absorptance (α_s) and tailorable, spatially uniform thermal emittance (ε) to the surfaces of panels of 6061-T6 aluminum alloy. These panels and their thermal-radiation properties are used in thermal-control applications that involve various degrees of solar heating and radiative cooling.

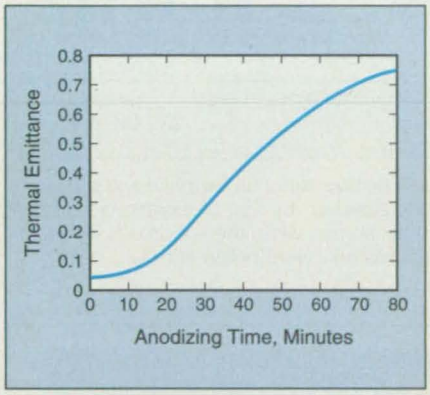
Agitation of the anodizing solution is an essential feature of the improved anodizing process. Experiments in an anodizing facility that did not provide agitation revealed an unexpected dependence of α_s and ε on the size of the anodized panel. Further investigation revealed that agitation of the anodizing solution is critical for the production of reproducible and uniform anodic thermal-control surfaces on aluminum. Agitation eliminates the variation of α_s and ε with the size of the anodized panel. The theory that has been advanced to explain this improvement is that (a) the rate of the anodizing reaction depends on the temperature, (b) without agitation, a gradient of temperature forms at the surface of the aluminum, and (c) agitation eliminates the gradient of temperature so that the anodizing reaction at all exposed surface points occurs at the controlled temperature of the bulk of the anodizing solution.

The improved anodizing process begins with inspection of the 6061 aluminum panels to ensure that they are free of visible scratches or other surface damage. The panels are degreased by use of a solvent or emulsion, then racked for anodizing, by grasping them at minimal contact areas, which are preferably noncritical areas. The racked panels are cleaned in an alkaline bath, then rinsed to obtain a surface free of contamination as indicated by a water-break-free condition (meaning that water wets the entire surface evenly, without pulling back from greasy or otherwise contaminated spots). The panels are then subjected to a deoxidation treatment for less than 5 minutes — only long enough to remove surface oxides. (Excessive deoxidation would undesirably increase the solar absorptance of the subsequently anodized surfaces.)

The panels are then immersed in the anodizing solution, which contains 41.0 to 107.5 g/L total chromic acid (as CrO_3) and 41.0 to 52.0 g/L free chromic acid (as CrO_3). Such a solution is typical of chromic-acid anodizing in accordance with MIL-A-8625 Type I, Anodic Coatings for Aluminum and Aluminum Alloys. During operation, the bath is agitated vigorously and its temperature is maintained at 95±2 °F (≈35±1 °C).

Electric current is applied to the panels within two minutes of immersion. The anodizing voltage is ramped up, at 5 volts per minute, to a constant level of 15.0 volts. Anodizing is performed for the total time, including ramp time, necessary to achieve the desired ε (see figure).

The panels are removed from the anodizing solution within two minutes of stopping the current and are then thoroughly rinsed. Next, the panels are sealed by immersing them in deionized water at 165±5 °F (≈74±3 °C) for a time long enough to achieve between 14 and 18 percent hydration. After sealing, the parts are dried. Air heating to no more than 160 °F (71 °C) for a maximum of 45 minutes can be used to facilitate drying. The dried panels must be handled only with clean gloves and packaged to prevent damage to the anodic films.



The **Thermal Emittance** of an anodized 6061 aluminum panel increases with the time spent in the anodizing process.

The α_s of the panels thus processed is 0.30±0.03; the ε of the panels depends on the total anodizing time, as mentioned above. The variations of emittance (a) from place to place on the same panel, (b) among panels in the same batch, and (c) between batches produced on subsequent days under nominally the same process conditions, all lie in the range of ±0.05. It is necessary to check the anodizing process daily to verify that the overall process is behaving as expected, prior to anodizing hardware: This preprocess testing is necessary because it is not possible to achieve the desired absorptance and emittance by stripping and reanodizing parts that were anodized incorrectly.

This work was done by Richard D. Sudduth and Johnny L. Golden of the Boeing Co. for **Marshall Space Flight Center**. *For further information,* ***write in 23*** *on the TSP Request Card.*
MFS-28923

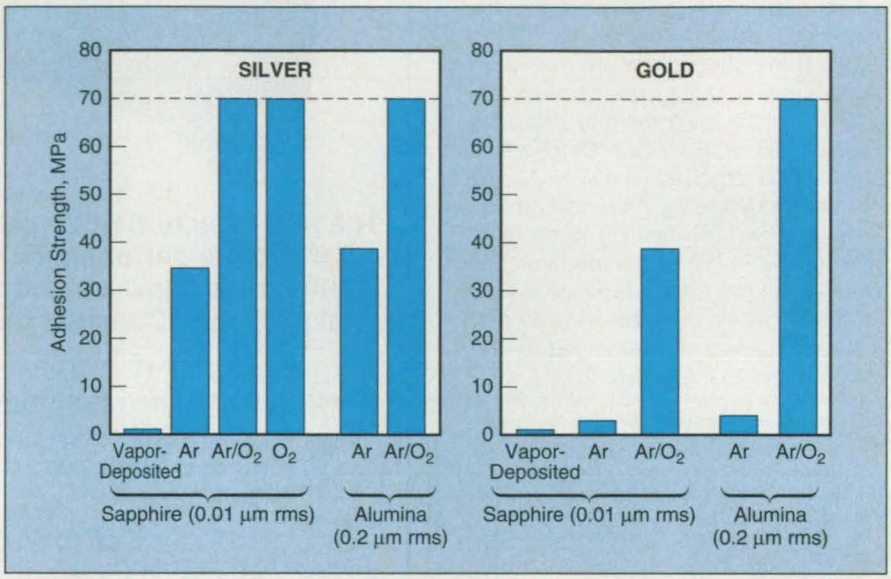
Oxygen-Assisted Screen-Cage Ion Plating of Ag or Au on Al_2O_3

The use of oxygen increases adhesion.

Lewis Research Center, Cleveland, Ohio

Oxygen-assisted screen-cage ion plating (SCIP) has been found to be an effective technique for deposition of adherent films of silver or gold on both the sapphire and polycrystalline-alumina forms of aluminum oxide. SCIP with or without oxygen holds promise for applying lubricating soft metallic films to high-temperature ceramic components of advanced combustion engines to reduce friction and wear. Other potential uses include coating ceramic components to provide thermally and/or electrically conductive surface layers, to provide optical reflectivity, or for decoration. The effectiveness of SCIP is attributed to its ability to provide a high-energy flux of ions and energetic neutral atoms that contribute to the adherence and desirable microstructure of the deposited film.

SCIP of silver on alumina without use of oxygen was described in "Screen-Cage Ion Plating of Silver on Polycrystalline Alumina" (LEW-15858), *NASA*



Adhesion Tests were performed on films of Ag and Au deposited on sapphire and polycrystalline alumina substrates. The adhesion strengths achieved by use of oxygen were often greater than the cohesive strengths of the substrates, so that when the specimens yielded in a tensile pull-testing apparatus, pieces of substrate material were pulled out.

Tech Briefs, Vol. 19, No. 2, (February 1995), page 78. To recapitulate: SCIP of silver without use of oxygen involves a vacuum chamber containing a plasma apparatus that has a diode configuration. The alumina or other electrically nonconductive substrate to be coated is mounted inside a silver screen cage in the chamber. Prior to deposition, the chamber is evacuated, then backfilled with argon to a pressure of about 20 mtorr (about 2.7 Pa), then a potential of few kilovolts is applied between the screen cage and an evaporative source of the silver to be deposited. The screen cage functions as both an electronic grid and as part of a cathode, while the evaporative source acts as an anode, and an argon plasma is created. The potential is then increased by a few kilovolts, and the evaporative source is activated, causing silver to be deposited on the substrate. An important advantage of SCIP is known in the industry as "throwing power" — the ability to deposit a substantial amount of the anode material all over the substrate, including places that are not on direct lines of sight from the anode.

Oxygen-assisted SCIP of silver or gold is similar, except that the gas used to form the plasma is a mixture of equal parts of argon and oxygen, and in the case of gold, the screen cage is made of gold and the evaporative source contains gold. In experiments, SCIP both with and without oxygen was used to deposit silver and gold on both polycrystalline alumina and sapphire substrates. In addition, the metals were vapor-deposited on sapphire, and silver was deposited on sapphire by SCIP using pure oxygen. The resulting specimens were then tested for adhesion of the metal coats. The results of the adhesion tests (see figure) indicate that adhesion was greatly increased by use of oxygen-assisted SCIP. In the case of silver on sapphire, an equal increase was observed in the specimen coated in the oxygen (only) plasma.

This work was done by Talivaldis Spalvins and Harold E. Sliney of **Lewis Research Center**. *For further information,* ***write in 98*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Lewis Research Center; (216) 433-2320. Refer to LEW-16282.

Repairing Welds With Friction-Bonded Plugs

Marshall Space Flight Center, Alabama

A technique for closing holes in welds involves the use of friction-bonded plugs, eliminating the need to reheat the welds to melting temperature. The technique can be used, for example, to close an inspection hole that has been drilled in a weld; heretofore, this would have been done by rewelding the hole. It is preferable to avoid rewelding because additional cycles of heating and cooling can weaken the weld. In the present technique, the hole to be repaired is first widened slightly and tapered by use of an end mill. Then a plug with one end tapered to fit snugly in the hole is pushed into the hole and turned to generate frictional heat. The force of insertion, speed of rotation, and rotation time are selected to obtain the desired amount of frictional heating and deformation (upset) of the material on and near the contact surfaces. Rotation is then stopped and the insertion force increased for a little while longer to further upset the material at the contact surfaces. The repair is then complete, and the protruding part of the plug can be machined off, flush with the surrounding weld surface. Beyond eliminating the need for rewelding, one of the advantages of this technique is that it can be used to repair dissimilar metals, whereas, in most cases, fusion welding can be done only on similar metals.

This work was done by R. Jeffrey Ding and Arthur C. Nunes, Jr., of **Marshall Space Flight Center** *and Peter A. Oelgoetz of Rockwell International Corp.*

For further information, ***write in 58*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center; (205) 544-0021. Refer to MFS-30102.

SEE IT, HEAR IT, GET IT ... FIRST AT

TECHNOLOGY 2006

- **Attend NASA's telemedicine symposium, covering such topics as image compression, satellite communication, high-resolution visualization, and Internet tools for telemedicine and medical education.**
- **Visit exhibits at TeleCon XVI/TeleMed II — the world's largest teleconferencing show — complimentary to Technology 2006 attendees and concurrent with Technology 2006 at the Anaheim Convention Center.**
- **For the first time, Technology 2006 will award continuing professional development credits.**

Sponsors and Cooperating Organizations

American Institute of Physics, American Geophysical Union, American Astronomical Society, Federal Laboratory Consortium, International Technology Education Association, National Association of Small Business Investment Companies, Technology Utilization Foundation, NASA, *NASA Tech Briefs*

PROGRAM-AT-A-GLANCE

Tuesday, 29 October
exhibit hours: 9 am-4 pm*

9:00 am - 10:00 am
Exhibit Hall Opening Breakfast

9:00 am - 1:00 pm
Poster Presentation Showcase

10:30 am - 12:00 noon
Concurrent Sessions — T1
Advanced Manufacturing 1
Agriculture 1
Computers & Communications 1
Education 1
Environmental Technology 1
Materials 1
Medical & Rehabilitative Technology 1
Power & Energy 1

1:00 pm - 4:00 pm
Keynote Plenary Session
- Daniel Goldin, NASA Administrator
- James Barksdale, Pres. & CEO, Netscape Communications
- Glen Urban, Dean, Sloan School, MIT
- Ace Allen, Director, U Kansas Med Cntr
- Jay Sanders, Pres., Am. Telemed Assn

Wednesday, 30 October
exhibit hours: 10 am-4 pm*

8:30 am-10:00 am
Plenary: Innovative Agricultural Technology
Plenary: Growth Opportunities for Small Business/presented by the Small Business Administration

10:30 am-12:00 noon
Concurrent Sessions — W1
Advanced Manufacturing 2
Agriculture 2
Computers & Communications 2
Environmental Technology 2
Materials 2
Medical & Rehab. Technology 2
Physics 1
Power & Energy 2
Small Business 1

2:00 pm-3:30 pm
Concurrent Sessions — W2
Advanced Manufacturing 3
Computers & Communications 3
Environmental Technology 3
Materials 3
Medical & Rehab. Technology 3
Physics 2
Power & Energy 3
Small Business 2
Telemedicine 1

4:00 pm-5:30 pm
Concurrent Sessions — W3
Advanced Manufacturing 4
Environmental Technology 4
Materials 4
Physics 3
Power & Energy 4
Small Business 3
Telemedicine 2 & 3

7:00 pm — Seventh Annual Technology Transfer Awards Dinner

Thursday, 31 October**
exhibit hours: 10 am-3 pm*

8:30 am-12:00 noon
(A) Russian Aerospace & Aviation Technology Partnerships

(B) Tech. Commercialization Strategies/ Finding Niche Markets

(C) Protecting Technology from Industrial Espionage/presented by the FBI and Dept. of Commerce

(D) Financial Planning for Individuals and Small Business

2:00 pm-5:30 pm

(A) Russian Partnership (ct'd)

(E) Introduction to Patents and Licensing

(F) Setting up Your Company's INTRAnet

(G) Intellectual Property — Defining, Valuing, and Protecting It

Telemedicine 4 & 5 **(2-3:30)**

Telemedicine 6 & 7 **(4-5:30)**

Note: Monday evening, 28 October
Reception at Richard Nixon Library

* Lunch is available for purchase in the exhibit hall from 12:00 noon - 2:00 p.m.
** Short Courses A-G on Thursday require individual registration

Preregistration Form

USE A SEPARATE FORM OR PHOTOCOPY FOR EACH REGISTRANT. BE SURE TO ANSWER ALL QUESTIONS BELOW.
DO NOT USE THIS FORM IF YOU ARE AN EXHIBITOR OR SPEAKER.

Name _____

Title _____

Company _____ Place your label here

Address _____

City/St/Zip _____

Phone No. _____ Fax No. _____

E-Mail Address _____

PLEASE REGISTER ME FOR THE FOLLOWING:

(check all that apply)	by 10/11	after 10/11	
❒ **Conference Registration**	**$375**	**$450**	$_____

Includes sessions & refreshment breaks on Tues., Oct. 29 & Wed., Oct. 30; 1 ticket to the opening reception on Mon., Oct. 28; exhibit hall opening breakfast on Tues., Oct. 29; 1 ticket to the Awards Dinner on Wed., Oct. 30 & entrance to the exhibits Oct. 29-31.

*Thursday's Post-Conference Sessions **are not** included.*

❒ **1-Day Conference Registration**	**$160**	**$185**	$_____

check day: ❒ **10/29** **or** ❒ **10/30**

Includes sessions & refreshment breaks on the applicable day only, exhibit hall opening breakfast on Tues., Oct. 29 & entrance to the exhibits Oct. 29-31.

OPTIONAL SHORT COURSES ON THURSDAY, 31 OCTOBER

(Morning short courses include continental breakfast.)

	by 10/4	**after 10/4**	
Morning			
_____ (A) Russian Partnerships *(full day, incl. refreshments, lunch)*	$350	$400	$_____
_____ (B) Commercialization & Niche Markets	$100	$125	_____
_____ (C) Industrial Espionage	$100	$125	_____
_____ (D) Financial Planning	$100	$125	_____
Afternoon			
_____ (E) Patents & Licensing	$100	$125	_____
_____ (F) INTRAnet	$100	$125	_____
_____ (G) Intellectual Property	$100	$125	_____
❒ **Awards Dinner: _____tickets @**	**$55**	**$65**	_____
❒ **Exhibits Only**	**FREE**	**FREE**	**$ 0**

Includes the exhibit hall opening breakfast on Tues., Oct. 29 & entrance to exhibits Oct. 29-31.

❒ ***Guest/Spouse Registration**	**$95**	**$110**	$_____

Includes the exhibit hall opening breakfast on Tues., Oct. 29; entrance to exhibits Oct. 29-31; a ticket to the opening reception on Mon., Oct. 28 & a ticket to the Awards Dinner on Wed., Oct. 30.

***** ***Guests must be over the age of 18.***

TOTAL AMOUNT ENCLOSED $_____

❒ Check/MO enclosed
(payable to Technology Utilization Foundation)

❒ Charge my: ❒ MasterCard ❒ VISA ❒ Am Ex

Card No. _____

Cardholder Name _____

Signature _____ Exp. Date _____

Registrations & Awards Dinner reservations are transferable. Cancellations must be received in writing by October 4 for a full refund. Refunds will not be granted for "no shows." *A $50 processing fee applies for all refunds.*

1 Which of the following best describes your industry or service? *(check one)*

1 ❒ Electronics	7 ❒ Materials/Chemicals	13 ❒ Research Lab
2 ❒ Computers	8 ❒ Industrial Equipment	14 ❒ University
3 ❒ Communications	9 ❒ Manufacturing	15 ❒ Agriculture
4 ❒ Aerospace	10 ❒ Power/Energy	16 ❒ Environment
5 ❒ Defense	11 ❒ Biomedicine	17 ❒ Other (specify)
6 ❒ Government	12 ❒ Transportation/Automotive	_____

2 Which of these products do you recommend, specify, or authorize the purchase of? *(check all that apply)*

18 ❒ Electronic Components & Systems	26 ❒ Test/Measurement Instruments
19 ❒ Software	27 ❒ Sensors/Transducers
20 ❒ Computers/Peripherals	28 ❒ Data Acquisition
21 ❒ CAD/CAE/CAM/CASE	29 ❒ Video/Imaging Equipment
22 ❒ Lasers/Optics	30 ❒ Industrial Controls/Systems
23 ❒ Materials	31 ❒ Communications Equipment
24 ❒ Mechanical Components	32 ❒ Laboratory Equipment
25 ❒ Positioning Equip./Motion Control	

3 Your role in purchasing is:

33 ❒ Decision maker 34 ❒ Specify 35 ❒ Recommend

4 Your principal job function is: *(check one)*

36 ❒ General & Corporate Management	40 ❒ Manufacturing/Production
37 ❒ Design & Development Engineering	41 ❒ Purchasing/Procurement
38 ❒ Engineering Services - Tests/Quality	42 ❒ Other (specify)
39 ❒ Basic Research	_____

If you require assistance to fully participate, call Wendy Corvi at 1-800-944-NASA.

HOTEL & TRAVEL INFORMATION

(identify yourself as an attendee of Technology 2006)

	single	**double**
Anaheim Marriott Hotel (headquarters hotel)	$118 (government rate: $90 single or double)	$128
Tel: 800-228-9290 or 714-750-8000		
Anaheim Inn at the Park	$79	$89
Tel: 800-421-6662 or 714-750-1811		

Both hotels are walking distance to the Anaheim Convention Center. *Rates are subject to a 15% tax.*

Rates NOT guaranteed after 14 October 1996.

Official Airline: United Airlines — discount rates are available, call 800-521-4041 and mention the **Meeting Code: 502BA.**

RETURN WITH PAYMENT TO:

Technology 2006, c/o Convention Data Services, Inc., P.O. Box 1328, Hyannis, MA 02601
For fastest registration fax to: (508) 778-7718

Construction of Tests of Information-Retrieval Systems

The Internet is utilized in constructing test collections.

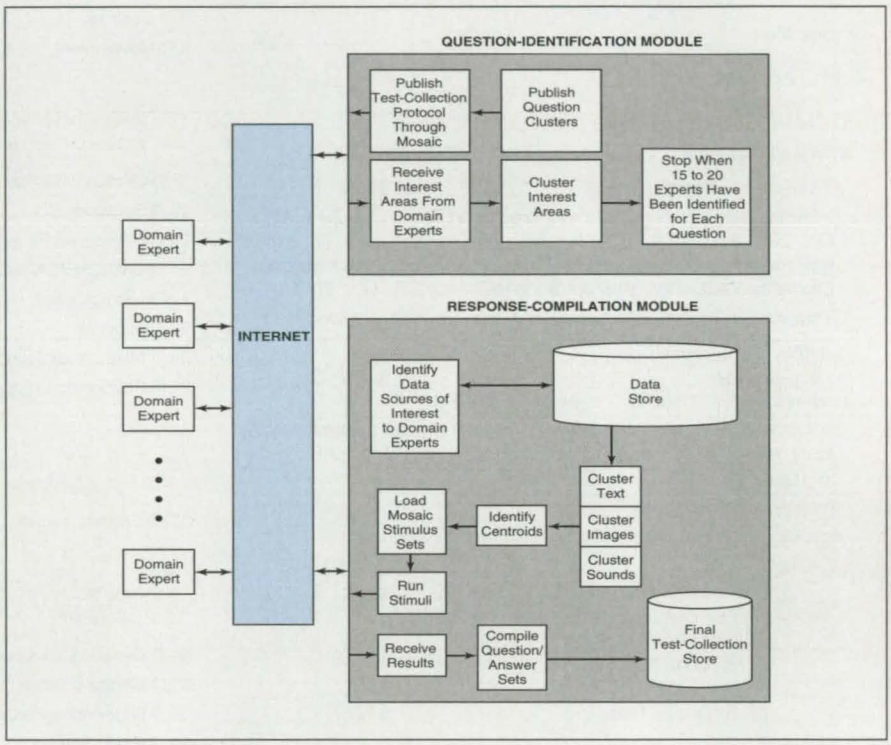
Lyndon B. Johnson Space Center, Houston, Texas

A method of measuring the performances of computerized multimedia (text, images, and sound) information-retrieval systems involves utilization of the Internet in constructing test collections with the help of experts in various domains of specialized knowledge. "Test collection" denotes a collection of sets of questions and answers, devised by the domain experts, that are representative of (1) questions asked of information-retrieval systems within their domains and (2) the correct and/or relevant (in their expert opinions) answers that information-retrieval systems should give to those questions.

In measuring the performance of an information-retrieval system by this method, one seeks to determine to what degrees the system approaches optimality according to the following three criteria:

- Retrieval of the minimum number of items considered by the experts to be irrelevant (this is the traditional precision criterion);
- Retrieval of the maximum number of items considered by the experts to be relevant to greater or lesser degrees (this is the traditional recall criterion); and
- Correlation between the ordering of the retrieved items and the ordering preferred by the experts.

An essential component of the method is a theory for constructing a test collection that is truly representative in the sense that it is robust in the face of variability of judgments among experts. The theory is based partly on techniques of psychometric scaling and stochastic transitivity as applied to the judgments of the experts.



The **General Procedures for Construction of Test Collections** are implemented in modules. The test collections are constructed from the judgments of experts with whom the test-collection constructor communicates through the Internet.

Heretofore, the acquisition of test collections from the experts has been impeded by the geographic dispersion of the experts. The Internet now makes it possible to largely overcome this impediment. In particular, its Mosaic presentation feature accommodates pairwise multimedia presentations of question and answer data to the experts and enables the experts to send their judgments back by electronic mail (see figure).

This work was done by Mark E. Rorvig of **Johnson Space Center**. *For further information,* ***write in 96*** *on the TSP Request Card. MSC-22542*

Spreadsheet Fourier Analysis of Repetitive Data Signals

The technique can be used to determine spectral contents of complex data signals.

John F. Kennedy Space Center, Florida

A technique for frequency- and time-domain analysis of repetitive data signals involves the insertion of the signal representation into a commercial spreadsheet computer program, computing the Fourier series of the signal. By use of a macro in the spreadsheet, any number of harmonics of the fundamental frequency of the stream can be determined (see Figure 1). The technique can be used to determine the spectral contents of complex data signals, such as modulated unbalanced synchronous quaternary or binary phase-shift keying (see Figure 2),

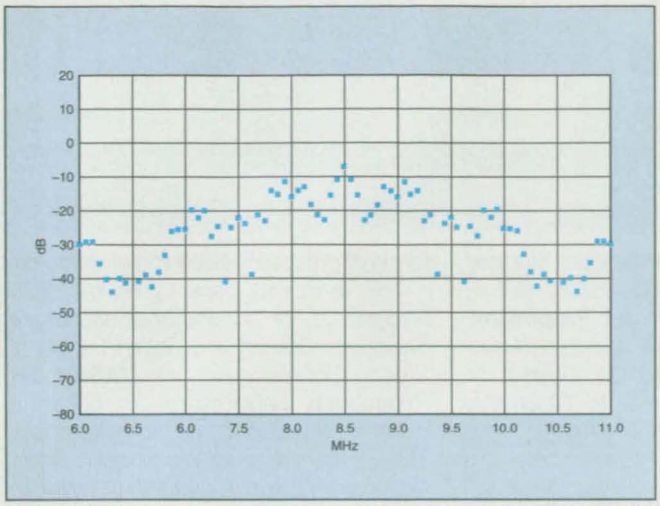


Figure 1. This **Computed Frequency Spectrum** of binary phase shift keyed 32-bit pattern, hexidecimal 59CDB300, modulated at 8.5 MHz and data rate of 2Mbps was derived via a macro in a commercial spreadsheet computer program.

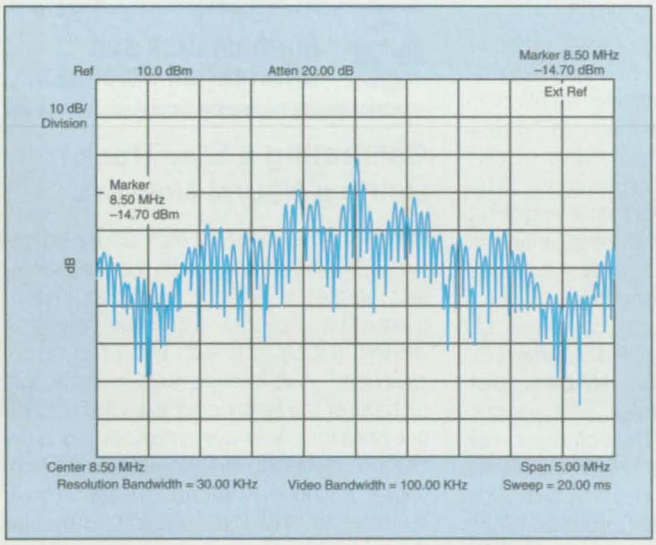


Figure 2. The **Actual Spectral Plot** of the data stream demonstrated good correlation between the computed approach in Figure 1 and the actual shown here.

baseband biphase or non-return-to-zero, level. A principal ad-vantage of this technique over techniques based on fast Fourier transforms (FFTs) is that the Fourier series represents the exact spectral contents as precisely as desired, whereas FFTs are only approximate. One use of this technique is to determine exact filters for a given code and to use the magnitude of those filters in an error-correction algorithm. By extension of this concept, the technique can be used to design coding algorithms coupled with filtering aimed at achieving transmission at higher data rates, less bandwidth, and/or lower error rates in an operating environment. The technique can also be used to aid instruction in frequency analysis and/or the scientific use of spreadsheets.

This work was done by Lewis Lineberger of **Kennedy Space Center.** *For further information,* ***write in 12*** *on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Kennedy Space Center; (407) 867-2544. Refer to KSC-11812.

Books & Reports

These reports, studies, and handbooks are available from NASA as Technical Support Packages (TSPs) when a Request Card number is cited.

Physical Sciences

External Cluster Combustion of Binary-Fuel Drops

A report presents a theoretical study of the sheet flame combustion of clusters of binary-fuel drops. This is one in a series of related studies by the author. "Binary fuel" as used here denotes a liquid fuel that comprises a solvent (a larger-mass-fraction, more viscous, less volatile constituent) and a solute (a smaller-mass-fraction, less viscous, more volatile constituent). The binary-fuel concept provides a simplified model for predicting trends in the behavior of practical liquid fuels, which typically contain tens of constituents. In this study, the timing of ignition and the location of the flame relative to a cluster of drops are calculated by use of criteria derived in previous studies.

This work was done by Josette Bellan of Caltech for **NASA's Jet Propulsion Laboratory.** *To obtain a copy of the report, "External Cluster Combustion of Binary-Fuel Drops,"* ***write in 70*** *on the TSP Request Card. NPO-19920*

Cause of Irregularity in Combustion in Hybrid Rocket Motors

Two reports discuss physical and chemical mechanisms involved in combustion in hybrid rocket motors. Included in the reports are descriptions of experiments that were conducted in an effort to identify the cause of subacoustic pressure irregularities that have been observed in such combustion. The researchers hypothesize that it might be possible to eliminate the irregularities in combustion by adding a slight amount of solid oxidizer to the hybrid fuel.

This work was done by Leon D. Strand, Robert L. Ray, and Norman S. Cohen of Caltech for **NASA's Jet Propulsion Laboratory**. *To obtain copies of the reports, "Characterization of Hybrid Rocket Internal Heat Flux and HTPB Fuel Pyrolysis" and "Hybrid Propulsion Based on Fluid-Controlled Solid Gas Generators,"* ***write in 11*** *on the TSP Request Card. NPO-19794*

Analysis of the Orbit of the TOPEX/Poseidon Satellite

A report reviews the history of the orbit of the TOPEX/Poseidon satellite around the Earth during its three-year primary mission. The TOPEX/Poseidon mission is a joint project of NASA and the French space agency Centre National d'Etudes Spatiales (CNES). Following launch on August 10, 1992, the TOPEX/Poseidon satellite began a global study of ocean circulation. In a precise-orbit-determination (POD) process that involved the use of a combination of dual-frequency radar altimetry with laser ranging and with Doppler orbitography integrated by satellite (DORIS), radial positions were defined, relative to the geocenter, to a root-mean-square accuracy of about 4 cm. The results from the POD process were used to compute a representation of the orbit in terms of precise classical mean elements.

This work was done by Raymond B. Frauenholz, Ramachand Bhat, and Bruce Shapiro of Caltech and Robert Lequitt of Sterling Software, Inc., for **NASA's Jet Propulsion Laboratory**. *To obtain a copy of the report, "An Analysis of the TOPEX/Poseidon Operational Orbit: Observed Variations and Why,"* ***write in 56*** *on the TSP Request Card. NPO-19853*

Mathematics and Information Sciences

Calibrating a Star Tracker Using a Neural Network

A report discusses a method for adaptive in-flight calibration of a star tracker. A star tracker is an optoelectronic instrument that includes a charge-coupled-device (CCD) camera mounted in a spacecraft and is used to determine the attitude of the spacecraft from the apparent positions of known stars. In this calibration method, a general regression neural network integrates in-flight measurements and star-catalog data to "learn" a nonlinear mapping that quantifies the distortions introduced into CCD star images.

This work was done by David S. Bayard of Caltech for **NASA's Jet Propulsion Laboratory.** *To obtain a copy of the report, "Neural Net Application to In-Flight Star Tracker Calibration,"* ***write in 21*** *on the TSP Request Card. NPO-19900*

Materials

HAN as Oxidizer in Hybrid Rockets

A report proposes the use of hydroxyl amine nitrate (HAN) as an oxidizer instead of liquid oxygen in hybrid rocket engines. A hybrid rocket engine is one

Far more powerful than just a materials library

MSC/MVISION and IBM

As analysis complexity increases and design cycles shrink, engineers need a quick, comprehensive, easy-to-use method of comparing, evaluating, and analying materials alternatives. The industry standard for materials information storage and exchange, MSC/MVISION provides far more power and functionality than ordinary materials libraries — especially when it runs on IBM's RISC System/6000. The MSC/MVISION Materials Information System integrates the broadest range of up-to-date materials data directly into MSC/NASTRAN, MSC/PATRAN, Pro/ENGINEER, and other popular CAD and CAE environments.

Imagine the Possibilities

The IBM RISC System/6000 family of products delivers the power and performance that make it the key solution for business. IBM is the fastest growing provider of UNIX systems with superior technology, scalability, application leadership, robust productivity tools, and world-renowned service and support.

For more information about MSC/MVISION or for a copy of the MSC White Paper "Why Materials Are No Longer a Simple Assumption," contact MSC today at **1-800-642-7437**, ext. **2500** or **http://www.macsch.com.**

IBM Business Partner

For more information about IBM's RISC System/6000, call **1-800-426-2255,** or visit the IBM website at **http://www.Austin.IBM.com**

MSC **The MacNeal-Schwendler Corporation**

For More Information Write In No. 648

in which a solid fuel is burned by use of liquid or gaseous oxidizer. The flow of oxidizer can be started or stopped to start or stop the engine. HAN and its derivatives have been used as components of liquid propellants in military guns. Unlike liquid oxygen, HAN can be stored at room temperature and can be handled with relative safety. It generates benign exhaust products. It has been extensively characterized with respect to thermodynamic properties and compatibility with various materials. Issues to be addressed in future development include combustion efficiencies, burning rates, and scaling rules.

This work was done by Kumar N. Ramohalli and Warren Dowler of Caltech for **NASA's Jet Propulsion Laboratory**. *To obtain a copy of the report, "HAN Hybrids for Safe and Low Cost Propulsion,"* ***write in 19*** *on the TSP Request Card. NPO-19854*

Electronic Systems

Autonomous Optical Navigation for Pluto Fast Flyby Mission

A paper describes an autonomous optical-navigation system to be added to the spacecraft of the Pluto Fast Flyby Mission, which is intended to make scientific observations from a trajectory passing near the planet Pluto and involving approach velocities of 15 to 20 km/s. The optical-navigation system would include a camera that would acquire still images of Pluto against the star background, at designated times during the last few days before the initially predicted time of closest approach to Pluto. The system would process the image data into information on the location of the spacecraft relative to Pluto, then use this information along with previous estimates of the spacecraft trajectory to obtain increasingly accurate estimates of the trajectory and, in particular, of the time of closest approach.

This work was done by Robin M. Vaughan and Stephen P. Synnott of Caltech for **NASA's Jet Propulsion Laboratory**. *To obtain a copy of the report, "Autonomous Optical Navigation for the Pluto Fast Flyby Mission,"* ***write in 1*** *on the TSP Request Card. NPO-19743*

Mechanics

Protective Gas Bags for the Mars Lander

A report describes preliminary design studies and experiments for developing a system of gas bags that could be inflated on command to surround the main body of the lander portion of the *Mars Pathfinder* spacecraft. The gas bags are needed to cushion the lander against the impact of landing on the Martian surface. The lander would have a tetrahedral body, each face of which would be covered by a gas bag comprising six approximately spherical lobes of 0.9-m radius pressed together on 1.0-m centers. When inflated, the gas bags would be held in place and in shape by ropes. The objective of the efforts described in the report was to minimize the total mass while maximizing the performance of the gas bags.

This work was done by Tommaso P. Rivellini of Caltech for **NASA's Jet Propulsion Laboratory**. *To obtain a copy of the report, "Development and Testing of the Mars Pathfinder Inflatable Landing System,"* ***write in 24*** *on the TSP Request Card. NPO-19925*

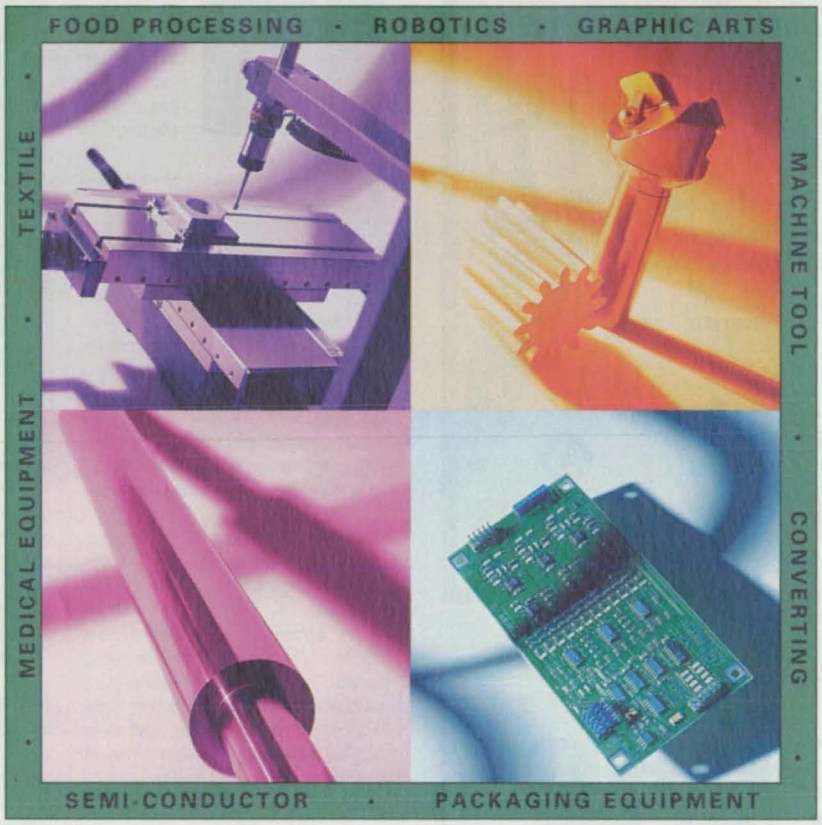
Machinery/Automation

Computer-Controlled Two-Axis Pointing System

A brief report describes a small, lightweight, computer-controlled pointing system for the *Mars Pathfinder* lander and possibly other spacecraft and planetary landers. The system includes a two-axis, motor-driven gimbal and electronic control circuitry, with motor current and voltage feedback. The system implements control techniques described in U.S. Patent 4,692,674, which accompanies the report.

This work was done by Douglas Packard and Michael R. Johnson of Caltech for **NASA's Jet Propulsion Laboratory**. *To obtain a copy of the report, "Small Two Axis Gimbal With Direct Computer Control" and of the patent, "Brushless DC Motor Control System Responsive To Control Signals Generated By A Computer Or The Like,"* ***write in 14*** *on the TSP Request Card. NPO-19800*

We Believe That Every Application Has One Feedback Solution.



It's Heidenhain. Every industry has one company that defines it. In position feedback that company is **HEIDENHAIN**. ■ We lead the industry. And, more importantly, we will continue to lead it with innovative linear and rotary encoders that have no equal. ■ Currently, we offer you 100,000 variants of encoders. This unique flexibility and capability enables us to do what no other company can — offer a system that exactly fits your application needs. And that, in turn, gives your machinery the edge in the marketplace. It's more efficient. More accurate. Easier to use. ■ Additionally, we offer you OEM salesmen who are so experienced they usually function as part of our customers' design team. A service we're happy to provide free because linear and rotary encoders are most effective when "designed in" at the earliest possible conceptual stages. ■ Every application, your application, has one feedback solution. It's **HEIDENHAIN**.

HEIDENHAIN

HEIDENHAIN CORPORATION ■ 115 Commerce Drive ■ Schaumburg, IL 60173 ■ Phone: 847.490.1191 ■ FAX: 847.490.3931

North American Sales & Service Offices
Salem, New Hampshire • Aquascaliante, Mexico • Los Alamitos, California • Mississauga, Ontario, Canada

New on the Market

Product of the Month

Software Partners/32, Topsfield, MA, has introduced SafetyPosit, a software-based **data backup service** that backs up irreplaceable data to a secure, remote storage site over an Internet connection. The storage vault can support up to 9 terabytes of data and includes a security firewall, a RAID server to receive backups, and a robotic tape library for storage. A 128-bit data encryption system encrypts data before leaving the desktop, and it is stored in encrypted format. Only the user with the original key can read the data. Pricing ranges from $49.95 per month for 100 MB of data to $395 per month for up to 1 gigabyte of monthly new data.

For More Information Write In No. 720

ImageNation, Beaverton, OR, offers a **PC-based machine vision system,** which includes a Costar CV-M10 progressive scan video camera, two ImageNation PX500 frame grabber boards, and software that integrates the components. The system provides 500 x 485 TV lines of resolution in standard RS-170 format at a video rate of 60 frames per second.

For More Information Write In No. 715

Columbia Research Laboratories, Woodlyn, PA, has announced the 2684 Series of integral, full bridge, encapsulated, temperature-compensated **strain sensors**, which are bonded directly to the surface being tested. The direct strain measurement sensors can be installed by field technicians or manufacturing personnel and are available to match a variety of materials.

For More Information Write In No. 719

Phytron, Waltham, MA, has introduced the ZSS 25.500 **stepper motor**, which features 500 full steps per revolution and a 25 mm diameter. The motor is available in two lengths with three different windings per length. Holding torques are 10 or 20 mNm, depending on the motor length. Speeds to 4500 RPM can be reached.

For More Information Write In No. 723

The BENGAL **abrasive waterjet machining center** from Flow International Corp., Kent, WA, features the FlowMaster™ PC-based control system, an abrasive waterjet, an X-Y motion system, and a 39.3 x 19.6" work table. Designed for machining prototypes of most materials, the system provides linear accuracy of ±0.006 and repeatability of ±0.004.

For More Information Write In No. 716

The SERVOSTAR **digital servo amplifier** from Kollmorgen Motion Technologies Group, Radford, VA, is used in machine tool, packaging, electronic assembly, and defense applications, and operates brushless motors in single- or multi-axis motion control systems. Current ratings from 3 to 35 amps are available.

For More Information Write In No. 721

The PCI XPG-1000 **power grabber** from DIPIX Technologies, Ottawa, ON, Canada, utilizes a PCI local bus master/slave controller that allows the unit to function as a PCI bus master, taking control of the PCI bus in burst mode and allowing the host processor to continue processing while data is transferred to/from the unit. The system features up to 256 MB of flexible image memory, and frame grabbing from most sensors at data rates to 48 MB/second.

For More Information Write In No. 718

Transicoil, Valley Forge, PA, offers the Size 5 **brushless DC motor** for motion control. The 0.5" OD motor is available in two high-speed models: 0 to 50,000 RPM and 0 to 100,000 RPM. Features include long and short configurations, harsh environment designs, various coil winding voltages, and custom drive electronics.

For More Information Write In No. 722

To us, it is, at 6,500 metric tons, the largest, the most powerful, the most advanced aluminum extrusion press in the world.

To you, it is the world's most sophisticated idea machine. It opens new possibilities. It shortens the distance from concept to reality. It sharpens your competitive edge.

And, along with complete painting facilities and an anodizing system that goes state-of-the-art one better, it's just one of eight presses available to meet your most demanding specifications.

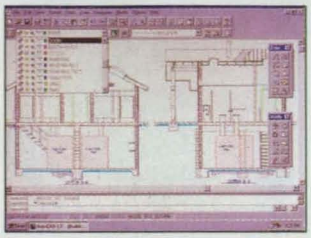
Until today, there were things you just couldn't do with aluminum extrusions. Welcome to the future.

Aluminum Shapes Inc.

THE FUTURE TAKING FORM

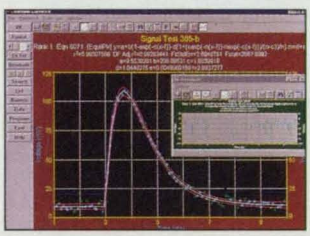
9000 RIVER ROAD, DELAIR, NJ 08110 609.662.5500 fax 609.662.5605

New on Disk



AutoCAD LT for Windows 95 **2D design and drafting software** from Autodesk, San Rafael, CA, is data-compatible with AutoCAD R13 and runs on MS-Windows NT 3.51. Users can exchange files with AutoCAD 13 users without translation. It also reads and writes AutoCAD releases 11 and 12 drawing files, as well as drawings from previous versions of AutoCAD LT. An OLE 2.0 server and container support allows users to link spreadsheets or other objects into drawings and/or embed drawings into reports. The program costs $489 and ships with both CD-ROM and 1.44 MB diskette.

For More Information Write In No. 725



TableCurve 2D Version 4.0 from Jandel Scientific Software, San Rafael, CA, is a 2D **automated curve-fitting software** package for Windows 95, NT, and 3.1 that locates best-fit candidate equations from a built-in set of more than 3,600 functions, enabling users to find the equation best describing their data. Users also can enter their own functions, which can be fitted and ranked with the built-in equations. A new custom formatting option allows users to customize graphs using one of five residuals graph formats. The 32-bit program is priced at $495.

For More Information Write In No. 729

MicroSim Corp., Irvine, CA, has announced its 6.3 release of **electronic design automation software**, which includes a graphical part browser, error traceback feature, a symbol creation wizard for schematic entry, goal functions wizard, and expanded simulation libraries. A Message Viewer helps to identify and correct hardware language syntax errors in synthesizing Complex Programmable Logic Devices (CPLDs) or Programmable Logic Devices (PLDs).The program is available for Windows 3.1, Windows NT, Windows 95, and Sun Microsystems platforms and is priced from $479.

For More Information Write In No. 732

Milestones, Etc. Version 4.5 **project management software** from Kidasa Software, Austin, TX, creates Gantt charts, timelines, machine cycles and other project schedules. Schedules are created using an on-screen toolbox from which users select standard commercial or government symbology. It supports yearly, quarterly, weekly, daily, hourly, minute, and user-defined timescales. The cost is $199 and the program runs with Windows 3.1, Windows 95, Windows NT, and Windows/Workgroups.

For More Information Write In No. 727

Analytical Graphics, King of Prussia, PA, has released Satellite Tool Kit (STK)® **graphical and numerical analysis software**, which enables visualization and analysis of relationships involving satellites, aircraft, ships, ground vehicles, ground stations, and targets. A new user interface, a database of thousands of space vehicles, and a data reporting tool for customizing data are included. The program runs on UNIX systems and on PCs with Windows 95 or Windows NT.

For More Information Write In No. 737

Cadkey, Windsor, CT, has announced SiteSculptor™ **virtual reality model language (VRML) software** for building VRML worlds for home pages on the World Wide Web. The authoring software operates on Windows 95, NT, 3.1, and Windows for Workgroups. It provides 3D modeling tools such as CAD solid modeling, NURBS surface creation, and boolean operators for building 3D multimedia web sites. Users can create, animate, and walk through a virtual world, and can create and edit various 3D shapes. The software costs $49.95.

For More Information Write In No. 730

Success 3.0 for Windows from U.S. COST, Atlanta, GA, is **estimating and cost management software** that allows users to organize projects and prepare budgetary estimates. It provides access to labor crafts, equipment, crews, and materials, and connects with CAE/CAD, scheduling, accounting, and bidding software using OLE 2.0 automation. The software automatically launches, passes data to, and controls Windows-based programs such as Microsoft Project, Excel, Word, and @Risk.

For More Information Write In No. 735

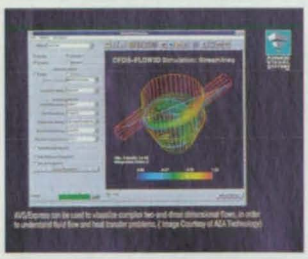
New on Disk

ICEMetrix for AutoCAD Release 13 is **parametric editing software for AutoCAD** from ICEM Technologies, a division of Control Data Systems, Arden Hills, MN. It operates within any existing AutoCAD drawing file and enables users to redesign, edit, or adjust drawings and view multiple variations of a design. When a dimension is changed, the user can preview how the drawing will be affected, and can reject or accept the change or modify the dimension again. It is available for DOS, Windows 3.1, 95, and NT and costs $487.

For More Information Write In No. 731

Evolution Computing, Tempe, AZ, has released EasyCAD for Windows version 4.5 **CAD software**, which interfaces with AutoCAD® via .DXF file exchange, named layers, and compatible entities. New features include bitmap fill editing, scaled print preview, autosave, chained offsets, and a macro language of more than 30 new commands. AutoCAD characters are transferable, and drawing files from AutoCAD become half the size in EasyCAD. The software operates in Windows 95, NT, 3.1, and Windows for Workgroups, as well as OS/2 Warp.

For More Information Write In No. 734

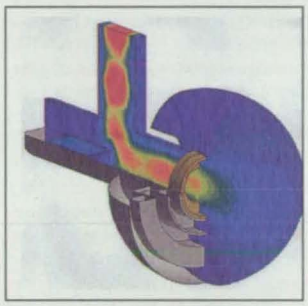


Advanced Visual Systems, Waltham, MA, has released AVS/Express 3.0 **3D data visualization and imaging software** in two editions: a Visualization Edition for end-users, and a Developer Edition for technical and commercial developers. The multiplatform software is used for data visualization, image processing, graphics display, and database connectivity and generates 2D plots and graphs. Pricing of the Visualization Edition starts at $6000 for UNIX systems and $2995 for Windows 95 and NT; the Developer Edition starts at $25,000 for UNIX and $18,000 for Windows.

For More Information Write In No. 728

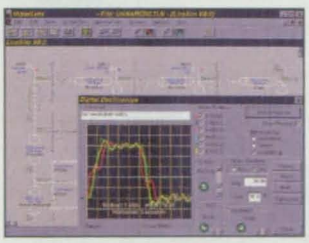
SolidWorks Corp., Concord, MA, has announced SolidWorks 96 **mechanical design software** for Microsoft Windows NT and Windows 95. Enhancements to the previous version include advanced assembly modeling, new part modeling features, and drafting enhancements that include automatic creation of an embedded Excel spreadsheet. Models can be designed in the context of an assembly; the motion of an assembly and its components can be viewed in real-time using Dynamic Assembly Visualization. The program costs $3995.

For More Information Write In No. 726



The MacNeal-Schwendler Corp., Los Angeles, CA, has introduced Version 2 of MicroWaveLab **3D electromagnetic fields simulation software** for designing high-frequency devices such as antennas, microstrip and waveguide components, and resonators. It determines the electromagnetic behavior of new designs before prototyping, and verifies existing designs. Results are displayed in Smith charts, omega-beta diagrams, polar plots, X-Y graphs, and tabular matrices. It operates on UNIX workstations, multi-processing supercomputers, and Windows NT.

For More Information Write In No. 736



LineSim for Windows **signal-integrity analysis software tool** from Hyper-Lynx, Redmond, WA, is an interactive, pre-route tool that enables designers to investigate and plan for signal integrity issues before PCB layout at the pre-schematic design stage. The program can model virtually any type of electronic system. Modeling screens are included for PCB cross-section, whole PCB stackups, connectors, cables, and wires. It operates on Windows 3.1, NT, and 95 and costs $1495.

For More Information Write In No. 733

New Literature

Geotest, Irvine, CA, has released a 64-page catalog of **PC-based test equipment**, including test platforms, software, interfaces, and instrumentation for ATE, data acquisition, and test and measurement applications. New products described include digital instrumentation, switching/relay instruments, platforms and interfaces, and avionics support instruments.

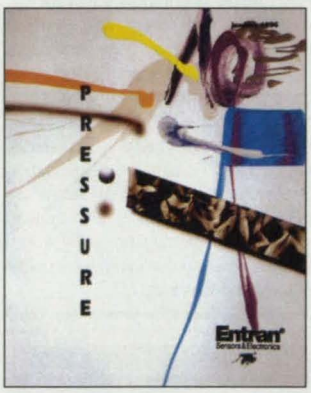
For More Information Write In No. 740

Switches are described in a 180-page catalog from Cherry Electrical Products division of The Cherry Corp., Waukegan, IL. Snap-action, selector and key switches are included in a nine-page selection guide. A technical reference section features switch terminology, electrical life charts, a glossary, and international standards.

For More Information Write In No. 741

Hilliard Corp., Elmira, NY, offers a brochure describing MT overrunning **clutches and clutch couplings**. They are available in a range of sizes, with bores ranging from 1/4" to 5", in torque ratings from 60 lb.-ft. to 21,800 lb.-ft. The brochure includes specifications, performance data, and applications.

For More Information Write In No. 742

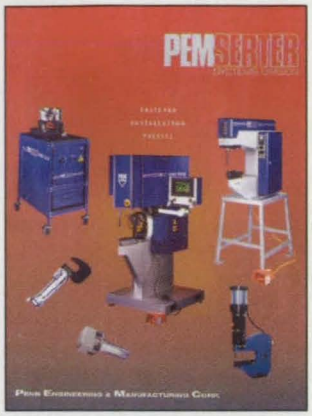


Entran Devices, Fairfield, NJ, has released a 112-page catalog of **sensors and electronics** for pressure measurement. Included are new models for static and dynamic measurement with associated power supplies, meters, and amplifiers. Sensors from sub-miniature to heavy-duty designs are described, with pressure ranges from 2 psi to 25,000 psi in low and high temperature ranges.

For More Information Write In No. 747

A 40-page catalog of **linear bearing components and automation accessories** from Tusk Direct, Bethel, CT, features ball slides, crossed roller slides, recirculating slide guides, and ball bushing and shafting systems. The products are used by design engineers in industrial design of motion control equipment and machinery.

For More Information Write In No. 744

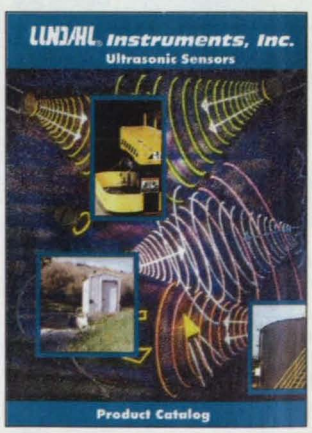


PEMSERTER® Plus and Series 2000™ **fastener-installation systems** from Penn Engineering & Manufacturing Corp., Danboro, PA, are detailed in a 12-page brochure. Included are the Series 4 manual press, the Series B49 pneumatic press, the TNT 618™ turret nut tool system, the Series P3 hand press, and the MICRO-MATE® hand tool. The presses can handle high-volume applications or perform prototype work.

For More Information Write In No. 743

Metal and polymer seals specifically designed for harsh environments are described in a design manual from Advanced Products, North Haven, CT. Step-by-step instructions for determining the type, size, and material of seals for each application are provided; flow charts, applications, and features are included for each seal type. The 167-page manual is available in three-ring binder format.

For More Information Write In No. 746



Lundahl Instruments, Logan, UT, offers a 32-page catalog of **ultrasonic sensors and sensor systems** for environmental monitoring, industrial automation, and collision-avoidance applications. Selection guides for controllers and sensors and self-contained sensors are provided, as well as an accessories selection chart.

For More Information Write In No. 745

Add Cutting Edge Technology to Your Manufacturing Processes!

ATTEND

AUTOFACT® '96

Advancing Product and Process Design Engineering in Manufacturing

November 12-14, 1996 • Cobo Center • Detroit, Michigan

AUTOFACT '96 is the industry's premier conference and exposition for advancing product and process design engineering in manufacturing. Learn how to integrate cutting edge technology to upgrade your manufacturing processes.

Investigate the latest computer technology applications for:

Design Engineering
Process Engineering
Manufacturing Management
Manufacturing Systems Engineering
Information Systems Management

NEW

Simplify your technology search at this year's pavilions:

Controls
EDM/PDM
MES/MRP
Rapid Prototyping
Simulation
Systems & Communications

See and compare technology developments for manufacturing processes:

Product Design
Rapid Prototyping
Computer-Aided Design
Computer-Aided Engineering
Computer-Aided Manufacturing
Workstations

Process Design
Manufacturing Requirements Planning
Manufacturing Execution Systems
Factory Automation
Machine Vision
EDM/PDM Tools
and more...

Bring your manufacturing team!

Yes, tell me more about the 1996 Series of AUTOFACT Events:
Please check all that apply:

☐ AUTOFACT West '96
March 25-28, 1996
Los Angeles, California
With WESTEC '96

☐ AUTOFACT Asia '96
July 9-12, 1996
Singapore
A High Growth Region

☐ AUTOFACT '96
November 12-14, 1996
Detroit, Michigan
The Premier Event

Name/Title _____

Company/Division _____

Address _____

City/State/Zip/Country _____

Phone/Fax _____

SME®

Mail or Fax this page to: Irene Tsatsanis
Society of Manufacturing Engineers
One SME Drive • PO Box 930 • Dearborn, MI 48121
Fax: 313/271-2861
or
Call our customer service department to receive more information. Phone: 1-800-733-4763 (in the USA)
313/271-1500 (outside USA)

Code: AF96/NASA

Marketplace

Advertisers Index

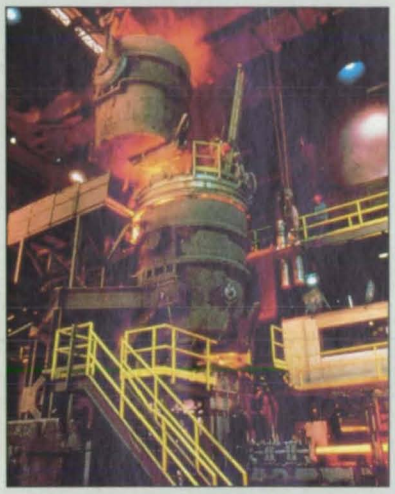
*RAC stands for Reader Action Card. For further information on these advertisers, please write in the RAC number on the Reader Action Card in this issue. This index is compiled as a service to our readers and advertisers. Every precaution is taken to insure its accuracy, but the publisher assumes no liability for errors or omissions.

NASA Tech Briefs, ISSN 0145-319X, USPS 750-070, copyright© 1996 by Associated Business Publications Co., Ltd. Copyright is not claimed for the individual "tech briefs" contained in this publication. The U.S. Government has a paid-up license to exercise all rights under the copyright claimed herein for government purposes. NASA Tech Briefs is published monthly by Associated Business Publications Co., Ltd., 317 Madison Ave., Ste. 921, New York, NY 10017-5391. Editorial, sales, production and circulation offices at 317 Madison Ave., New York, NY 10017-5391. Subscription for non-qualified subscribers in the U.S., Panama Canal Zone, and Puerto Rico, $75.00 for 1 year $125.00 for 2 years; $200.00 for 3 years. Single copies $10.00. Foreign subscriptions one-year U.S. Funds $195.00. Remit by check, draft, postal, express orders or VISA, MasterCard, or American Express. Other remittances at sender's risk. Address all communications for subscriptions or circulation to NASA Tech Briefs, 317 Madison Ave., New York, NY 10017-5391. Second Class postage paid at New York, NY and additional mailing offices.

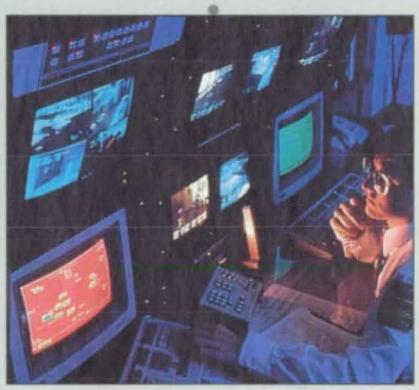
POSTMASTER: please send changes to NASA Tech Briefs, P. O. Box 10523, Riverton, NJ 08076-0523.

NASA Solutions. . .

Making Space Technology Work for You



Security Systems Software CLIPS, a Johnson Space Center expert system program, enabled Software House to develop the *C.CURESystem 1 Plus*. This system allows users to manage large amounts of information, solve unique security problems and gain power over access control with time schedules, authorization levels and door entry with card validation.



Plasma Torch Using a plasma torch technology developed by Ames Research Center, Plasma Technology Corporation (PTC) has revived interest in a decade-old system for industrial heating. The *plasma torch* line developed by PTC far surpasses conventional methods. It offers greater temperature and processing control, faster reaction time, lower capital costs and a more efficient use of energy.

Environmental Seal Magnetizing fuel by dispersing finely ground particles of iron oxide through it – an idea developed by a Lewis Research Center scientist is the concept behind Ferrofluidic Corporation's *ferrofluids seal*. The initial use was in a zero leakage non-wearing seal for making semiconductor chips. The corporation now manufactures rotary feedthrough seals for the semiconductor industry.

NASA technology positioned the U.S. in the forefront of space exploration. Whether it is sensors, microelectronics, information systems or another area, NASA technologies can help your business position itself in front of your competition.

TechTracS – the newest search engine for finding the NASA technologies with the greatest commercial potential – can be accessed over the Internet through the NASA Commercial Technology Home Page: http://nctn.hq.nasa.gov.

To match your companies needs with NASA solutions contact the NTTC by

- Internet: http://www.nttc.edu.
- Phone: 1-800-678-6882.

GOULD
Instrument Systems

New Gould COBRA16 Real-Time Analysis System

Gould's new COBRA16 combines a real-time recording system with the power of real-time mathematical calculations to provide real-time results. Its Windows 95® control system allows real-time color monitoring of raw or computed data. With its extensive post-acquisition analysis program, the COBRA16 delivers unparalleled performance in a portable package.

Real-Time Results

If every test problem were the same, the answers would be simple.

Now, Gould's new Real-Time Math Module lets you create a unique mathematical solution to your special test problem. This new module converts real-time raw data to useful information at the time and place of acquisition. Instantaneous answers make the most effective use of your valuable test cell resources, providing savings which go directly to your bottom line.

Add Gould's powerful Real-Time Math Module, the heart of our new COBRA16 System, to any existing TA11 or TA6000 product to provide powerful, enhanced functionality. Perform real-time calculations at 50,000 samples per second. Use resultant math outputs as inputs to additional math functions, providing for complex equations. Trigger acquisition using derived results, raw data or combinations. To ensure easily interpreted results, define your input units to provide real-world values; such as PSIG or Watts.

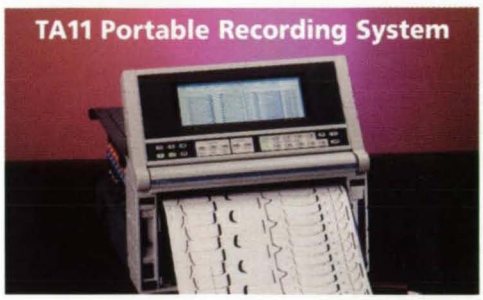
If you have uncommon problems, call your Gould representative for some surprisingly uncommon solutions.

$$\sqrt{\frac{\left(\int \sin\left(\frac{\text{input1}}{\pi}\right) dt\right) \times e^{\text{input2}}}{\left(\frac{8.214 \times \text{input3}}{\tan^{-1}(\text{input4})}\right) \times \log(\text{input5} + 6.1)}}$$

TA6000 Recording System

• Up to 64 channels • Continuously record to Hard Disk at 1 MS/sec • External high resolution color monitor • Compatible with Real-Time Math Module

TA11 Portable Recording System



• Up to 16 channels • Record transient signals to 8 Msample memory • Compatible with Real-Time Math Module

6600 Series Signal Conditioning

• Wide selection allows instrumentation to be used with strain gage, temperature, and frequency conversion transducers • The perfect complement to Gould's Real-Time Math Module

Fast Action FAX: (216) 328-7404 attention Inquires Manager, or CALL: (800) 468-5365

❑ Have a Gould Sales Representative call me to arrange a demonstration

❑ Rush me free information on Gould's new Real-Time Math

NTB 9/96

(Please print)

Name: _____

Title: _____

Company: _____

Street: _____

City: _____ State: _____ Zip: _____

Telephone: ( ) _____

FAX or mail coupon/photocopy (you may affix business card) to: Gould Instrument Systems, Inc. 8333 Rockside Road, Valley View, OH 44125

For More Information Write In No. 539