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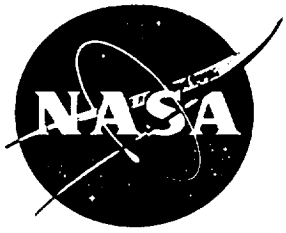
The NASA SBIR Product Catalog

Third Edition



National Aeronautics and Space Administration
Small Business Innovation Research Program
Washington, DC 20546

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NASA Small Business Innovation Research

Product Catalog

Foreword

This document is the third annual issue of a catalog of products that have been produced as a result of projects supported under the Small Business Innovation (SBIR) programs of the National Aeronautics and Space Administration. Since 1983 the NASA SBIR program has benefitted both the agency and the high-technology small business community. By making it possible for more small businesses to participate in NASA's research and development, SBIR provides opportunities for these entrepreneurs to develop products that may also have significant commercial markets. Structured in three phases, the SBIR program uses Phase I to assess the technical feasibility of novel ideas proposed by small companies and Phase II to conduct R&D on the best concepts. Phase III, not funded by SBIR, is the utilization and/or commercialization phase.

The purpose of this catalog is to assist small business firms in making the community aware of products emerging from their efforts in the SBIR program. It contains descriptions of some products that have advanced into Phase III and others that are identified as prospective products. Both lists of products in this catalog are based on information supplied by NASA SBIR contractors in responding to an invitation to be represented in this document. Generally, all products suggested by the small firms have been included in order to meet the goals of information exchange for SBIR results. Of the 444 SBIR contractors NASA queried, 137 provided information on 219 products included in this catalog.

The catalog presents the product information in the technology areas listed in the table of contents. Within each area, the products are listed in alphabetical order by product name and are given identifying numbers, e.g., A.01. Also included is an alphabetical listing of the companies that have products described in this catalog. This listing cross-references the product list and provides information on the business activity of each firm. In addition, there are three indexes: one a list of firms by states, one that lists the products according to NASA Centers that managed the SBIR projects, and one that lists the products by the relevant Technical Topics utilized in NASA's annual program solicitation under which each SBIR project was selected.

One major national objective for the SBIR Program is broad commercial applications for the results of R&D sponsored by the Federal government and performed by small businesses. Our hope is that this catalog will stimulate the interest of potential customers and investors in the products listed and that it will encourage contacts with SBIR participants whose research results have already borne fruit.

Harry W. Johnson
Director, Small Business Innovation Research

Table of Contents

PRODUCTS

This section describes products that were derived from NASA SBIR contracts. The products are listed according to the technical areas used by the Small Business Administration in its reporting on the SBIR programs of all participating agencies. In addition to a description of the products, the names and telephone numbers of persons to contact for more information are provided. The SBIR project to which each product relates is identified by the NASA contract number, the responsible NASA Center, the year (PY) in which the Phase I proposal was submitted, and the relevant Technical Topic in NASA's annual program solicitation.

A: Computer and Communication Systems

A.01

Acousto-Optic Spectrometer

Firm: **Photonic Systems, Inc.**

The PSI AOS-1000 and 1000X4 use state-of-the-art acousto-optic Bragg cell technology to measure RF power spectral density. The PSI AOS-1000 operates over a 1 GHz instantaneous frequency range. The PSI AOS-1000X4 operates over a 4 GHz range using 4 separate 1 GHz bandwidth channels. Each system has a frequency resolution of 1 MHz. These spectrometers use frequency channelization to achieve 100 percent probability of detection. The output from each AOS-1000X4. Each spectrometer also contains a digital signal processing board, PC/AT computer and an IEEE 488 Bus Interface. Each unit is housed in a rack mount.

Applications: Instantaneous spectrum analysis measurement, microwave radiometry, and electronic intelligence reception.

Contact: Dennis R. Pape
407-984-8181

Related SBIR Contracts:
NAS5-34154 GSFC PY 1989 Topic 07
"Wideband, Multi-Channel, Acousto-Optic Spectrometer for Radio Astronomy Applications"

A.02

Digital Storage Device Prototype

Firm: **TINI Alloy Company**

The product is a prototype of a mass storage medium which is written and read optically, is physically non-volatile and suitable for archival storage, and is accessed with modified optical-scanning machinery. This is accomplished through mechanical movement of reflective domains, each on the order of a few microns in width, by means of shape memory film microactuators.

Applications: Data storage and retrieval.

Contact: A. David Johnson
510-483-9676

Related SBIR Contracts:
NAS2-13113 ARC PY 1987 Topic 06
"Digital Storage Device Using Thin-Film Shape-Memory Alloy"

A.03

Holographic Helmet-Mounted Display

Firm: **APA Optics, Inc.**

Lightweight helmet-mounted holographic display for use in NASA spacesuits. Projects CRT image onto helmet shield without obstructing vision.

Applications: Helmet-mounted display to be used in astronaut space suits.

Contact: Anil K. Jain
612-784-4995

Related SBIR Contracts:
NAS9-18163 JSC PY 1987 Topic 12
"Extravehicular-Mobility-Unit, Helmet-Mounted Display"

A.04

Intelligent Computational Resource Management System

Firm: **ISX Corporation**

The Intelligent Computational Resource Management System (ICRM) is a resource management system and technology for supporting resource usage by advanced applications in a distributed computing environment.

Applications: Management of supercomputing facilities, intelligent management of distributed computers, distributed intelligent network systems.

Contact: Scott Fouse
818-706-2020

Related SBIR Contracts:
NAS2-13027 ARC PY 1987 Topic 06
"Distributed Information Systems: The Intelligent Computational Resource Manager"

A.05

Magnetic Bearings for Optical-Disk Buffer

Firm: **Satcon Technology Corporation**

This product applies linear magnetic bearing technology to the suspension of the translator head of an optical disk data storage device. The magnetic bearing control loops perform well, achieving 100 Hz nominal bandwidth with phase margins between 37 and 63 degrees. The worst-case position resolution is 0.02 μ in the displacement loops and one μ rad in the rotation loops. The system is very robust to shock disturbances, recovering smoothly even when collisions occur between the translator and frame. The unique start-up/shut-down circuit has proven very effective.

Applications: Optical disks, Michaelson interferometers, cryogenic temperature optical movements, and chip processing.

Contact: Richard L. Hockney
617-661-0540

Related SBIR Contracts:
NAS5-30309 GSFC PY 1986 Topic 08
"Magnetic Bearings for a High-Performance Optical Disk Buffer"

A.06

Program CC, Version 4

Firm: **Systems Technology, Inc.**

Program CC is a computer-aided control-system design program that implements a broad range of classical and modern methods. The latest version includes singular value MIMO robustness methods and H_∞ optimal control features based on developments in STI SBIR projects.

Applications: Aerospace flight control systems (Pegasus, C-17); tracking antennas/telescopes (Keck telescope); computer disk drives, servo actuators, ground vehicles, chemical process control.

Contact: Jun Taira
310-679-2281

Related SBIR Contracts:
NAS1-17987 LaRC PY 1983 Topic 03
"Advanced Piloted Aircraft Flight Control System Design Methodology"
NAS1-18634 LaRC PY 1987 Topic 03
"Practical Applications of Multivariable Robustness Methods to Advanced Flight Control"

A.07

QASE®RT

Firm: **Advanced System Technologies**

QASE®RT supports system and software engineers by evaluating responsiveness and reliability of computer systems designs (software, hardware, and data). It combines and enhances the features of traditional CASE tools, performance modeling tools, and simulation languages. QASE®RT gives the user both analytic and simulation models to assess the performance effects of different hardware and software designs. The analytical models can be used to rapidly evaluate many design alternatives. The simulation models automatically build from a common system description to investigative system behavior in detail. QASE®RT is an ideal tool for designing real-time and distributed systems.

Applications: Computer system designs where performance and reliability are an issue. Examples include: air traffic control, C^3I, embedded systems, on-line and distributed systems.

Contact: Melinda Hackstass
303-790-4242

Related SBIR Contracts:
NAS7-995 JPL PY 1985 Topic 06
"Integrated Modeling Tool for Performance Engineering of Complex Computer Systems"

A.08

STARLIGHT - The Ultimate Simulation Computer

Firm: **Electronic Associates, Inc.**

The STARLIGHT simulation digital computer system solves differential equations 10 to 100 times faster than conventional high-speed computers. The key to its performance is an innovative hardware-and-software structure with a data flow processor and parallel compiler that maps the equations to the hardware for optimized solutions. The design uses a digital implementation of analog computer architecture to provide computing speeds that far exceed digital computers on the market today. STARLIGHT brings simulation computing capability to many small engineering organizations that cannot afford large simulation computer technology. STARLIGHT utilizes off-the-shelf, commercially available, components, is a UNIX®-based operating system, and has Ethernet® and X-Window® capability.

Applications: It will handle a wide range of dynamic and hardware-in-the-loop simulation applications. These include missile guidance

systems, power plant control systems, robotics and other forms of automated manufacturing equipment, rotating machinery and turbine engines, continuous real time and faster than real time system simulation of systems of nonlinear ordinary and partial differential equations in mechanical, electrical, fluid mechanics and heat transfer applications, and on line data acquisition and processing.

Contact: Ronald M. Maslo
908-229-1100

Related SBIR Contracts:
NAS5-30905 GSFC PY 1988 Topic 05
"A Parallel Processor for Simulating Manipulators and Mechanical Systems"

A.09
STel-9623 TDRSS User Transponder
Firm: **Stanford Telecommunications, Inc.**
The STel-9623 is a low-cost, TDRSS user transponder. The unit is a complete transponder with S-band transmit power options of either 5 watts or 2.5 watts. The spread spectrum receiver employs a unique architecture that provides short code (1023 Gold Code) acquisition in 2 seconds with C/No as low as 33 dB-Hz, frequency uncertainty ± 1500 Hz, and data modulation superimposed.

Applications: The STel-9623 is a transponder (receiver and transmitter) capable of providing Tracking and Data Relay Satellite System users with a versatile, low-cost communications solution. It is designed for ground, airborne, and high altitude application. Class-S screening may be obtained for space applications.

Contact: Aaron Weinberg
703-438-8022

Related SBIR Contracts:
NAS5-29416 GSFC PY 1984 Topic 08
"Integrated Receiver Using Programmable Charge-Coupled Devices"

A.10
Spacecraft Supercomputer
Firm: **Omitron, Inc.**
The Spacecraft Supercomputer is based on modular parallel processing technology and is available in Rad-Hard Class-S qualification. The NASA-funded SBIR Phase-I project is based on Omitron's existing parallel-processor testbed. The technology is directly applicable to use on board spacecraft as a result of an Army-funded development effort for space-rating of components. The goal of this project was to define an architecture having an order of magnitude performance increase over existing onboard computing resources; however, it has been shown that improvements of several orders of magnitude are achievable. With scalable processor and communication resources, the hardware can be matched to the problem domain while retaining redundancy and reprogrammability. Scalable parallel processing is applicable to a large set of onboard tasks now and in the immediate future. It provides a capability to generate and distribute data products rapidly that cannot otherwise be done.

Applications: Although focussed toward flight systems, the parallel supercomputer can provide a low-cost approach for any ground-based, computationally intensive task. The unit is programmed in the "C" language.

Contact: Frederick J. Hawkins
301-474-1700

Related SBIR Contracts:
NAS5-31409 GSFC PY 1990 Topic 06
"Spacecraft Supercomputer"

B: Information Processing and AI

B.01

English Language Interface to the Geographical Information System GRASS

Firm: **Netrologic, Inc.**

The product is a software interface to the geographical information system (GIS), GRASS, which permits the user to retrieve information from the GRASS database through English-language requests. The language interpreter that is built into the system is BBN's PARLANCE. With this interface, users can perform tasks that require many lines of GRASS code with a single English-language request. The system can handle first order constraints (i.e., not just Boolean combinations of simple constraints).

Applications: With an appropriate domain model, users of many different levels of expertise can use the same interface to the system with equal facility. Users unfamiliar with the particular system can obtain immediate access to the database.

Contact: Sue Toledo
619-587-0970

Related SBIR Contracts:
NAS13-424 SSC PY 1988 Topic 07
"A Natural Language Interface to a Geographical Information System"

B.02

FDP 3107 Frequency Domain Processor

Firm: **Macrodyne, Inc.**

The FDP 3107 multi-dimensional frequency domain processor to 120 MHz, is a signal processor used in laser Doppler velocimetry techniques. Using high-speed digital technology, the FDP 2\3107 provides the user enhanced performance in complex flow fields associated with very low signal-to-noise regimes in boundary layer studies. Major improvements in signal detection plus a significant increase in measurement accuracy provide the experimenter an eight-fold increase in signals over that of present technology. An improved operating efficiency in test cells or other applications offers the user a tangible return.

Applications: The primary uses of the FDP 3107 are in turbomachinery, wind tunnels, combustion engines, propellers, water turbines, channel flow, pumps, blood flow, crystal growth. As an example, LDV techniques have been used extensively to study the mechanical structure of jet wings in wind tunnels by mapping the flowfield in proximity to the wing.

Contact: Clifford J. Jurus
518-383-3800

Related SBIR Contracts:
NAS1-18661 LaRC PY 1986 Topic 08
"Frequency Domain Laser-Velocimeter Signal Processor"

B.03

InQuisiX

Firm: **Software Productivity Solutions, Inc.**

InQuisiX is a highly adaptable classification and search engine that, when integrated in a software development environment, is an advanced software-reuse library system. An InQuisiX reuse library system with its set of cooperating tools supports a software-development process based on reusing software assets instead of development from scratch. InQuisiX provides high-performance classification, cataloguing, searching, browsing, retrieval, and synthesis capabilities that form the foundation for comprehensive automation reuse. The InQuisiX capabilities are adaptable and extensible to support an organization's unique development process. The product includes a set of open interfaces to promote integration into the customer's software development environment.

Applications: InQuisiX may be applied to the development of any software application, independent of language. Because InQuisiX is a general-purpose information-retrieval system, it may be applied to enable reuse of software, architectures, designs, tests, documents, or any other data.

Contact: Edward R. Comer
407-984-3370

Related SBIR Contracts:
NAS1-18663 LaRC PY 1986 Topic 06
"Reliable, Knowledge-Based Reusable Software Synthesis System"

B.04

Knowledge-Based Development Tool

Firm: **Prospective Computer Analysts**

The Knowledge-Based Development Tool (KBDT) automatically crates dependency models for expert system diagnostic reasoning from CAD/CAE database files. KBDT also works interactively with design engineers to extract design rationale that can be used to enhance the diagnostic reasoning process.

Applications: May be used to augment the design of any type of system created using CAD/CAE tools.

Contact: Greg Winter
516-484-4610

Related SBIR Contracts:
NAS10-11602 KSC PY 1987 Topic 06
"CAD/CAE Knowledge-Based Development Tool"

B.05

MetaData

Firm: **I-Kinetics, Inc.**

This product is the first object-oriented tool for large-system data-specification management. MetaData is a complete, rapid application and development environment for creating and managing data specifications shared by distributed system applications. Data interfaces between different applications typically account for 50 to 80 percent of the code in a systems integration project. MetaData sharply reduces this major lifecycle cost by managing data specifications and automatically generating data interfaces for the developer. It is ideal for maintaining formal specification integrity among the various modules and project teams of a large system. MetaData uses an object-oriented model for describing and manipulating complex data exchanged between networked applications. Applications can be integrated using either dynamic or static data specifications. Static specification supports high-performance compile-time optimization. Dynamic specification allows creation of new types of complex data during runtime. MetaData's runtime services bear the full burden of updating changed specifications shared among networked applications. With either method, MetaData manages the tedious and error-prone packing of data into, and unpacking of data from, files or network packets. Metadata is compatible with any network transport or interprocess communication service that can transmit byte buffers. Objects can be passed to a high-level service, such as RPC or Sunsoft's ToolTalk™, or to lower-level services such as TCP/IP, SNA, or Novell IPX for transport over the network. MetaData for C development is available now for Sun/Unix, NeXT/Unix and PC/DOS platforms. MetaData for Common Lisp is available for all Franz Lisp platforms and the Apple Macintosh II family.

Applications: CAD/CAM tool integration; distributed trading systems; distributed information systems for operations support.

Contact: Bruce H. Cottman
617-661-8181

Related SBIR Contracts:
NAS9-18487 JSC PY 1990 Topic 05
"MetaAgents: A Framework for Intelligent Distributed Systems"

B.06

GIS-Multi-View

Firm: **Delta Data Systems, Inc.**

The product expands on basic GIS analysis by affording format-free (Raster and Vector), resolution-independent processing. A spatially integrated data volume with components having any dynamic, radiometric, or spatial resolution may be classified, transformed from format to format (vectorization), inventoried, and/or modelled without reduction to a least common denominator of resolution.

Applications: An enhancement of general geographic data processing capabilities has an across-the-board application potential in geo-science and natural resource applications.

Contact: Ren Clark
601-799-1813

Related SBIR Contracts:
NAS13-521 SSC PY 1990 Topic 07
"The Display/Analysis of Variable Resolution Spatial Data in a GIS Environment"

B.07

Neural Net Toolbox

Firm: **Accurate Automation Corporation**

The neural net toolbox is designed to be used with IRIX (UNIX) systems running on a Silicon Graphics high-performance, three-dimensional graphics superworkstation. This consists of a library of neural network algorithms that can be used for applications. Accurate Automation has developed a neurocontroller for robotic and telerobotic control using a unique, three-tier, decentralized controller operating neural networks. This controller is used for neuro-control movement training, sensor data association, task improvement and multi-joint control.

Applications: The neurocontroller is designed to improve robotic control. The neural net toolbox is designed to assist users of Silicon Graphics workstations to use neural networks in their applications.

Contact: Robert M. Pap
615-622-4642

Related SBIR Contracts:
NAS8-38967 MSFC PY 1989 Topic 05
"Advanced Telerobotic Concepts Using Neural Networks"

B.08

Neural Networks for Fault Monitoring

Firm: **Netrologic, Inc.**

The Neural Network for Fault Monitoring is capable of integrating multiple time-series in real time to determine fault conditions for rocket engines or machine tools.

Applications: Fault diagnosis and performance monitoring.

Contact: Dan Greenwood
619-587-0970

Related SBIR Contracts:
NAS9-17995 JSC PY 1986 Topic 06
"Space Transportation Analysis and Intelligent Space Systems"

B.09

NueX™

Firm: **Charles River Analytics, Inc.**

NueX is a hybrid neural network/expert system environment for exploring, learning and mastering neural and rule-based computing on the Mac. The integration of artificial neural networks (ANNs) and knowledge-based expert systems (KBs) is an ideal step in the development of intelligent systems. in general, the two methods complement each other such that ANNs provide soft constraints, while expert systems allow hard constraints. NueX exploits the complementary strengths of neural networks and expert systems to provide a hybrid environment, allowing one to create intelligent systems that can outperform either method alone. NueX 1.2 is currently available on the Macintosh. NueX features include a graphical network editor, interactive or automatic architecture development, backpropagation learning paradigm, use of any spreadsheet package as a data editor, graphical monitor for network training, rule/fast editor, forward chaining inference engine, rulebase inference monitor, automatic learning rulebase, access to network parameters and training functions from rulebase, a programmable user-interface object accessible from rulebase.

Applications: Intelligent tutoring systems, multiple target recognition, neural guidance and control, physiological monitoring, plant monitoring, situation assessment, and financial forecasting.

Contact: James M. Mazzu
617-491-3474

Related SBIR Contracts:
NAS8-39310 MSFC PY 1991 Topic 07
"A Hybrid, Neural-Network and Expert-System Approach to Remote Sensing"

B.10

ObjectExpress®

Firm: **I-Kinetics, Inc.**

ObjectExpress® is a complete development toolset for transporting complex data between different applications. It completely protects the developer from the tedious and error-prone encoding and decoding of objects from files or network packets. ObjectExpress includes both an object-oriented API for describing and manipulating data and dynamic data typing extensions for C, C++, Lisp, and Ada. Dynamic data specification enables the application to create new classes or types of complex data during runtime. ObjectExpress's runtime services bear the full burden of updating shared specifications throughout a distributed system. Static specification is also available, supporting high-performance compile-time optimization. The ObjectExpress library is used with either a high-level network transport service, such as Sun's ONC or ToolTalk, or lower-level services such as TCP/IP or Netware's IPX.

Applications: System integration, database gateways, and telemetry feeds.

Contact: Bruce H. Cottman
617-661-8181

Related SBIR Contracts:
NAS10-11464 KSC PY 1987 Topic 06
"A Development Framework for Distributed Artificial Intelligence"

B.11

Real-Time Integrated GPS/INS Navigation and Attitude Determination Software

Firm: **Mayflower Communications Company**

Mayflower has developed real-time Ada software that implements a multi-mode, reconfigurable Kalman filter specifically designed for use in attitude determination onboard spacecraft. This GPS/INS attitude determination software provides a low-cost alternative to star-trackers and other high-cost attitude systems. This software can be used in simulation or in a hard real-time system, and supports run-time modification of the stated error model definition. The simulation version runs

on PC compatibles and DEC VAX systems. The real-time system runs on Intel 386/486 systems.

Applications: Kalman filter development for space, avionics, and military systems. This software can support simulations during development, or it can be used in real-time applications.

Contact: Triveni Upadhyay
617-942-2666

Related SBIR Contracts:
NAS8-38479 MSFC PY 1988 Topic 09
"Autonomous, Integrated GPS/INS Navigation Experiment for OMV and STV"

B.12
SDL CASE Tool
Firm: **Charles River Analytics, Inc.**
SDL is a computer-aided software engineering (CASE) tool for embedding system knowledge into applications. SDL is an object-oriented shell supporting topological, rule-based, and procedural programming paradigms. SDL has an X-Windows user interface supporting interactive development and compilation into Ada source code.

Applications: Embedded systems, real-time expert systems, monitoring and diagnosis, intelligent systems, decision aids, real-time simulation, flight simulators, vehicle health monitoring.

Contact: J. Leslie Walker
617-491-3474

Related SBIR Contracts:
NAS2-13014 ARC PY 1987 Topic 03
"Expert Systems for Real-Time Monitoring and Fault Diagnosis"

B.13
SOCIAL
Firm: **Symbiotics, Inc.**
SOCIAL extends MetaCourier with a library of predefined building blocks that are specialized for particular integration and coordination tasks. For example, SOCIAL gateways provide a uniform, high-level model for integrating both custom programs and applications implemented with standard DBMSs, 4GLs, CASE tools, and AI shells. SOCIAL managers provide non-intrusive, distributed control models. Managers function as intermediaries that route task requests and results among applications, eliminating the need for "hardwired" direct connections. Scripting tools enable complex sequences of distributed activities to be executed automatically with a single command. NASA is using SOCIAL to unify applications that will automate critical launch-operation support functions for the Space Shuttle fleet, such as system monitoring, fault isolation, and management. SOCIAL will connect and manage these applications non-intrusively, promoting cooperation and synergy through the sharing of information and complementary problem-solving skills.

Applications: Together with MetaCourier, SOCIAL simplifies development and maintenance of complex distributed systems. Application domains include distributed decision support (e.g., planning and scheduling), concurrent engineering, office automation, and automated operational support of complex systems (e.g., computer, communication, power, or manufacturing-process control networks).

Contact: Richard M. Adler
617-876-3635

Related SBIR Contracts:
NAS10-11606 KSC PY 1987 Topic 06
"A Development Framework for Distributed Artificial Intelligence"

B.14
Sentinel
Firm: **Omitron, Inc.**
Sentinel evolved from knowledge-based systems technology developed for monitoring NASA spacecraft. Sentinel includes a concept-oriented knowledge-base, a configuration software system architecture, and interactive tools for generating process specifications in engineering terms. Sentinel helps the user generate a process specification to tailor one or more custom "expert" application programs. Sentinel can generate simple PC-based programs to monitor a "what if" process and can configure multiple programs to be hosted on networked VAXs to monitor a production process in real time.

Applications: Industrial process control and engineering simulations.

Contact: Craig M. Bearer
301-474-1700

Related SBIR Contracts:
NAS5-30637 GSFC PY 1990 Topic 07
"A Concept-Oriented, Distributed, Expert System for Spacecraft Control"

B.15

Smart Eyes for Bar Code Labels

Firm: **Triangle R&D Corporation**

Smart Eyes is a vision system capable of finding the location (position and orientation) of specially designed bar code labels. The vision system uses a conventional solid state camera connected to an inexpensive IBM PC-compatible computer. If the camera is equipped with zoom lens, the system can also decode the bar code label. The system can be hand-held or mounted on an automated device such as a robot.

Applications: Ideal for applications in which automatic storage and retrieval systems are used. Applications include warehousing, part position verification, and inventory control.

Contact: Donald R. Myers
919-781-8148

Related SBIR Contracts:
NAS5-30709 GSFC PY 1987 Topic 05
"Telerobotic Rendezvous and Docking Vision System Architecture"

B.16

VGRID3D

Firm: **VIGYAN Research Associates, Inc.**

VGRID3D is an interactive program for the generation of three-dimensional, unstructured grids over complex configurations. The user has options for interactively generating, visualizing, and modifying the surface grid made up of triangles. The field grid is then generated using the "advancing-front" technique. Options are available for restarting a partially completed grid, local remeshing, and grid quality evaluation and smoothing. Interactive preprocessor programs to prepare input to VGRID3D are also available.

Applications: Computational fluid dynamics, aircraft design, automobile design.

Contact: Paresh Parikh
804-865-6575

Related SBIR Contracts:
NAS1-18670 LaRC PY 1986 Topic 02
"Generation of Unstructured Grids in Three-Dimensions"

B.17

VODEM Manual Data Entry and Proofreading System

Firm: **Gamma Research, Inc.**

The VODEM system for manual data entry and proofreading (visual verification) has been developed to dramatically increase accuracy, speed and lower costs of both centralized and distributed data entry. Inaccuracy can be vitally expensive for critical data. OTA estimates 25 percent of all paid working hours in the United States will be spent using computer keyboards. VODEM is the first product specifically designed to address the problem of white-collar productivity in computer LAN data entry tasks. The technology is a TQM approach integrating SPC with human factors, imaging, MS Windows, OCR, and new theories of human error in psycho-physics. A testing technology has also been developed to screen operators and improve their key capture and proofreading attention skills.

Applications: In business practice, VODEM can be used in any task where at least 2000 characters of data per day are manually entered into computers or reviewed by management for accuracy and sign-off. This would apply to CIM systems such as EDI, JCALS and other networked information systems. Trends toward single-point data entry would benefit from added control of accuracy. For centralized key entry data processing centers, up to 36 percent of technology provides methods to quality control data entry at the user level and provides management the tools to develop standards for accuracy in computerized data interchange. VODEM can also be used in education curriculum development and textbook publishing for unified keyboarding; in personnel management; and in psycho-medical research.

Contact: John Woo, Jr.
205-533-7103

Related SBIR Contracts:
NAS8-37407 MSFC PY 1986 Topic 07
"Control of Manual Data Entry Accuracy in Management and Engineering Information Systems"

B.18

VPLOT3D

Firm: **VIGYAN Research Associates, Inc.**

VPLOT3D is an interactive, menu-driven graphics program for interpretation and display of fluid dynamic data on unstructured (tetrahedral) grids. VPLOT3D uses the full graphics capabilities of an IRIS workstation and guides the user through pop-up menus with a variety of options. VPLOT3D has

options for line and Gouraud-shaded contour plots, velocity vectors, particle traces, oil flow traces, and interactive display manipulation. Dynamic memory allocation eliminates the need to compile frequently.

Applications: Computational fluid dynamics, aircraft design, automobile design.

Contact: Paresh Parikh
804-865-6575

Related SBIR Contracts:
NAS1-18670 LaRC PY 1986 Topic 02
"Generation of Unstructured Grids in Three-Dimensions"

C: Robotics and Automation

C.01
CyberImage
Firm: **Cybernet Systems Corporation**
A low-cost, general-purpose machine-vision and image-processing system and environment. Provides most basic image-processing and enhancement facilities. Interfaces to a variety of image-input devices and image file formats, display, printing, and image-editing facilities, and an extensible Pascal-like user programming facility with enhancements for operator overloading, object segmentation, model-based object matching, and nearest-neighbor matching. Users can incorporate compiled functions and can extend interfaces and communications facilities. System supports Apple Quick Time, and System 7.0. Interfaces with CAD interchange data are planned for 1992.

Applications: Space telerobotics, hazardous or underwater robotics, industrial robotics, mobile robot navigation, image processing, video/photo editing.

Contact: Heidi N. Jacobus
313-668-2567

Related SBIR Contracts:
NAS7-1116 JPL PY 1990 Topic 05
"Intelligent Robot/Sensor Operations Planning Systems"

C.02
Cybernet Force-Reflecting Handcontroller
Firm: **Cybernet Systems Corporation**
This product is a six-axis force-reflecting universal master that provides user inputs in x, y, z, pitch, roll, and yaw. Additional thumb switches and LVDT trigger provide inputs for control cueing, indexing, and end-effector control. The master is supplied with a controller and C-based software for easy interfacing to a variety of industrial and specialty robots (as slaves).

Applications: Space telerobotics, hazardous or underwater robotics, interaction with virtual environments.

Contact: Heidi N. Jacobus
313-668-2567

Related SBIR Contracts:
NAS9-18351 JSC PY 1988 Topic 09
"A Compact Six-Degree-of-Freedom Force Reflecting Hand Controller with Cueing of Modes"

C.03
Dual-Axis, Digital Servo Controller
Firm: **The Navtrol Company, Inc.**
The dual-axis, digital servo controller (DDSC) is a highly capable, compact, lightweight, low-power controller. Receiving analog or discrete sensor signals through extensive I/O, it generates controlled current, 0 to 8 amperes, by means of pulse-width modulation (PWM) for brush or brushless type DC motors to provide independent force, velocity, or position control for two loops. Incremental or absolute angle encoders, resolvers, potentiometers, or even motor commutation signals can provide position and/or velocity measurements. One to seven controllers can operate autonomously or collectively, exchanging data and commands with a supervisory controller over a single, differential, high-speed (5 MHz) serial interface. The DDSC, only 4.5" x 5.5" inches in size, requires only dc motor voltage (28 Vdc) for power and consumes only 3.7 watts. Sophisticated estimation, control, and transformation algorithms provide smooth, precise, and versatile tracking and control.

Applications: Pointing systems, robotic systems, and other servo-control applications for commercial, space, and military utilization.

Contact: Richard J. Brown
214-234-3319

Related SBIR Contracts:
NAS5-29437 GSFC PY 1984 Topic 14
"Low-Power, Digital Controller for Laser Communications"
NAS5-30633 GSFC PY 1987 Topic 05
"Telerobotic, Digital Controller System"

C.04

Ground Vehicle Manager's Associate

Firm: **ISX Corporation**

The Ground Vehicle Manager's Associate is a mixed-initiative, human-computer problem-solving system based on deep expert-assistant knowledge of the domain and about how to aid the user performing tasks. The NASA application is control and management of micro-robots on the lunar surface.

Applications: Management of multiple semi-autonomous vehicles performing a variety of missions.

Contact: Phil Dodson
818-706-2020

Related SBIR Contracts:
NAS2-13373 ARC PY 1989 Topic 06
"Knowledge-Based Decision Support for Space System Engineering Managers"

C.05

Holotrack

Firm: **Cybernet Systems Corporation**

Holotrack is a holographic-based, three-dimensional targeting system that uses a conventional, video-based imaging system to locate objects in three space. Three-dimensional targets are captured in holographic images. The flat hologram of the three-dimensional target can be mounted on an object so as to provide an easily identifiable feature for machine-vision recognition and pose determination.

Applications: Space telerobotics, hazardous or underwater robotics, industrial robotics, mobile robot navigation.

Contact: Heidi N. Jacobus
313-668-2567

Related SBIR Contracts:
NAS8-38916 MSFC PY 1990 Topic 05
"Robotic Guidance Systems Using Specialized and Generalized Targets"

C.06

Impulse Shaping™ Software

Firm: **Convolve, Inc.**

A set of algorithms that improve dynamic performance by reducing residual vibrations in systems. The algorithms are simple to apply given a knowledge of the vibrational characteristics of the closed-loop system.

Applications: Satellite control, other telerobotic-systems control; coordinate measuring machines, computer disk drives, other precision manufacturing systems.

Contact: Whitney Rappole
914-273-4042

Related SBIR Contracts:
NAS5-32034 GSFC PY 1990 Topic 05
"A Method of Improving the Dynamic Performance of Telerobotic Systems"

C.07

Manipulator Fast Motion Planner

Firm: **Netrologic, Inc.**

Netrologic has developed a software for motion planning and control of a robot manipulator working in a complex environment. The task of the motion planner is to maneuver the robot arm around the obstacles cluttering the workspace to reach a target. The robot software uses stereo vision to "see" the target and uses intelligent reasoning to avoid collision of its arm with obstacles and with its own "body" and to place the hand at desired locations for manipulation. The main features of the scheme are fast and intelligent planning of robot path, simplicity and its applicability to most existing industrial robot manipulators. The software is developed in a PC environment.

Applications: The general application of the software is for the robotic assembly, maintenance and inspection tasks that demand reasoning and decision making. More sophisticated applications of the software are for hazardous and chemical material handling, and inspection of places unsafe for humans such as waste storage tanks.

Contact: Dan Greenwood
619-587-0970

Related SBIR Contracts:
NAS7-1110 JPL PY 1988 Topic 05
"Neural-Network Path Planning and Digital Adaptive Control of Redundant Robots"

C.08

Motion Planning Algorithms for Dexterous Manipulator

Firm: **Odetics, Inc.**

Motion planning algorithms generate safe trajectories around obstacles in the manipulator workspace. The manipulator's redundant degree of freedom is used to avoid collisions with obstacles. The workspace model is sensor-acquired or CAD-

based. The algorithms are designed to run in real time.

Applications: Material handling, remote manipulation, autonomous navigation in cluttered and/or unstructured environments.

Contact: Nigel King
714-758-0300

Related SBIR Contracts:
NAS7-1055 JPL PY 1988 Topic 05
"End Point Collision Avoidance Path Planner for Redundant Degree-of-Freedom Manipulators"

C.09
Odetics Dexterous Manipulator
Firm: **Odetics, Inc.**
The Odetics Dexterous Manipulator is a seven-degree-of-freedom robot manipulator. It is electrically powered and has a modular design. The manipulator has a high payload-to-weight ratio (50 lb payload, 150 lb weight). Each of the seven joints incorporates a unique drivetrain design which provides zero-backlash operation, is insensitive to wear, and is single-fault tolerant to motor or servo amplifier failure. The sensing system provides position, velocity, motor winding temperature, and torque measurements for each joint, and in also single-fault tolerant. The control system provide dexterous motion by controlling the endpoint motion and manipulator pose simultaneously.

Applications: The manipulator is targeted to address applications requiring high dexterity, as well as the strength of a hydraulic manipulator, for which hydraulic systems are impractical or impossible. Examples include satellite servicing and truss assembly in space, as well as hazardous material handling in unstructured terrestrial environments. The manipulator's modularity will support a wide range of applications that require fewer than seven degrees of freedom. Batch-oriented, flexible manufacturing systems will benefit from the simple reconfiguration capability.

Contact: Sam Harris
714-758-0300

Related SBIR Contracts:
NAS7-1062 JPL PY 1987 Topic 05
"Control Algorithm for a Redundant Degree-of-Freedom Manipulator"

C.10
Omni-Wrist
Firm: **Ross-Hime Designs, Inc.**
The Omni-Wrist is a three-axis, robot-wrist mechanism featuring highly flexible, singularity-free motion. A unique, 180 degree pitch and yaw, and 360 degree continuous roll is produced. Modular in design, the three wrist motors are located in its base. An internal cable-routing passage is provided for end-effectors. High precision and a 25-pound load capacity are also featured.

Applications: Aerospace, military, undersea, ultrasonic testing, spray finishing, and welding.

Contact: Mark Elling Rosheim
612-379-3808

Related SBIR Contracts:
NAS1-18673 LaRC PY 1986 Topic 05
"Computer Controlled Telerobot Wrist Module"

C.11
RT/Expert
Firm: **Integrated Systems, Inc.**
RT/Expert is a knowledge-based expert system that automates and accelerates the development of real-time systems. The RT/Expert Module is integrated into ISI CAE/CASE tools, providing an integrated environment for rule-based logic and complex numerical computation. Decision structures built with RT/Expert can be automatically converted into real-time C, Ada or Fortran code.

Applications: Real-time controls or supervisory control, monitoring and diagnostics, and autonomous control tuning.

Contact: Robert Kosut
408-980-1500

Related SBIR Contracts:
NAS2-12738 ARC PY 1986 Topic 03
"Automation Tools for Self-Repairing Flight Control Systems"

C.12
Reactive Planning for EVA Retriever
Firm: **Advanced Decision Systems**
The Reactive Planner implements technology for reactive execution of robotic tasks. Reactive execution is the ability to adapt to an uncooperative environment while following a plan. The plan representation language and execution system developed for this project supplies five capabilities essential to reactive response. This system is able

to: react to unexpected events, act to acquire knowledge, act on beliefs, react to internal states (as well as external conditions), and act on predictions about the future. This reactive planner was developed for the Extra Vehicular Activity Retriever (EVAR), a robot whose purpose is to retrieve tools, or astronauts, that become detached from the Space Station.

Applications: Planning and control of robotic devices in uncertain or dynamic environments.

Contact: David Gaw
415-960-7557

Related SBIR Contracts:
NAS9-18162 JSC PY 1987 Topic 05
"Architectures for Semi-Autonomous Planning"

C.13
Serpentine Truss Robot
Firm: **Foster-Miller, Inc.**
The self-contained, deployable serpentine truss (SCDST) is a highly articulated robot designed to be operated in tightly constrained environments. The device consists of an innovative articulated-truss structure, a deployable mechanism, and a distributed microprocessor-network system controller. No other robot has yet been designed that has reach capability in excess of 6 m; a deployment mechanism that facilitates launching the device along a circuitous trajectory, thus snaking around obstacles; and a controller performing the necessary transformations and feedback functions for over 20 actuators in real time.

Applications: Pre-launch inspection and preparation of Space Shuttle payloads. Inspection and light tactile tasks in cramped and hazardous environments.

Contact: Richard M. Weisman
617-890-3200

Related SBIR Contracts:
NAS10-11794 KSC PY 1989 Topic 05
"Self-Contained Deployable Serpentine Truss (SCDST) for Pre-Launch Access of Space Shuttle Orbiter Payloads"

C.14
Tactile Sensor
Firm: **Bonneville Scientific, Inc.**
Bonneville Scientific has successfully developed and patented a technology that can mimic the human sense of touch. This technology is the only one in existence today sufficiently rugged and reliable for use in robotic tactile sensing in factory automation applications. Bonneville's tactile sensors, when applied to the gripper of a robot, enable the robot to "feel" the object it is touching. The Bonneville tactile sensor is a thin device that can replace the existing rubber pad on most robot grippers. This enables the robot to discern the shape of the object it is touching, and to control the forces it is placing on the object, thus significantly increasing the robot's capability.

Applications: Targeted applications for Bonneville's unique sensing technology include tactile sensing, force-torque sensing, foot-force mapping, gait analysis, and programmable limit switches.

Contact: Josephine M. Grahn
801-359-0402

Related SBIR Contracts:
NAS1-17997 LaRC PY 1983 Topic 05
"Six-Component, Robotic, Force-Torque Sensor"

C.15
Zero-G Robotic Testbed
Firm: **Intelligent Automation Systems**
Intelligent Automation Systems has developed a robotic grasping testbed for simulating object retrieval in space. The testbed is comprised of a tetherless grasping robot and an object which float independently on a frictionless air table. Information from high-resolution tactile sensors, joint torque sensors, and an electric eye is used by a three-computer control system aboard the robot to make grasping strategy decisions and execute arm motions. In addition, a PC-compatible simulation of the robotic grasping testbed is available. This program which runs under Microsoft Windows features adjustable shape and mass of robot and object and programmable grasping strategies.

Applications: Material handling, parts assembly, telerobotics.

Contact: Steven J. Gordon
617-354-3830

Related SBIR Contracts:
NAS9-18353 JSC PY 1988 Topic 05
"Robotic Testbed for Adaptive Grasping of Objects in Space"

D: Signal and Image Processing

D.01
Adaptive Imager
Firm: **Odetics, Inc.**
This prototype imager performs edge enhancement at RS-170 video rates (30 frames/sec). It is a very-high-speed, non-linear, large-area convolver that has the ability to enhance edges in the dark areas of a scene as well as the bright areas in the same scene. It produces a visually-enhanced output image that is based on an algorithm patterned after human vision.

Applications: Computer vision and image-edge enhancement of objects in low-light environments. Provides a means for measuring reflectance changes independent of scene illumination.

Contact: George B. Westrom
714-758-0300

Related SBIR Contracts:
NAS1-18468 LaRC PY 1985 Topic 07
"Adaptive Focal Plane Processor for Image Enhancement"

D.02
Digital Image Profiler
Firm: **Laser Power Corporation**
The Digital Image Profiler is designed to detect faint optical sources in the presence of bright optical sources. An image of a known or suspected optical binary is scanned across a linear array of slit-like fiber bundles. Each of the resultant one-dimensional image profiles is processed by specially designed computer-controlled electronics. Post-processing techniques reveal the faint source.

Applications: Verification of suspected faint stellar companions.

Contact: Grahm Flint
619-755-0700

Related SBIR Contracts:
NAS7-1103 JPL PY 1988 Topic 08
"Digital Image Profilers for Detecting Faint Sources Which Have Bright Companions"

D.03
Interferometric Satellite Tracking System
Firm: **Interferometrics, Inc.**
The interferometric satellite tracking system uses the techniques of very long baseline interferometry to track satellites with expected accuracies that are an order of magnitude greater than present systems. Unlike existing tracking techniques, this system is completely passive and uses normal satellite traffic or transponder noise to perform the correlations. The system consists of three field stations and a central processing microcomputer. Each field station includes a 1.8 meter antenna, downconverter, data buffers, and control computer. The field stations transmit data to and receive schedules from the central processing site via dial-up phone lines. The tracking system, which is presently undergoing deployment in the southwestern U.S. within the K-band downlink beam of TDRS-E, is also capable of tracking Ku-band domestic satellites in addition to the TDRS. Additional RF front ends can be employed to track C-band satellites as well.

Applications: Passive satellite tracking.

Contact: E. James Wadiak
703-790-8500

Related SBIR Contracts:
NAS5-30313 GSFC PY 1986 Topic 07
"Interferometric Tracking System for the Tracking and Data Relay Satellite"

D.04
SHARPS
Firm: **Marquest Group Inc.**
A precision, short range, cabled acoustic positioning system for shallow water operations, the Sonic High Accuracy Ranging and Positioning System (SHARPS) provides centimeter accuracy and position updates up to 10 times per second at ranges up to 100 meters. Tracking of multiple targets is supported, and area coverage can be increased by adding additional beacons. The system is virtually immune to the "multi-path" problems which have plagued earlier systems in shallow water or enclosed spaces.

Applications: SHARPS has been used in underwater mapping and surveying applications as well as in tracking vehicles and divers inside steel tanks or other enclosed structures. It has been used to provide navigation and control of underwater vehicles for telerobotics.

Contact: Tagore Somers, Martin Bowen
508-759-1311

Related SBIR Contracts:
NAS8-38897 MSFC PY 1990 Topic 08
"NASA Three-Dimensional Underwater Positioning System"

E: Microelectronics

E.01

ARACOR VLSI Qualification Test System

Firm: **Advanced Research and Applications Corporation**

The ARACOR VLSI Qualification Test System (QTS) will provide fully-automated certification testing of BLSI components for space programs and other high reliability applications. The basic hardware consists of an input tray, an x-ray radiation source, an electrical stress/test station, and an annealing station. A pick-and-place robotic system moves the parts between stations. Special chip carriers maintain appropriate bias conditions on the parts in transit. A computer controls all system functions and provides menus to set test parameters. System activity and test status are displayed in real time. Application software (which requires an HP4145B or HP4142B) includes total-dose harness assurance and channel hot-electron device lifetime modules.

Applications: The ARACOR VLSI QTS is being developed to support a new methodology to qualify VLSI circuits for high-reliability applications. In this new procurement scheme, each vendor incorporates a standard technology characterization vehicle (TCV) as a drop-in on its product wafers. After processing, the TCVs are pulled and characterized on the QTS using standard test procedures. If the TCVs pass the tests, all associated parts that meet performance requirements are qualified. This new approach significantly reduces the cost of procuring qualified components and is ideally suited to situations in which a variety of part types must be procured from multiple vendors in small quantities.

Contact: Jim Wiedeman
408-733-7780

Related SBIR Contracts:
NAS7-1083 JPL PY 1989 Topic 13
"Automated Radiation/Reliability VLSI Qualification"

E.02

III-V Compound Epi-Wafers

Firm: **Spire Corporation**

Spire supplies MOCVD-grown GaAs/AlGaAs epitaxial wafers for use in DH and quantum-well diode lasers. Wafers can be grown with a two- to three-inch diameter and uniformity of ± 3 percent. Thinned and processed wafers are also available. The company welcomes inquiries for processed, quantum-well laser-array bars ready for mounting. Customers are provided complete analysis results including photoluminescence, IR reflectance, and polaron profile with each lot to assure compliance with specifications.

Applications: Semiconductor diode lasers, quantum-well devices, Bragg reflector structures, optical waveguides, optoelectronic devices.

Contact: Kurt Linden
617-275-6000

Related SBIR Contracts:
NAS1-18660 LaRC PY 1986 Topic 08
"Low-Cost AlGaAs Laser Arrays for Solid-State Laser Pumps"

E.03

Indium-Phosphide Epitaxial Wafers and Solar Cells

Firm: **Spire Corporation**

Spire supplies both indium-phosphide epitaxial wafers and solar cells. The epitaxial wafers are two inches in diameter and can have both P and N doping. Indium-phosphide solar cells are 20 percent efficient and hardened against high-energy radiation damage.

Applications: Indium-phosphide semiconductor devices such as Gunn diodes, solar cells, and optoelectronic devices.

Contact: Kurt Linden
617-275-6000

Related SBIR Contracts:
NAS3-24857 LeRC PY 1984 Topic 10
"High-Efficiency, Radiation-Resistant, Indium-Phosphide Solar Cells"

E.04

Superconducting YBCO Films on Sapphire

Firm: **Neocera, Inc.**

Epitaxial (001) oriented yttrium-barium-copper-oxide (YBCO) films grown on sapphire substrates are in demand for a variety of device applications, including high-Q microwave resonators, delay lines and filters. R- or M-plane sapphire substrates with dimensions of up to 1" x 1", and 5, 10 or 15 mils thickness can be coated with high quality YBCO with a suitable intermediate buffer layer. Two-inch-diameter films and double-sided coating will be available soon. The films are guaranteed to have $T_c \geq 88$ K, $\Delta T_c \leq 1$ K, $J_c(77\ K) \geq 10^6/CM^2$, and $R_s(77$ k, 10 GHz) $\leq 1m\Omega$. In addition, CeO_2- or YSZ-buffered

sapphire substrates can be supplied without the YBCO coating.

Applications: By replacing currently available microwave circuit elements with superconducting equivalents, considerable size and payload savings can be achieved. Due to its low dielectric constant, small loss tangent, low cost, availability and superior mechanical properties, sapphire is a good substrate for active and passive superconducting microwave components. These YBCO films on sapphire substrates perform nearly as well as YBCO films grown epitaxially on lanthanum aluminate substrates without the associated substrate loss and twinning restrictions.

Contact: Alberto Pique
301-314-9937

Related SBIR Contracts:
NAS3-25929 LeRC PY 1989 Topic 04
"Microwave-Compatible High-T_c Superconducting Films on Sapphire Substrates"

E.05
Three-Dimensional Short Stack
Firm: **Irvine Sensors Corporation**
The Three-Dimensional Short Stack packages four to ten memory chips into the space normally consumed by one. The current configuration consists of four 128 K x 8 static RAMS.

Applications: A joint venture with a major computer firm is developing PC applications of this technology. Other uses include computer memory cards; processor multi-chip modules; bulk memory storage; space data recorders.

Contact: Myles F. Suer
714-549-8211

Related SBIR Contracts:
NAS5-30871 GSFC PY 1989 Topic 06
"Three-Dimensional, Solid-State, Multi-Port Memory System"

F: Electronic Devices and Equipment

F.01
Auto-Cal Detector Calibration System
Firm: **Cambridge Research Company**
The Auto-Cal Detector Calibration System has been developed to provide detectors with an absolute accuracy of 0.02 percent. It utilizes a frequency-doubled argon ion laser operating at 257 nanometers as the ultraviolet light source which is stabilized to 0.05 percent by a laser intensity stabilizer. The laser beam is controlled by a series of beam-steering optics that direct the beam to either the detector (e.g. spectrometer) or the LaseRad cryogenic radiometer. LaseRad is an electrical substitution radiometer with improved performance due to cryogenic cooling of the absorptive cavity to 4.2 K, resulting in an absolute accuracy of 0.02 percent. Design innovations incorporated in the LaseRad include: a side-viewing, highly-absorptive cavity, a compact dewar, and computer control. The dewar has a hold time of ≈12 hours. The cavity interior is coated with specular polyurethane carbon black paint allowing operation from the UV to the far IR (10.6 μm). Its temperature is actively controlled using a thin-film heater and monitored by a sensitive digital temperature controller. At 4.2 K, the thermal properties of the materials used in the receiver cavity undergo dramatic changes. The specific heat of copper decreases by three orders of magnitude, and its thermal conductivity increases by at least a factor of three. The thermometers and the heater are attached with superconducting niobium titanium wire to eliminate ohmic losses in the heater power measurement and to minimize extraneous heat fluxes from the cavity. These effects increase the responsivity and the sensitivity, and shorten the time constant of the system. The LaseRad system is operated by an AT-type computer using menu-driven software.

Applications: To date, cryogenic radiometers have been confined to national standards laboratories due to their cost and the need for special facilities. With its compact dewar, computer control, and low cost, the Auto-Cal System gives corporate metrologists the ability to produce better quality products by maintaining an absolute reference standard in their own facility.

Contact: Clifford Hoyt
617-491-2627

Related SBIR Contracts:
NAS5-30631 GSFC PY 1987 Topic 08
"Automated Characterization and Calibration of Ultraviolet Spectrophotometers Using Intensity-Stabilized Lasers"

F.02
Automated Reliability Test Set for Electronic Modules
Firm: **Shason Microwave Corporation**
This product is an instrumentation system used in high temperature burn-in or accelerated-life test programs. The test set is computer controlled for

continuous monitoring of both RF and DC parameters of the test samples. The test set is expandable to sixty-four channels or samples. The frequency range of the test samples can be in the millimeter-wave range (60 GHz). The computer controller is menu driven for a user-friendly interface. The results of the long-duration controlled testing can be used to calculate and/or verify the mean-time-to-failure (MTTF) of most electronic assemblies.

Applications: This automated reliability test set can be used to measure product MTTF. This information can then be used in the quality and reliability engineering of complex electronic systems such as radar systems and solid-state communications systems.

Contact: Roland Shaw
713-333-1950

Related SBIR Contracts:
NAS9-18358 JSC PY 1988 Topic 14
"Integrated, Active-Antenna Module for Space Station Multiple-Access Communication"

F.03

Cryogenic TIA Input Stage

Firm: **Infrared Laboratories, Inc.**

The TIA (trans-impedance amplifier) module consists of a hybrid circuit containing a monolithic, dual silicon JFET. The JFET is carefully selected for low noise and close matching of dc characteristics. The result is a balanced JFET source follower that provides extremely high performance as a low noise, trans-impedance amplifier input stage. Tests show that for feedback resistors up to 1×10^{11} ohms the noise spectrum is dominated by Johnson noise at temperatures down to 4 K. Input capacitance is less than 4 pf.

Applications: Low-noise cryogenic amplifier for real-time use with infrared detectors (bolometers, photodetectors, and detectors made of extrinsic silicon or indium antimonide). Well suited for both laboratory and space-flight applications.

Contact: Eric Low
602-622-7074

Related SBIR Contracts:
NAS2-12154 ARC PY 1983 Topic 08
"Advanced Components for Spaceborne Infrared Astronomy"

F.04

GaAs Readout and Preprocessing Electronics

Firm: **Top-Vu Technology**

GaAs electronics for high performance readout and processing of the infrared signal.

Applications: Space infrared telescope facility (SIRTF) using mosaic focal plane arrays. A large deployable reflector and infrared sensor.

Contact: Tho Vu
612-633-5925

Related SBIR Contracts:
NAS2-13200 ARC PY 1988 Topic 08
"GaAs Readout and Preprocessing Electronics for Two-Dimensional, Focal-Plane-Array, IR Astronomy"

F.05

JF-4 Integrating Cryogenic Amplifier

Firm: **Infrared Laboratories, Inc.**

The JF-4 is a single-channel, integrating amplifier module designed for use with infrared detectors operating in the temperature range from 1 to 45 K. It consists of a hybrid circuit containing a balanced JFET integrating amplifier with voltage gain of 0.90, an input capacitance of 7.5 pf, and a read noise of less than 20 electrons. The charge-compensated JFET reset switch provides for rapid and accurate reset of the input-to-ground potential, and the device is designed for continuous non-destructive read-out by sampling the output. Output impedance is less than 100 K ohms. Power dissipation, including heater power, is less than 250 microwatts at a temperature of 4 K.

Applications: Low-noise, cryogenic, integrating amplifier for use with infrared detectors (bolometers, photodetectors, and detectors made of extrinsic silicon or indium antimonide). Well suited for both laboratory and space flight applications.

Contact: Eric Low
602-622-7074

Related SBIR Contracts:
NAS2-12154 ARC PY 1983 Topic 08
"Advanced Components for Spaceborne Infrared Astronomy"

F.06

Wireless Headset Network

Firm: **Telenexus, Inc.**

The Wireless Headset Network is a self-contained voice-communication system with one base station supporting up to 16 full-duplex headset units. Each headset unit can communicate with any unit in the system, either privately or in groups.

Applications: Industrial communications, military tactical communication, training systems, search and rescue operation, entertainment production, other task coordination applications.

Contact: Chuck Lau
214-423-0667

Related SBIR Contracts:
NAS10-11607 KSC PY 1987 Topic 13
"A Wireless Headset Network"

G: Microwave Electronic Devices

G.01

Custom, Fully Monolithic GaAs Switch Matrix Subsystems

Firm: **Microwave Monolithics, Inc.**

This product is a family of custom, fully monolithic, microwave switch matrices fabricated in gallium arsenide using monolithic microwave integrated circuit technology. Microwave Monolithics's ULSI monolithic implementation features GaAs field-effect transistors utilized as passive switches and proprietary fabrication technology to achieve performance heretofore unattainable in fully monolithic form. Fully monolithic implementation is the key to small size, light weight, and high reliability. A novel packaging approach complements the monolithic switch matrix and preserves the low on-chip crosstalk levels. An internal controller is typically included for system interfacing and control, and fixed-gain buffer amplifiers can be optionally included within the package to set subsystem gain. This custom product line is fully compatible with a wide range of matrix sizes, operating modes, configurations, and frequency bands. As an example, a packaged 6 X 6 IF switch matrix subsystem, including the switching MMIC, buffer amplifiers, and an internal controller capable of autonomous TDMA operation, is currently being fabricated for Lewis Research Center. This advanced subsystem occupies just 3.8" X 3.8" X 1.15", or 16.6 cubic inches (excluding connectors), and weighs a mere 1.5 pounds. Nominal insertion loss is 0 dB, and isolation is greater than 60 dB across the specified band of 3 to 6 GHz.

Applications: In addition to a wide variety of multi-beam satellite switching applications, other custom versions of the monolithic switch matrix could find use in systems ranging from ground-based wideband communications systems (including data, voice, and video distribution) to high-speed automated test equipment. Commercial and military radar systems would benefit from the flexible signal-routing capabilities inherent in switch-matrix architectures, and electronic countermeasures equipment could become more responsive to rapidly changing electromagnetic environments.

Contact: Daniel R. Ch'en
805-584-6642

Related SBIR Contracts:
NAS3-24252 LeRC PY 1983 Topic 14
"Advanced Monolithic Gallium Arsenide Switch Matrix"

G.02

Solid-State Active Ku-Band Antenna

Firm: **Shason Microwave Corporation**

This solid-state active antenna combines the latest advances in microwave-frequency integrated circuits with state-of-the-art printed-circuit antenna fabrication to produce a full-duplex transmit and receive module. This module is used in high-technology electronic systems such as radar systems, solid-state phased-array antenna systems, satellite communication systems, and other systems that involve the reception or transmission of high-frequency radio waves.

Applications: This active antenna module can be used on a communications system or radar system to improve both the transmitted and received signal strength. The active antenna can be used as a single antenna element or combined with numerous identical antennas to form an array of elements.

Contact: Roland Shaw
713-333-1950

Related SBIR Contracts:
NAS9-18358 JSC PY 1988 Topic 14
"Integrated, Active-Antenna Module for Space Station Multiple-Access Communication"

H: Optical Devices and Lasers

H.01

Acousto-Optic Tunable Filters

Firm: **AOTF Technology, Inc.**

An acousto-optic tunable filter is a solid-state optical filter. The spectral bandpass of the filter can be tuned by changing the frequency of the applied R.F. signal. The AOTF functions as an electrically tuned optical filter, with a range from ultraviolet to infrared. (120 nm. to beyond 10 μm.) The AOTF has the ability to operate in sequential and multiwavelength modes.

Applications: Ideal for space-based applications because of its small size, reliability, fast switching time and absence of moving parts. Often used in optical equipment such as microscope and telescope spectrometers. AOTF devices can be used to upgrade existing equipment which used mechanically tuned systems.

Contact: Patrick Katzka
408-734-5435

Related SBIR Contracts:
NAS7-1112 JPL PY 1988 Topic 08
"AOTF Enhancements for a Space-Based Spectropolarimeter"

H.02

Alpha-Numeric Electrochromic Displays

Firm: **EIC Laboratories, Inc.**

The alpha-numeric electrochromic displays have a memory, can retain images indefinitely with no power drain, and are capable of >5,000 switching cycles.

Applications: These alpha-numeric displays can be applied in portable computers, aircraft cockpits, automobiles, portable sensing equipment, and any device where power is limited.

Contact: Dennis N. Crouse
617-769-9450

Related SBIR Contracts:
NAS9-18169 JSC PY 1987 Topic 12
"Variable-Transmittance, Electrochromic Space Suit Visor"

H.03

Cobra 2000 Laser

Firm: **Schwartz Electro-Optics, Inc.**

The Cobra 2000 is a tunable solid-state laser based on the cobalt-doped magnesium fluoride (Co:MgF_2) crystal. The laser provides from tens of millijoules to 900 millijoules of tunable radiation over the 1750-2500 nm wavelength region.

Applications: Excitation and local and remote sensing of gases such as H_2O, CO_2, CO, CH_4, N_2O, HF, HI, and NO_2; medical laser systems based on the ability to control tissue-penetration depth via wavelength tunability; testing of low-loss silica and fluoride fibers in the near IR.

Contact: Craig Smith
407-298-1802

Related SBIR Contracts:
NAS1-18442 LaRC PY 1985 Topic 08
"Cobalt-Doped Magnesium Fluoride Laser for Remote Sensing"

H.04

Eagle 3004 Vision System

Firm: **Coleman Research Corporation**

The Eagle 3004 is a three-dimensional vision system employing coherent detection of frequency-modulated laser radar signals. It makes a direct, unambiguous measurement of the absolute distance to any arbitrary surface in any lighting, including direct sunlight and total shade. The system has an operating range of up to 5 m with a resolution of 4 mm and maintains a sustained throughput of 262,144 measurements per second. Related systems measuring at slower rates can obtain resolutions of less than 10 microns. Fiber-optic coupled versions are also available.

Applications: Three-dimensional robot guidance and control, autonomous vehicle guidance and control, telerobotics, artificial intelligence development, inspection systems, process monitoring, factory automation, non-destructive evaluation.

Contact: Tony Slotwinski
703-719-9200

Related SBIR Contracts:
NAS1-18890 LaRC PY 1987 Topic 05
"Improvement of Range of Coherent Laser Radar"

H.05

High-Power Diode Laser for Solid-State Laser Pumping (SPI-LASE™ 50)

Firm: **Spire Corporation**

Spire has developed a diode laser emitting at 785 nm, 792 nm or 808 nm for pumping solid-state laser rods of Ho:YAG, Nd:YLF and Nd:YAG. Designated the SPI-LASE™ 50, the laser emits 50 W of quasi-CW power over a 1-cm wide region, ideal

for pumping solid-state laser rods or bars. When compared to flash-lamp pumping, diode laser pumping is more reliable, more efficient and requires no high voltage power supplies. The lasers are made from single quantum well epitaxial wafers which are grown in an MOCVD production machine. Each laser is burned in at full operating power for 1 million pulses prior to shipment.

Applications: Pumps for solid-state lasers that are used for ranging, optical communications, atmospheric studies, ophthalmology, and clinical medicine.

Contact: Kurt Linden
617-275-6000

Related SBIR Contracts:
NAS1-19301 LaRC PY 1989 Topic 08
"Development of 780 and 792 Nanometer Diode Laser Pumps for Solid-State Lasers"

H.06
Interferometer for Aspheric Testing
Firm: **APA Optics, Inc.**
A unique interferometer for aspheric testing (IAT) which uses computer-generated holograms as null-lenses to test aspheric optical components for quality control and certification.

Applications: Production testing of aspheric mirrors or optical elements.

Contact: Anil K. Jain
612-784-4995

Related SBIR Contracts:
NAS9-18163 JSC PY 1987 Topic 12
"Extravehicular-Mobility-Unit, Helmet-Mounted Display"

H.07
Laser Rods: Yttrium-Aluminum-Garnet
Firm: **Scientific Materials Corporation**
ND:YAG and CTH:YAG laser rods with the SciMax label are of the highest quality. SM has developed manufacturing processes which improve the uniformity of production crystals, generating superior quality laser rod showing 10 to 40 percent improved operating characteristics over conventional Nd:YAG.

Applications: SciMax L.S. Grade Nd:YAG laser rods and crystals are used in components for solid-state lasers. The crystals are engineered for specific wavelengths of laser radiation for applications in medical systems, scientific R&D, telecommunication, fiber optics, industrial and military systems.

Contact: Ralph L. Hutcheson
406-585-3772

Related SBIR Contracts:
NAS1-18857 LaRC PY 1987 Topic 08
"A Method to Provide Lower Cost Crystal Properties Study Samples"

H.08
Model 100 Profilometer
Firm: **Bauer Associates, Inc.**
The Model 100 is a noncontacting, optical profilometer for ultra-accurate measurements of surface contours on aspheric optics. The Model 100 is easy to use and routinely achieves Angstrom-level accuracy for scan lengths from under 5 mm to over 200 mm. It is self-aligning and accommodates flat, convex, or concave test pieces.

Applications: The Model 100 is an excellent tool for measuring surface quality of spheric or aspheric optics used in visible, infrared, ultra-violet, and x-ray systems.

Contact: Paul Glenn
617-235-8775

Related SBIR Contracts:
NAS5-30311 GSFC PY 1986 Topic 08
"Measurement of Upper-Mid-Frequency Errors on Arbitrary Grazing Incidence Optics"

H.09
Multimode Optical Switch and Control Unit
Firm: **Geo Centers, Inc.**
The product is a fiber-optic, single-pole, double-throw optical switch compatible with multimode fiber-optic and electronics interfaces to control switch operations. The switch is unique in that it has no moving parts and can be activated in less than 1 μs.

Applications: The switch has been designed for use in optical engine control systems. It provides a cost-effective means of interfacing arrays of optical sensors to a single optoelectronic interface. It will find additional applications in other areas where multiple optical sensors are used.

Contact: Bruce N. Nelson
617-964-7070

Related SBIR Contracts:
NAS3-25947 LeRC PY 1988 Topic 01
"Fast Optical Switch for Multimode Fiber Optic-Based Control Systems"

H.10
Omniview
Firm: **TeleRobotics International, Inc.**
The Omniview Camera System provides the capability to electronically pan, tilt, rotate, and zoom within a hemispherical field of view. Absence of mechanical mechanisms improves reliability, and electronic control of viewing parameters provides flexible viewing situations. The system corrects distortion from a fisheye lens and can display multiple images from a s single camera at up to 30 frames per second. It eliminates need for mechanical pan and tilt mechanism and gimbal mounted stabilized platforms.

Applications: Remote viewing in space, unmanned vehicles, and surveillance systems. Automated visual inspection, robotic position control and virtual reality system.

Contact: Dan Kuban
615-690-5600

Related SBIR Contracts:
NAS1-18855 LaRC PY 1987 Topic 07
"Electro-Optical Pan, Tilt, and Zoom: A Miniature Viewing System"

H.11
Series 120 Diode-Pumped Solid-State Ring Laser
Firm: **Lightwave Electronics Corporation**
The Series 120 Nd:YAG Non-Planar Ring Laser is a source of ultra-narrow linewidth, frequency-stable laser light at either 1064 or 1319 nm. Laser-diode pumping of unprecedented compactness and efficiency is incorporated. A patented monolithic ring cavity configuration ensures stable single-frequency output at high power levels.

Applications: The Series 120 laser is suitable for a variety of applications including fiber-optic sensing, difference frequency generation, video bandwidth communication, infrared interferometry, and more.

Contact: Bob Mortensen
415-962-0755

Related SBIR Contracts:
NAS7-999 JPL PY 1985 Topic 14
"Prototype Laser-Diode-Pumped, Solid-State Laser Transmitter"

H.12
Series 122 Diode-Pumped Solid-State Non-Planar Ring Laser
Firm: **Lightwave Electronics Corporation**
The Series 122 Diode-Pumped Solid-State Non-Planar Ring Laser is a source of single-frequency, narrow-linewidth, frequency-stable, frequency-tunable, ultra-low-noise laser light at either 1064 or 1319 nm. Laser-diode pumping is incorporated for unprecedented compactness and efficiency. This Nd:YAG laser utilizes a patented monolithic ring cavity configuration to ensure stable single-frequency output at high-power levels. An active noise-reduction system provides a specified output noise level of less than 0.1 percent rms and a microprocessor-controlled power supply makes the laser system easy to use as well as offers computer interfacing capability.

Applications: The Series 122 laser will find use in applications such as wide-bandwidth analog communication, single-mode fiber studies and applications, difference frequency generation, holography and other interferometric studies, coherent optical communication, resonant frequency doubling, and others.

Contact: Bob Mortensen
415-962-0755

Related SBIR Contracts:
NAS7-999 JPL PY 1985 Topic 14
"Prototype Laser-Diode-Pumped, Solid-State Laser Transmitter"

H.13
Solid State Laser Scanner
Firm: **APA Optics, Inc.**
APA Optics has developed a high-speed solid-state device for scanning a laser beam without the use of moving components. Bragg diffraction gratings are electro-optically established using semiconductor pn junctions in epitaxial $Al_xGa_{1-x}As$ waveguides to deflect angularly the guided laser beam. An integrated-optic, solid-state scanner offers the benefits of no moving parts, reduced size and mass, improved reliability, low cost, and low operating power.

Applications: Bar code scanning, laser printing, optical recording, commercial inspection.

Contact: Anil K. Jain
612-784-4995

Related SBIR Contracts:
NAS9-17813 JSC PY 1985 Topic 06
"Integrated Optic Device for Laser Beam Scanning"

H.14
Ultra-Violet Fourier Transform Spectrome
Firm: **Optra, Inc.**
Fourier transform spectrometer systems have seen little use outside of the research laboratories because of complexity and lack of robustness. Improvements funded by this NASA SBIR program have addressed both of these issues and have provided the basis for a practical process control spectrometer.

Applications: Analytical laboratories and process control.

Contact: James R. Engel
508-921-2100

Related SBIR Contracts:
NAS7-1109 JPL PY 1988 Topic 08
"Auto-Aligned Fourier Transform Ultraviolet Spectrometer"

I: Advanced Materials

I.01
Biaxially Oriented Liquid Crystal Polymer Film
Firm: **Foster-Miller, Inc.**
The low-dielectric constant (less than 3.0), low-water-absorption (less than 0.1 percent), high-melt-temperature thermoplastic (270°C) can be extruded into thin dielectric layers. This extended substrate can be further refined to produce an in-plane coefficient of thermal expansion (CTE) that can range from 0 ppm/°C to 30 ppm/°C. By matching the substrate CTE to the CTE of the electrical component, such as leadless ceramic chip carriers, thermal cycling-induced solder joint failures can be significantly reduced.

Applications: Multilayer packaging of high I/O and VHSIC devices using SMT, as well as applications in flexible printed circuits, tape automated bonding, and laminated multichip modules.

Contact: Leslie S. Rubin
617-890-3200

Related SBIR Contracts:
NAS5-31404 GSFC PY 1990 Topic 04
"Liquid Crystal Polymers for Coefficient of Thermal Expansion Matched PWBs"

I.02
CVD Silicon Carbide™
Firm: **Morton International, Inc.**
CVD Silicon Carbide™ is a theoretically dense, fine-grained, highly pure (both chemical and phase purity) material possessing superior thermal, mechanical, and optical properties. The polycrystalline material is produced via the chemical vapor deposition (CVD) method. The material's hardness, thermal characteristics, stiffness, polishability, and non-toxic nature make it an attractive candidate material for many applications.

Applications: Uses include: substrate material for optical mirrors for ground or space based telescopes; synchrotron optics; structural applications; wear components; electronic ceramics.

Contact: William R. Haigis
800-552-2283

Related SBIR Contracts:
NAS1-18476 LaRC PY 1985 Topic 08
"Fabrication of Lightweight Silicon/Silicon Carbide LIDAR Mirrors"

I.03
Clean-Room Floor Tile Covering
Firm: **Springborn Laboratories, Inc.**
This product is a specialized floor-covering package (tile and adhesive) that meets the requirements of a Class 100 Clean Room. It is easily cleaned by a water/alcohol wet mop; chemically resistant to hypergolic materials; non-particle generating; low outgassing (ASTM E-505, 1 percent total mass loss, 0.1 percent total collected volatile, condensable materials); antistatic, 10^{7} ohms resistance; and exceeds NFPA Class 1 flammability requirements.

Applications: Recommended for clean-room installations up to Class 100, or other environments requiring excellent chemical resistance, static dissipation, and unique non-outgassing characteristics.

Contact: James P. Galica
203-749-8371

Related SBIR Contracts:
NAS10-11552 KSC PY 1987 Topic 04
"Specialized Floor Coverings for Launch Site Facilities"

I.04

Distributed Fiber-Optic Composite-Material Cure Monitoring and Control System

Firm: **Geo Centers, Inc.**

The product is a distributed, fiber-optic measurement system for use in composite-material fabrication. The system both monitors and controls autoclave temperature and pressure during composite-material fabrication. Additionally, it monitors the state of cure of the organic matrices used in these advanced materials. The system is unique in that as many as 50 independent sensors can be addressed by the system control interface.

Applications: The major application of the product is in monitoring and controlling the processing of advanced composite materials. Better control of these parameters during material fabrication should increase the manufacturing yield of these materials. The system is used for monitoring temperature and pressure by utilities, and in industrial process control and environmental monitoring applications.

Contact: Bruce N. Nelson
617-964-7070

Related SBIR Contracts:
NAS3-25817 LeRC PY 1987 Topic 04
"Embedded Fiber-Optic Sensors for Polymer-Matrix-Composite Process Monitoring"

I.05

Iridium/Rhenium Liquid Rocket Thrust Chamber

Firm: **Ultramet**

A significant increase in liquid rocket engine performance is provided by rhenium thrust chambers, fabricated by chemical vapor deposition (CVD), coated on the interior surface with iridium (also by CVD) for oxidation protection. This materials combination allows operation above 2200°C (4000°F), or some 500-800°C (800-1450°F) above the current state-of-the-art material. Extensive development and testing since 1983, under several NASA SBIR contracts but with substantial commercial support as well, has demonstrated a 10 percent increase in specific impulse (Thrust) through the higher operating temperature, which translates into weight savings through less propellant required for equal performance. This means either increased performance; increased payload capability, either in fuel (for longer time on orbit) or in additional revenue-producing transponders on communications satellites; or, alternatively, decreased launch costs. Flight qualification testing for a commercial customer is planned for early 1993.

Applications: Rocket nozzles and thrust chambers in the 1-lb. to 1000-lb. thrust range for orbital insertion engines, attitude control thrusters, and reaction control thrusters for commercial (particularly telecommunications), civil (i.e., NASA missions), and military satellites and spacecraft.

Contact: Robert H. Tuffias
818-899-0236

Related SBIR Contracts:
NAS03-25792 LeRC PY 1985 Topic 11
"High-Temperature, Oxidation-Resistant Thruster Materials"

I.06

Polyamide/Liquid-Crystal-Polymer Blend

Firm: **Foster-Miller, Inc.**

PI/LCP Blend Structures represent a new class of "Polymer Microcomposites" with performance superior to currently available polymer systems. Through a proprietary process, Foster-Miller has developed the means of producing biaxially oriented structures that exhibit near zero coefficient of thermal expansion (CTE), ultra-high stiffness (2 Mpsi in film form), and high tensile strength (≈70 ksi in film form). Foster-Miller's manufacturing technology, based on a new extrusion die, helps overcome processing difficulties in the extrusion of high-viscosity, high-temperature thermoplastics. This processing technology can be used to process films, tubes, and rods.

Applications: Aircraft interior surfaces such as luggage compartment panels, electronics such as multichip modules, barrier films for food packaging, medical products such as balloon catheters for angioplasty, cryogenic tanks, and uses in the transportation, telecommunications, chemical and recreational equipment fields.

Contact: Ross Haigighat
617-890-3200

Related SBIR Contracts:
NAS1-19302 LaRC PY 1989 Topic 04
"Polyamide/Liquid-Crystal-Polymer Blend"
NAS1-18527 LaRC PY 1985 Topic 04
"High-Performance LaRC-TPI Film"

I.07

Polyimide Foam

Firm: **High Technology Systems, Inc.**

This product is available as an adhesive resin and as fine powders in both the polyimide and polyamic acid forms. This system has been demonstrated to possess thermal resistance,

excellent flexural modulus and high adhesive strength when applied to metals such as titanium and stainless steel. Both the adhesive resins and fine powders are suitable for composite system applications. These materials have thermoplastic characteristics. The polyimide foam is a non-burning, smokeless insulating and acoustical foam.

Applications: Applications for powder and resins would be in coating, composites, laminates and molded parts for aerospace, electronic and defense industries; for foam, sound dampening, insulation and fire barrier for Marine, aerospace, construction, and automotive industries.

Contact: Alan M. Evans
518-283-8072

Related SBIR Contracts:
NAS1-19315 LaRC PY 1989 Topic 04
"Methods for Producing Fine-Particle Thermoplastic Polyimide Sulfone Powder"

I.08

Polymer Reaction Monitor

Firm: **Foster-Miller, Inc.**

The In Situ Fiber-Optic Polymer-Reaction Monitor is the first analytical system capable of directly measuring reaction chemistry in a wide variety of monomers and polymers. The Foster-Miller/NASA fiber-optic method is unique because it tracks a fundamental aspect of a chemical reaction: the vibration of atoms and molecules associated with the dissociation and formation of chemical bonds. The vibrational characteristics are picked up by a novel infrared fiber-optic sensor imbedded in the composite part. These new infrared-transmitting optical fibers are connected to a powerful Fourier transform infrared (FTIR) spectrometer that can compute and display spectral changes in real time. A complete system consists of a specially designed FTIR spectrometer optimized for fiber-optic work, associated computer and software, optical interface to carry the IR beam outside the spectrometer and return it, and an optical fiber sensor. To date, the principal application for the system is as an in-process monitor for controlling the manufacture of advanced carbon-fiber composite materials. Other applications are envisioned for the technology presented by this development. Traditional infrared sampling practice requires that the specimen to be analyzed be brought into the spectroscopy laboratory. Sampling with fiber-optic spectroscopy eliminates that requirement. Permitting the use of infrared spectroscopy in the manufacturing or process development environment.

Applications: Monitoring thin film coatings on food-packaging materials; solution polymerization reactions for plastics manufacture; low-level detection of analytes in biological substances; composite cure monitoring.

Contact: Mark Druy
617-890-3200

Related SBIR Contracts:
NAS1-18659 LaRC PY 1986 Topic 04
"In Situ, Fiber-Optic Sensor for FTIR Monitoring of Composite Cure Cycles"

I.09

Rigid Zirconia Fibrous Tile

Firm: **MER Corporation**

Rigid ZrO_2 fibrous tiles have excellent thermal shock resistance and low thermal conductivity. Heretofore, it has not been possible to make rigid ZrO_2 tiles that will withstand thermal shock without cracking. High-strength, small-diameter fibers of ZrO_2 have made possible the manufacture of rigid tiles with temperature capabilities well over 4000°F. High emissivity coatings have also been applied to the rigid Zirconia tiles.

Applications: Space vehicle insulation, and high-temperature insulation materials for furnaces.

Contact: J. C. Withers
602-574-1980

Related SBIR Contracts:
NAS9-18525 JSC PY 1989 Topic 04
"A Whisker-Reinforced High-Temperature Structural Insulation"

I.10

Titanium Fibers, Filaments, Strips, and Foils

Firm: **Ribbon Technology Corporation**

Ribtec produces rapidly solidified titanium-alloy ribbons, fibers, filaments, strips, and foils. Titanium foils are 100 mm (4") wide, and up to 2 m (6') long. Titanium fibers and filaments range from 100 μm to 0.5 mm effective diameter. Ribbons are as narrow as 2 mm and as thick as 0.5 mm. Titanium strip is cast to 100 mm (4") wide and 0.5 mm thick.

Applications: Foils: honeycomb structures, metal matrix composites; strips; engine flaps. Ribbons: metal matrix composites. Fibers and Filaments: catalyst supports, filters, prosthetic devices.

Contact: Thomas Gaspar
614-864-5444

Related SBIR Contracts:
NAS1-18288 LaRC PY 1984 Topic 01
"Rapidly Solidified Titanium Alloys by Melt Overflow"

I.11
Tungsten and Molybdenum Alloys
Firm: **Metadyne, Inc.**
Precipitation-strengthened alloys of tungsten and molybdenum (Mo-Hf-C, Mo-Re-Hf-C, Mo-W-Hf-C) have been developed for elevated temperature applications. These products are manufactured by using powder metallurgy techniques. The alloys are available in forms of ingot, rod, and fibers for further use in component manufacturing.

Applications: Refractory metal alloys of tungsten and molybdenum have excellent elevated temperature strengths and therefore are suitable for applications requiring extended exposure at elevated temperatures. Some commercial applications are: fiber-reinforced superalloys, isothermal forging dies, furnace components, and space power components.

Contact: Raman L. Daga
607-732-1300

Related SBIR Contracts:
NAS3-25149 LeRC PY 1985 Topic 04
"High-Strength, Refractory-Metal Fibers by Advanced Powder Metallurgy"

J: Materials Processing

J.01
Accessories for Pulsed Laser Deposition
Firm: **Neocera, Inc.**
As a result of the company's high-quality YBCO-on-sapphire research effort, two accessories for the high-temperature pulsed-laser deposition of multilayer films are commercially-available. The first accessory is a six-target carrousel assembly that permits the sequential deposition of up to six materials without breaking vacuum. Targets rotate at 17 rpm, and can be indexed into position from outside the deposition chamber. Both rotational feedthrus are welded bellows for UHV compatibility. The second accessory is a 2"-diameter substrate heater assembly. The heater can operate continuously up to 950 C in pure oxygen. Uniformity is ±4 C over the central 1.25" diameter. The assembly includes heater and shielding, thermocouple, rugged XYZ support structure, shutter, electrical and rotary feedthru, flange, and connectors. A fully programmable compatible temperature controller is also available for profiled substrate temperature applications.

Applications: The carrousel is a unique device for pulsed laser deposition of multilayer thin film structures while the substrate heater can, in principle, be used with any deposition method requiring heated substrates. It is designed specifically to be used in the presence of an oxygen ambient.

Contact: Steve Green
301-314-9937

Related SBIR Contracts:
NAS3-25929 LeRC PY 1989 Topic 04
"Microwave-Compatible High-T_c Superconducting Films on Sapphire Substrates"

J.02
Advanced Melt Spinner Equipment - Model 10TX
Firm: **Marko Materials, Inc.**
The fully automated PLC-operated vacuum melt spinner equipment produces rapidly solidified powders of intermetallic alloys, nickel aluminide, titanium aluminides, molybdenum disilicides, rare-earth magnet alloys and various advanced metal alloys. Marko Materials is the sole producer in USA of the advanced melt spinner equipment for production of rapidly solidified powders via rapid solidification technology.

Applications: Rapidly solidified powders can be used to fabricate monolithic as well as intermetallic matrix composites suitable for high- temperature aerospace applications.

Contact: Ranjan Ray
508-663-2210

Related SBIR Contracts:
NAS3-25448 LeRC PY 1986 Topic 15
"Fine-Grained, Nickel-Aluminide Alloys with Improved Formability Made Via Rapid Solidification"

J.03
DIFKIN, A Coupled-Mass Transport and Chemical Kinetics Code for CVD Modeling
Firm: **Aerodyne Research, Inc.**
The DIFKIN code solves the governing equations for coupled-mass transport and finite-rate chemistry in a two-dimensional flow. This flow configuration is an idealization of the deposition region in a CVD reactor, in which the reactants flow horizon-

tally over a tilted, flat substrate within a water-cooled tube. A deposition chemistry model using reactive sticking coefficients for each gas-phase species provides the diffusion boundary conditions and allows the prediction of deposition rates and distribution of depositing species.

Applications: In a comparison to observations in the NASA SiC CVD reactor, the DIFKIN model predictions agreed reasonably well. These comparisons demonstrate that a coupled diffusion and finite-rate chemistry approach is required to model SiC CVD, and that the present model is useful in investigating chemical effects in CVD.

Contact: Kurt D. Annen
508-663-9500

Related SBIR Contracts:
NAS3-24531 LeRC PY 1984 Topic 08
"Optimization of Silicon Carbide Production"

J.04
IONGUARD®
Firm: **Spire Corporation**
IONGUARD® is Spire's proprietary processing service that improves the wear-, corrosion-, and fatigue-resistance and other surface properties of a wide range of finished components. In the process, an ion implanter accelerates a beam of ionized atoms to such a high velocity that the ions are embedded in the near-surface region of the target, resulting in improved surface properties. Spire has eight in-house implanters and offers ion species of all stable elements to treat a wide range of metal alloys, ceramics, and polymer materials.

Applications: Orthopaedic implants, aerospace bearings, semiconductor wafers.

Contact: Bruce Haywood
617-275-6000

Related SBIR Contracts:
NAS8-35262 MSFC PY 1983 Topic 11
"Dry-Film Lubricant for Bearings Using Ion Implantation"

J.05
Ion-Beam-Assisted Deposition
Firm: **Spire Corporation**
Ion-Beam-Assisted Deposition (IBAD) is a physical vapor deposition process in which energetic ions and atoms of a single element or compound converge simultaneously on a substrate. It offers superior adhesion as compared to conventional wet-chemical processes. Spire has three IBAD systems capable of depositing a wide variety of metals, metalloids, and ceramics.

Applications: Catheters, orthopaedic hips and knees, stents, electrodes, sensors, and general patient care products.

Contact: Bruce Haywood
617-275-6000

Related SBIR Contracts:
NAS3-25326 LeRC PY 1987 Topic 04
"Oxidation Resistant Ti-6Al-4V-SiC Composite Materials by Ion-Beam Processing"

J.06
Model 1000 Welding Controller
Firm: **Mid-South Engineering, Inc.**
The Model 1000 Welding Controller is a gas tungsten arc welding (GTAW) control system with numerous useful features for industrial applications: computer models allow pre-process (off-line) parameter selections; weld programmer allows selection of operating parameters (current, voltage, etc.) on a common time base; digital automatic voltage control gives enhanced control capability; graphical displays allow easy operator programming and interpretation; Microsoft Windows® environment allows easy software maintenance and upgrades.

Applications: The system has application in any situation where gas tungsten arc welding is performed. The flexibility and precision of the system makes it particularly suitable for aerospace, automotive, military, and nuclear applications.

Contact: Kristinn Anderson
615-383-8877

Related SBIR Contracts:
NAS8-37401 MSFC PY 1986 Topic 04
"Intelligent, Gas-Tungsten-Arc Welding Control"

J.07
Real-Time, Adaptive-Vision Welding Guidance System
Firm: **International Technical Associates**
The product is a three-dimensional laser vision system that is able to track a seam in real time and provide corrections to a servo system in order to guide the path of a welder. The vision system is designed to be flexible and rugged, and can operate in the welding environment without loss of tracking accuracy.

Applications: Seam tracking, feature location, feature measurement, height measurement.

Contact: Phil Barone
408-748-9955

Related SBIR Contracts:
NAS8-38409 MSFC PY 1987 Topic 04
"Adaptive Vision for Welding Guidance System"

J.08
Stress Scanner Model SCA-1500
Firm: **Strainoptic Technologies, Inc.**
The SCA-1500 system is a PC-based data acquisition system for measuring stress birefringence in transparent material. The system permits static and dynamic readout of stress at a point or stress profile when scanning a line in applications where stress distribution is required. For example, in process control of oriented polymer films or measuring stress in structures using photoelastic coatings.

Applications: Stress analysis using photoelastic coatings and process control in manufacturing of float glass and production of biaxially oriented films.

Contact: Alex S. Redner
215-662-0100

Related SBIR Contracts:
NAS2-12666 ARC PY 1985 Topic 03
"Spectral Contents Readout of Birefringent Sensors"

K: Materials Testing and NDE

K.01
Automated Seal-Flaw Detection
Firm: **Winzen International, Inc.**
This high-resolution imaging system uses white light and image enhancement to characterize the seal joining two thin sheets of polyethylene film. A simple algorithm is able to classify the seal as good or bad in real time, i.e., as in the construction of a high-altitude scientific balloon.

Applications: Any heat-seal process joining translucent plastics, specific applications that require high-quality seals.

Contact: James L. Rand
512-690-3400

Related SBIR Contracts:
NAS5-30856 GSFC PY 1989 Topic 09
"Automated Seal-Flaw Detection"

K.02
Dual-Beam Lens for Micro-NDE
Firm: **Bio-Imaging Research, Inc.**
This product is a dual-beam lens for differential phase-contrast acoustic microscopy. As an attachment to acoustic microscopes, it allows higher resolution and generation of microscopic surface profiles of materials.

Applications: Materials characterization and evaluation, particularly inspection of surfaces of metals and composites for process evaluation.

Contact: David D. Waters
708-634-6425

Related SBIR Contracts:
NAS1-19099 LaRC PY 1988 Topic 04
"Differential-Phase, Acoustic Microscopy for Micro-NDE"

K.03
Dynamic Laser Speckle Profilometer (DyLASP)
Firm: **McMahan Electro-Optics, Inc.**
The Dynamic Laser Speckle Profilometer (DyLASP) locates defects in composite and metallic materials and assemblies. It operates in real time and displays results as a contour map of the assembly under test, with defects indicated by size and location. Minimum isolation is needed for test. All operations are controlled from the CRT with a mouse. Standard configuration allows inspection of areas up to 1 square meter and can profile resonance behavior of the object under test from 1 to 50 kHz. The DyLASP incorporates advanced laser targeting and imaging techniques developed by McMahan Electro-Optics scientists and engineers for advanced Air Force weapons systems.

Applications: Defect location and characterization in composite materials; resonance behavior in assemblies; stress/strain fields.

Contact: Robert H. Hart
919-549-7575

Related SBIR Contracts:
NAS1-18848 LaRC PY 1987 Topic 13
"Double-Pulsed, CCD, Phase-Sampled, Laser-Speckle Interferometric Metrology for NDT/E"

K.04

Fast Atom Sample Tester (FAST™)

Firm: **Physical Sciences, Inc.**

A pulsed, high-flux source of atomic oxygen has been developed and patented by Physical Sciences to perform accelerated erosion testing of spacecraft materials n a simulated low-earth-orbit environment. The device employees plasma formation in pure oxygen by laser-induced breakdown followed by hypersonic expansion to produce a relatively mono-energetic beam of oxygen atoms with velocity adjustable between 5 and 13 km/s. Fast oxygen atom fluxes of 10^{18} per pulse can be produced at 3 Hz, and the beam is expandable to areas of approximately 1000 cm^2.

Applications: Testing and aging certification of aerospace materials to be subjected to the low-earth-orbit environment. Surface modification applications.

Contact: George E. Caledonia
508-689-0003

Related SBIR Contracts:
NAS7-963 JPL PY 1984 Topic 04
"Novel Oxygen Atom Source for Material Degradation Studies"

K.05

High-Energy, Dual-Energy Computed Tomography Detector Package

Firm: **Advanced Research and Applications Corporation**

This innovative detector package has been developed to provide good-resolution (≥3 linepairs/mm) dual-energy computed tomography (CT) data at linear-accelerator energies (≥2 MeV). With its moderately high spatial resolution, high-energy design, and dual-energy capability, it is ideally suited for the inspection of large metal-matrix composite structures. The detector is also compatible with a standard load frame.

Applications: This detector, as part of a larger CT system, will provide key information needed by computer codes to generate better designs of structural components and more accurate predictions of in-service performance.

Contact: Jim Wiedeman
408-733-7780

Related SBIR Contracts:
NAS1-19093 LaRC PY 1988 Topic 04
"Dual-Energy Detector Package for Advanced Structures"

K.06

Instrumented Torque Wrench (INTOWS)

Firm: **ANCO Engineers, Inc.**

INTOWS is a computer-based quality-assurance tool to ensure that all bolt-torquing operations are performed according to specified procedures and provide a documented history of torquing operations. The system consists of an instrumented torque wrench, a handheld computer, and a barcode wand.

Applications: This portable, handheld system can be adapted to any situation where an approved quality-assurance procedure must be adhered to by an operator or technician.

Contact: Paul Ebanez
310-204-5050

Related SBIR Contracts:
NAS10-11501 KSC PY 1986 Topic 13
"Instrumented Torque Wrench"

K.07

Model V-1701 Digital Image-Oriented Signal Processing System

Firm: **McMahan Electro-Optics, Inc.**

This advanced application-oriented workstation is a by-product of the development of an innovative non-destructive testing and evaluation system for the Langley Materials Research Center. It is an interactive high performance system that allows fast manipulation of test data and systems under test.

Applications: The model V-1701 has been effectively applied to the thermal calibration of models in wind tunnels. It also has been applied as an advanced system to detect and measure turbulence. The system is being used in a wide range of aerospace applications: tracking, imagery exportation, sensor data fusion with neural-net and fuzzy logic capability.

Contact: Robert H. Hart
919-549-7575

Related SBIR Contracts:
NAS1-18848 LaRC PY 1987 Topic 13
"Double-Pulsed CCD, Phase-Sampled, Laser-Speckle Interferometric Metrology for NDT/E"

K.08

QUEST Integrated Load-Frame and Computed-Tomography System

Firm: **Advanced Research and Applications Corporation**

The QUEST (quantitative experimental stress tomography) Laboratory System is an integrated material testing system combining the performance of a standard load frame with the inspection capabilities of a high-resolution computed tomography (CT) instrument. The load frame is a closed-loop system with a ±500 kN capacity and the ability to measure all signal variables needed to conduct and evaluate compression, tension, or mixed-mode static and dynamic material tests. Additionally, the instrument has the ability to "pause and hold" a test at any point prior to catastrophic specimen failure and perform CT inspections of any or all cross sections of the specimen while maintaining the load. The CT system has a spatial resolution of 50 microns.

Applications: The QUEST system was developed so that material systems can be evaluated before, during, and after mechanical loading. The information will be used by computer codes to generate better designs of structural components and more accurate simulations of in-service performance.

Contact: Jim Wiedeman
408-733-7780

Related SBIR Contracts:
NAS1-18480 LaRC PY 1985 Topic 04
"Quantitative Experimental Stress Tomography (QUEST) Laboratory System"

K.09

Thermoelectric Microprobe

Firm: **QCI, Inc.**

The thermoelectric voltage generated by contact between the heated probe and a room temperature specimen is used for sorting and identifying alloys by category of heat treatment history.

Applications: Checking that heat treatment of precipitation hardened alloys has been properly performed. Straightening out materials mixups in shops, chemical plants, and laboratories.

Contact: Roger W. Derby
615-483-6498

Related SBIR Contracts:
NAS1-18852 LaRC PY 1987 Topic 13
"Thermoelectric Instrumentation for Characterization of Precipitation-Hardening Alloys"

K.10

Z Sensor

Firm: **Radiation Monitoring Devices, Inc.**

A portable, nondestructive analysis system that can be used to sort materials based on the materials' average atomic number of each specimen.

Applications: The Z Sensor provides a method to identify unknown materials and is complementary to other analytical techniques such as x-ray fluorescence.

Contact: Michael R. Squillante
617-926-1167

Related SBIR Contracts:
NAS7-1032 JPL PY 1986 Topic 05
"Proportional Proximity Sensor for Autonomous Space-Based Robots"

L: Materials Instrumentation

L.01

Miniature Materials Analysis X-Ray Laboratory

Firm: **Advanced Research and Applications Corporation**

The Miniature Materials Analysis X-Ray Laboratory is an extremely compact, low-mass, self-contained instrumentation system that accomplishes the x-ray diffraction and fluorescence analysis of materials (minerals, fuels and petroleum products, environmental contaminants) in the field setting. The system supports identification of polycrystalline samples by means of diffraction analysis, and enhanced fluorescence analysis for elements from carbon to molybdenum. Originally designed for the geological and exobiological surface exploration of the planet Mars, it is very robust, reliable, and portable. X-ray generator and electro-optic detector innovations have contributed to reducing substantially the dimensions and mass of the system.

Applications: The commercial applications of the Miniature X-Ray Laboratory include field exploration for mineral and petroleum resources, in situ materials-manufacturing process control, and environmental compliance monitoring.

Contact: Jim Wiedeman
408-733-7780

Related SBIR Contracts:
NAS2-13416 ARC PY 1989 Topic 08
"An Integrated Function X-Ray Laboratory for the Geological and Exobiological Exploration of Mars"

L.02

Multi-Color Imaging Pyrometer

Firm: **PSI Technology Company**

This instrument is a passive imaging pyrometer capable of measuring the temperature distribution across the surface of moving objects. Unlike infrared thermal imagers, the PSI pyrometer senses visible radiation to accurately measure temperatures between 600°C and 2200°C while minimizing errors associated with poorly known material emissivity. Images at six different wavelengths, from 450 to 950 nm, are projected concurrently onto a single CCD camera. The preferred wavelength for measurement of a particular temperature decreases as the temperature increases. The camera and optical system have been calibrated to relate the measured intensity at each pixel to the temperature of the heated object. The output of the camera is digitized by a frame grabber installed in a personal computer and analyzed automatically to yield temperature information. The data can be used in a feedback loop to alter the status of computer-activated switches and thereby to control a heating system.

Applications: The multi-color imaging pyrometer was designed to measure and control the temperatures of new materials subjected to thermal processing in a spaceborne laboratory. One use is in an acoustic leviation furnace in which material samples roughly 2 mm in diameter are heated to temperatures as high as 2500 K by a combination of radiant heating from the furnace walls and laser irradiation. Terrestrial applications include any high-temperature process where surface temperature fields must be measured and controlled. Custom-designed instruments to accommodate new applications are possible.

Contact: Michael B. Frisch
508-689-0003

Related SBIR Contracts:
NAS7-1002 JPL PY 1985 Topic 15
"Multi-Color, Imaging Pyrometer for Materials Processing in Space"

L.03

Optical Temperature Monitor

Firm: **PSI Technology Company**

This device is a specialized multi-wavelength pyrometer designed to accurately measure temperatures between 700° and 2500°C of materials with emissive properties that are poorly understood or that change with time or temperature. Its output is coupled to a computer that can be programmed to control the heating process. Originally designed for application to materials manufacturing in space, a commercial version of the instrument is now being developed for measuring and controlling temperatures in utility or industrial processes.

Applications: A specific application, for which the instrument is currently being tested, is the control of furnace exit-gas temperatures in utility boilers. Modified versions may find application in waste destruction and energy-intensive manufacturing processes such as steel, glass, cement, petrochemicals, pulp, and paper production.

Contact: Michael B. Frisch
508-689-0003

Related SBIR Contracts:
NAS7-1002 JPL PY 1985 Topic 15
"Multi-Color, Imaging Pyrometer for Materials Processing in Space"

L.04

Space Rated, Rugged, Compact Time-of-Flight Mass Spectrometer

Firm: **Schmidt Instruments, Inc.**

The Time-of-Flight Mass Spectrometer is small, rugged, and lightweight. It includes a hot filament ionizer with redundant filaments; complete power supply, control, and data acquisition electronics; serial control; and RS-485 data interface.

Applications: Materials processing; on-orbit environmental monitor; non-volatile residue sensor; residual gas analyzer.

Contact: Howard K. Schmidt
713-529-9040

Related SBIR Contracts:
NAS3-25971 LeRC PY 1988 Topic 08
"Autonomous Leak Detector for Orbiting Spacecraft (ALDOS) Development"

M: Aerodynamics and Aircraft

M.01

Aerospace Testing Services

Firm: **Physical Sciences, Inc.**

The firm offers a comprehensive state-of-the art suite of validated optical measurement techniques and systems to support research and advanced development throughout the aerospace industry. It has remote optical measurement capability for a wide range of applications from laboratory-scale research facilities to full-scale test or processing facilities. Single-point, time-resolved and planar

laser-induced fluorescence (PLIF) imaging measurements are provided on site.

Applications: On-site optical characterization services. Applications vary from characterization of temperature and species profiles in hypersonic flow to monitoring surface contaminants.

Contact: William J. Marinelli
508-689-0003

Related SBIR Contracts:
NAS3-26254 LeRC PY 1989 Topic 01
"Instantaneous Velocity Field Imagery Instrument for Supersonic Reacting Flows"
NAS1-19535 LaRC PY 1991 Topic 04
"Laser-Based Detection of Contamination on Adhesive Bonding Surfaces"

M.02
An Optical Angle-of-Attack Sensor
Firm: **Complere, Inc.**
This novel, laser-based instrument for the in situ measurement of wind-tunnel-model angle of attack enables continuous, time-dependent measurements to be made without signal dropout. The instrument also accounts for the largely unknown effects of model deflections and distortions due to changes in free-stream dynamic pressure and temperature. Detectors capable of 0.005 degree resolution over a 20 degree range and 0.01 degree resolution over a 40 degree range with time-dependent outputs of 60 Hz have been developed. This new instrument greatly improves wind tunnel testing efficiency and measurement accuracy as it removes the need for tedious and time-consuming model check-loading that is now required to estimate sting and balance deflections under wind tunnel dynamic loads. It provides sufficient angle-of- attack measurement accuracy for both transport and fighter model testing.

Applications: The instrument has been successfully tested in the NASA Ames 9 x 7 foot Supersonic Wind Tunnel, and a new instrument is being built for the NASA Ames 11 foot Transonic Wind Tunnel.

Contact: F. Kevin Owen
415-321-5630

Related SBIR Contracts:
NAS2-13202 ARC PY 1987 Topic 08
"An Optical Angle-of-Attack Sensor"

M.03
Burst Frequency Processor
Firm: **Physical Research, Inc.**
A multi-channel, ultra-high-speed laser velocimetry processing system designed for high flows and low-power Doppler signals. The system is capable of recording the raw Doppler signal from up to three components of a laser velocimeter in real time and post-processing the data using frequency domain signal-processing techniques. Its modular construction allows for easy addition of channels or upgrading of signal processing capabilities.

Applications: Use in supersonic and hypersonic wind tunnels as a laser anemometer measuring tool; needed for the development and design of future hypersonic aircraft.

Contact: Dariush Modarress
310-378-0056

Related SBIR Contracts:
NAS2-13268 ARC PY 1988 Topic 02
"Laser Velocimetry Processor for Hypersonic Flows"

M.04
EHPIC Mod 2.0
Firm: **Continuum Dynamics, Inc.**
The "EHPIC" software predicts performance of a general helicopter rotor in hover and axial climb. The analysis utilizes a free-wake model based on curved vortex filaments and converges the wake using an influence coefficient methodology. This innovative influence coefficient technique eliminates problems with converging a hydrodynamically unstable wake in the time domain. Commercial licensees of "EHPIC" claim superior accuracy over competing software.

Applications: The hover performance software can be used to develop new rotor designs as well as evaluate existing rotor systems.

Contact: Todd R. Quackenbush
609-734-9282

Related SBIR Contracts:
NAS2-12148 ARC PY 1983 Topic 03
"State-of-the-Art Rotary Wing Hover Performance Analysis"

M.05
Eddy Current Repulsion De-Icing Strip
Firm: **Electroimpact, Inc.**
The Eddy Current Repulsion De-Icing Strip (EDS) is a unique, patent-pending, in-flight, de-icing

system for aircraft. The system is targeted for general aviation, commuter, commercial transport, and military aircraft as a significant improvement over pneumatic boots or hot air anti-icing systems. The EDS uses electromagnetic repulsion for removing ice. An electrical power supply pulses a coil within a 0.10 inch thick copper/titanium laminate placed on the aircraft surface leading edge. The mechanical pulse of the outer titanium sheet removes ice. Average ice thickness is 0.020 inches and the EDS prevents any ice buildup over 0.090 inches. As well as allowing a minimum of residual ice, the EDS has several important advantages--it consumes far less power, requires no pilot judgement, operates automatically, and de-ices under all icing conditions.

Applications: The EDS system removes in-flight ice from general aviation, commuter, commercial transport, and military aircraft. The EDS replaces and is a significant improvement over pneumatic boots or hot air anti-icing systems. The EDS is retrofittable over the leading edge of wings, tail assemblies, and other critical aircraft components.

Contact: Samuel O. Smith
206-525-2403

Related SBIR Contracts:
NAS3-26252 LeRC PY 1989 Topic 03
"Eddy Current Repulsion De-Icing Strip"

M.06
Forebody Vortex Control
Firm: **Eidetics International, Inc.**
Forebody vortex control by blowing from small nozzles at the nose of a NASP-type aircraft is used to reduce or eliminate low-speed roll instability (wing rock). Control of the forebody vortices results in the indirect control of the wing vortices, which provides aerodynamic control of the vehicle rolling moment and suppression of wing rock.

Applications: This control system is being used for wing rock suppression/yawing moment control at medium to high angles of attack.

Contact: Gerald Malcolm
310-326-8228

Related SBIR Contracts:
NAS2-13196 ARC PY 1988 Topic 02
"Aerodynamic Control of NASP-Type Vehicles through Vortex Manipulation"

M.07
Laser Speckle Correlator
Firm: **American Research Corporation of Virginia**
The laser speckle correlator is a digital imaging system to be used for high-temperature optical strain measurements. This non-contact optical instrument is based on high-resolution photodiode array (i.e., charge-coupled device) technology. It consists of three main modules: three line-scan cameras with special optics; triple-beam laser illumination configuration with associated electro-mechanical shutters; and dedicated PC-based hardware and software measurement workstation including digital signal processing (DSP) analysis software based on Hypersignal-Windows Block Diagram programming module.

Applications: The major applications of this hybrid product include the physical and mechanical measurement instrumentation for materials testing and evaluation.

Contact: Adel K. Sarrafzadeh
703-731-0655

Related SBIR Contracts:
NAS1-19305 LaRC PY 1989 Topic 02
"Cross-Correlation, Optical Strain Sensor for Wind Tunnel Test Instrumentation"

M.08
NEARLEWICE
Firm: **Nielsen Engineering & Research, Inc.**
NEARLEWICE is a computer program which can be used to predict the shapes of ice accretions on the leading edges of airfoils and two-dimensional, streamlined bodies. The methodology used in NEARLEWICE consists of three basic components: water droplet trajectory calculation, determination of ice deposition and growth, and a flowfield analysis which is used both for the evaluation of the droplet trajectories and of the aerodynamic penalties. These three series of computations are performed at each time step in a quasi-steady manner to enable a time-dependent ice accretion analysis. NEARLEWICE calculates the flowfield by solving the Euler equations on an unstructured mesh. The mesh generation procedure requires only minimal input from the user to facilitate time-dependent mesh creation. NEARLEWICE will be extended to handle three-dimensional configurations in a future version.

Applications: NEARLEWICE can be used for the evaluation of in-flight performance of both fixed-wing aircraft and rotorcraft in icing conditions for design and certification purposes.

Contact: Steven C. Caruso
415-968-9457

Related SBIR Contracts:
NAS3-26059 LeRC PY 1988 Topic 03
"Unstructured Triangular Mesh, Navier-Stokes Method for Aerodynamics of Aircraft with Ice Accretion"

M.09
RotorCRAFT
Firm: **Continuum Dynamics, Inc.**
The RotorCRAFT code provides a comprehensive analysis of performance and unsteady blade-loading for isolated helicopter rotors. It employs a novel full-span constant vorticity contour free-wake model, a vortex lattice presentation of the blades, and a finite-element model of structural deflection.

Applications: RotorCRAFT may be used to predict the aerodynamic loading on a wide range of rotor designs operating at any speed from transition to high-speed cruise.

Contact: Todd R. Quackenbush
609-734-9282

Related SBIR Contracts:
NAS2-12838 ARC PY 1986 Topic 02
"An Advanced Free Wake Analysis for Unsteady Airloads"

M.10
Wind Tunnel Project Engineer's Intelligent Assistant
Firm: **ERC, Inc.**
This software program and database for micro-computers uses hypertext and expert systems. It has captured the knowledge of experienced test engineers used in setting up tests and diagnosing results. The Intelligent Assistant is in operation at NASA Ames Research Center. The system gives wind tunnel project engineers a tool for planning, conducting, and reporting wind tunnel tests. It will be used to educate new wind tunnel test engineers.

Applications: In wind tunnel and aerospace test facilities.

Contact: W. Andes Hoyt
615-455-9915

Related SBIR Contracts:
NAS2-13203 ARC PY 1988 Topic 03
"Intelligent Hypertext Systems for Aerospace Knowledge Representation"

N: Fluid Mechanics and Measurement

N.01
Diode-Laser Oxygen Sensor
Firm: **Southwest Sciences, Inc.**
The diode-laser oxygen sensor utilizes inexpensive near-infrared diode lasers for nonintrusive in situ measurements of molecular oxygen in combustion systems or other environments. The instrumentation can be designed to measure temperature and velocity as well as O_2 concentrations in high-speed, high-temperature flows. A prototype system utilizing fiber optics has been developed for near-simultaneous measurement of these parameters in eight optical channels.

Applications: This system can be used for wind tunnel diagnostics and aircraft engine performance testing. Other gases (e.g., CH_4, H_2O, NH_3, HC1) could also be measured by this approach.

Contact: Alan C. Stanton
505-984-1322

Related SBIR Contracts:
NAS1-19097 LaRC PY 1988 Topic 02
"Noninstrusive, Fast-Response, Oxygen Monitoring System for High-Temperature Flows"

N.02
FASTRAN
Firm: **CFD Research Corporation**
FASTRAN (Fast Transient Analysis) is a three-dimensional Navier-Stokes code for analyzing fast transient compressible flows. The code employs general curvilinear coordinates and a density-based, finite-volume approach. Differencing schemes include state-of-the-art high resolution techniques: Roe-Sweby TVD scheme, generalized Godunov-type of MUSCL schemes, and Colella's multi-dimensional PLM method. The code has been systematically validated for more than 20 test problems.

Applications: External and internal aerodynamics; nonlinear acoustics; pressure waves; study of fine details (small scale features) of flows; combustion instabilities; large eddy simulations.

Contact: Ashok K. Singhal
205-536-6576

Related SBIR Contracts:
NAS8-38489 MSFC PY 1988 Topic 11
"Advanced CFD Methodology for Fast Flow-Transients Encountered in Nonlinear Combustion Instability Problems"

N.03
FIDAP™ (Fluid Dynamics Analysis Package)
Firm: **Fluid Dynamics International**
FIDAP is a general purpose computational fluid dynamics package that analyzes a wide range of incompressible and subsonic compressible flows. FIDAP is a complete package that includes comprehensive pre- and post-processing capabilities and a flexible, powerful solver.

Applications: Industries that utilize FIDAP for many different fluid flow and heat- and mass-transfer applications include: electronics, automotive, chemical, material processing, food, aerospace, paper, polymer processing companies.

Contact: Simon Rosenblat
708-491-0200

Related SBIR Contracts:
NAS3-25946 LeRC PY 1988 Topic 15
"Numerical Simulation of Crystal Growth Processes"

N.04
NEKTON® Fluid-Flow Numerical Simulator
Firm: **Fluent, Inc.**
NEKTON is a powerful fluid-flow modeling package based on a finite-element technique known as the spectral element method for the simulation of two- and three-dimensional unsteady, incompressible fluid flow and heat transfer. It provides high-order accuracy while retaining geometric flexibility. NEKTON solves general moving-boundary problems (including free surface, moving walls, multiple fluid layers, and moving melt fronts) with conjugate heat transfer, heat generation, and/or forced and natural convection in Newtonian and non-Newtonian fluids. NEKTON is an attractive tool for the analysis of material processing, biological flow, and flow measurement. NEKTON's pre- and post-processors allow problem geometries and parameters to be specified directly with a mouse and pulldown menus in a Motif/X-Window environment.

Applications: Polymer processing, glass processing, extrusion, crystal growth, biological flows, heat exchanger design, electronics cooling, furnace modeling, metals processing.

Contact: S. Subbiah
603-643-2600

Related SBIR Contracts:
NAS1-19102 LaRC PY 1988 Topic 15
"Chemical-Vapor-Deposition, Fluid-Flow-Simulation Modelling Tool"

N.05
Optical-Fiber Temperature Sensor
Firm: **Conax Buffalo Corporation**
The optical-fiber temperature sensor consists of a high-temperature lightguide with an integral, emissive source coupled through fiber-optic cable to a conversion-electronics package that translates optical intensity to probe temperature.

Applications: Turbine-engine, gas-path temperature measurement.

Contact: Samuel Algera
716-684-4500

Related SBIR Contracts:
NAS3-25451 LeRC PY 1986 Topic 01
"Durable, Fast-Response, Optical-Fiber Temperature Sensor Usable from 200 to 1700°C"

N.06
PHLOW
Firm: **Computational Mechanics Company**
PHLOW is an X-Window-based software package that may be used for simulating laminar and turbulent incompressible flows. The code has been designed to operate on fully unstructured meshes and to use H-refinement and P-enrichment to systematically reduce the error in the numerical solution. The code has a versatile, user-friendly pre-processor and special graphics package designed for spectral types of elements. The code is operational on several platforms ranging from the workstation class of machines (Apollo, SGI, Sony, Sun) to mini-supercomputers and supercomputers.

Applications: Modeling the flow through coolant chambers and ducts of mechanical systems. Predicting the flow field and recirculation regions in the SSME. There is also great potential for applications in the HVAC, automotive, and food industries.

Contact: Steve Kennon
512-467-0618

Related SBIR Contracts:
NAS8-38404 MSFC PY 1987 Topic 02
"Adaptive Schemes for Complex, Subsonic, Three-Dimensional Flow Problems in Arbitrary Domains"

N.07
Particle Tracking Computer Software
Firm: **Scientific Research Associates, Inc.**
A particle tracking code has been coupled to a graphical user interface (GUI). The code computes particle trajectories for a given background flow field, taking into account particle drag, heat transfer, and mass transfer, and includes particle/wall reflection logic for complex geometries. The X/Motif-based GUI allows the user to specify input parameters such as particle size, injection locations, and boundary properties, and displays the particle trajectories as they are being computed.

Applications: Solid and liquid rocket engine components containing particles (solid particles, droplets, or bubbles) in a gaseous or liquid flow field; particle separators; dilute fuel sprays.

Contact: Frederik J. de Jong
203-659-0333

Related SBIR Contracts:
NAS8-39337 MSFC PY 1991 Topic 11
"An Interactive Tool for Discrete Phase Analysis in Two-Phase Flows"

N.08
Rayleigh Scattering Diagnostic for Density and Temperature
Firm: **Aerodyne Research, Inc.**
The system performs measurements of gas density and temperature at rates of up to 10 KHz. It utilizes both the 510 nm and 578 nm lines of a copper vapor laser in measuring the Rayleigh scattering signal and in subtracting out surface-scattered light. The system features a 1-inch-diameter probe containing the laser focusing optics, the collection optics, and a pressure transducer. The probe is water-cooled, and the optics and pressure transducer are protected with a purge-gas flow for use in combustion environments. The system includes PC-based data acquisition and reduction.

Applications: Measurement of temperatures in burners; system design conditions of 1200 K and 20 Atm.

Contact: Kurt D. Annen
508-663-9500

Related SBIR Contracts:
NAS3-24613 LeRC PY 1983 Topic 01
"A Rayleigh Scattering Diagnostic for Density and emperature Measurements"

N.09
TMRCAA
Firm: **Nielsen Engineering & Research, Inc.**
TMRCAA solves the three-dimensional, compressible, Navier-Stokes equations and uses any of several turbulence models up to a Reynolds-stress transport model. A distinguishing feature of the code is a high-accuracy, shock-capturing, finite-volume algorithm. The algorithm reduces significantly the number of grid points required for a calculation, when compared to typical second-order methods. This enables accurate simulations of complex turbulent and aeroacoustic phenomena at reasonable computational costs. This is a research code and requires some CFD background to use. It is available in source form. The code is applicable to relatively simple geometries only.

Applications: TMRCAA can be used for simulations of complex aeroacoustical flows and turbulence, and for Reynolds-averaged calculations.

Contact: Robert E. Childs
415-968-9457

Related SBIR Contracts:
NAS1-19530 LaRC PY 1991 Topic 02
"Methods for Computational Aeroacoustics"

N.10
The FDNS CFD Code
Firm: **SECA, Inc.**
The FDNS CFD code was developed under NASA SBIR to address rocket engine and plume analyses. The FDNS is a Navier-Stokes solver with advanced turbulence and chemical kinetics sub-models. The code is applicable to all flow regimes for both steady and unsteady flows. Both single and multiphase flows are treated.

Applications: The CFD analyses provided by SECA apply to solid and liquid rocket engine performance predictions, to exhaust-plumes, flow-field analyses, and to internal flow predictions of rocket engine systems. Blow-out behavior in combustors is also simulated.

Contact: Richard C. Farmer
205-534-2008

Related SBIR Contracts:
NAS8-37408 MSFC PY 1986 Topic 02
"The Use of Variational Principles in Improving CFD Methodology"

N.11
The Phase Doppler Particle Analyzer
Firm: **Aerometrics, Inc.**
The Phase Doppler Particle Analyzer (PDPA) is a laser-based particle-analysis system that measures size and velocity of particles passing through a measurement-probe volume. These measurements occur simultaneously and are displayed in any of several user-specified formats via Aerometrics' software. Aerometrics offers standard or fiber-optic one-, two-, or three-component PDPA systems, that can be used to conduct flow testing in three orthagonal directions. The PDPA is designed for use in measuring spherical particles that are between 0.5 and 10,000 micrometers in diameter. Aerometrics will customize any PDPA system to fit demanding or unusual testing conditions and frequently provides accessories, also often customized, which complement and enhance the PDPA capabilities. The PDPA system includes: transmitting optics, receiving optics, a signal processor, system software, and, if the system is fiber-optic, a fiber drive. Aerometrics does not make, but will provide, lasers and computer systems.

Applications: Spray nozzle development: gas turbines, fuels, paints, agricultural sprays, and medical nebulizers. Particle field characterization: two-phase flows, spray combustion, diesel spray formation, metal powder formation, polymer bead studies, chemical processes, spray drying, scrubbers, aircraft icing, condensation, sedimentation, cavitation and microbubbles, meteorology, clouds, aerosols, and fogs.

Contact: William D. Bachalo
408-738-6688

Related SBIR Contracts:
NAS3-25204 LeRC PY 1985 Topic 01
"Fuel Atomization and Air-Fuel Interactions in a Turbulent Environment"

N.12
Ultrasonic Phase Separator
Firm: **S. R. Taylor & Associates**
This product relies on ultrasonic candescence and radiation forces to separate gas bubbles from liquids in zero-gravity environments.

Applications: In addition to gas/liquid separation in zero-gravity, the ultrasonic phase separator can be used to assist in separation of emulsions, etc.

Contact: Scott R. Taylor
918-333-7052

Related SBIR Contracts:
NAS9-18173 JSC PY 1987 Topic 12
"Zero-Gravity Phase Separation"

O: Heat Transfer Devices

O.01
Cryogenic Heat Pipe
Firm: **Thermacore, Inc.**
This high-performance, nitrogen/stainless steel heat pipe for operation from 70 K to 100 K. Enhanced performance is obtained by utilizing a high-directional-permeability wick structure made by encasing a narrow gap annulus within a sintered-powder metal matrix. A one-meter long, 1.25 cm OD heat pipe at 80 K demonstrated a thermal performance of 3.5 watts with 0.4 cm adverse tilt and over 2 watts transport at 2.5 cm adverse tilt. The heat pipe demonstrated reliable start up against gravity while carrying several watts of thermal power. Operation in space is rated at two watt-meters. The purpose of Phase II is to perform a Space Shuttle flight test on this heat pipe design. Phase II started in September 1991.

Applications: Primarily designed for space use, these heat pipes are suitable for cooling infrared sensors and other surveillance detectors. Operation at high power or transport over long distances is possible for maneuvering satellites and space-based platforms. Potential commercial applications include cryogenic and other low-temperature heat pipes capable of operating in vibrating environments and against gravity fields.

Contact: John Rosenfield
717-569-6551

Related SBIR Contracts:
NAS5-31783 GSFC PY 1989 Topic 09
"Sintered-Powder, Artery-Free Wicks for Low-Temperature Heat Pipes"

O.02
Gas Dynamic Compressor
Firm: **ISTAR, Inc.**
The gas dynamic compressor generates hot compressed gas by transient detonation waves in transonic flow ducts.

Applications: The gas dynamic compressor is a means to augment conventional compressors or to develop high efficiency in small, disposable engines (e.g., missile propulsion).

Contact: A. Wortman
310-394-7332

Related SBIR Contracts:
NAS3-25453 LeRC PY 1986 Topic 01
"Detonation-Duct Gas Generator"

O.03
HA4 Heat Pipe Cold Plate
Firm: **Thermacore, Inc.**
Thermacore's HA4 Cold Plate provides effective cooling of heat-dissipating electronic components on surface-mounted circuit boards. The reliable performance of the HA4 prevents component overheating that causes components failure. The HA4 utilizes embedded copper/water heat pipes to carry the heat from components to a liquid- or air-cooled cold wall, with a typical center-to-cold-wall temperature difference of 20°C or less. While cooling at both edges is recommended for maximum plate performance, single-edge cooling is possible with a derated performance. The HA4's operation is insensitive to mounting orientation. Each HA4 Cold Plate is individually tested to assure a quality product with long life and high reliability. Dimensions of the HA4 are 9.5" by 4" by 0.12" thick. Its nominal power rating is 50 watts at a maximum temperature difference of 20°C. It weighs only 8 ounces.

Applications: The HA4 modular cold plate is used to cool electronic assemblies and fuel cells. Several thousand have been incorporated into electronics aboard F-15 and F-16 aircraft.

Contact: George Meyer
717-569-6551

Related SBIR Contracts:
NAS9-17610 JSC PY 1984 Topic 09
"Modular Cold Plates for High Heat Fluxes"

O.04
High-Density Thermal Energy Storage System
Firm: **Rocky Research**
Thermal storage system is usefule for lunar base and commercial AC systems for building cooling. The system is based on sorption process leading to a compactness of 1 cu. ft./ton-hr equipment.

Applications: Building HVAC and process cooling.

Contact: Uwe Rockenfeller
702-293-0851

Related SBIR Contracts:
NAS9-18643 JSC PY 1989 Topic 09
"High-Density, Chemical-Thermal Storage System for Low Gravity Environments"

O.05
High-Heat-Flux, Condensing Heat Exchanger
Firm: **Creare, Inc.**
The condenser uses capillary forces to maintain a thin condensate film and an internal drainage system to remove the liquid from the surface. Heat flux rates of over 60 w/cm^2-K and heat-transfer coefficients in excess of 8 w/cm^2-K have been demonstrated in water.

Applications: Two-phase space thermal management; thermal management for power systems and process equipment.

Contact: Jim Block
603-643-3800

Related SBIR Contracts:
NAS9-17989 JSC PY 1986 Topic 09
"Low-Film-Resistance Condenser for Operation in a Gravity-Free Environment"

O.06
High-Heat-Flux, Single-Phase Exchanger
Firm: **Creare, Inc.**
This single-phase heat exchanger can achieve heat fluxes comparable to those encountered in evaporating and condensing heat exchangers while maintaining high effectiveness and low pressure drop. With water as the cooling medium, a prototype heat exchanger achieved a heat flux of 56 w/cm^2 with an effectiveness of 84 percent and only a 250 Pa (0.04 psi) pressure drop. The same heat flux and effectiveness were achieved with air and a pressure drop of 10 kPa (1.4 psi).

Applications: Spacecraft thermal-management cooling for advanced electronic packaging concepts; cooling of microelectronics or electronics in harsh environments.

Contact: Jim Block
603-643-3800

Related SBIR Contracts:
NAS9-18167 JSC PY 1987 Topic 09
"Compact, High-Performance Heat Exchangers for Space Station Thermal Control"

O.07
Lightweight Ammonia Heat Pipe
Firm: **Thermacore, Inc.**
This newly developed product is a light-weight heat pipe made from an engineered composite material. The pressure envelope is constructed from an aluminum-foil-lined, carbon fiber/epoxy tube. The thin-walled tube weighs 56 percent less per unit-length than a comparable strength aluminum tube. Burst pressure of the tube is 1750 psi. The heat pipe is designed for operation in the -60 to +60°C temperature range and uses ammonia as the working fluid. The high-performance capillary wick structure is polymer-bonded, aluminum-powder metal with a single artery to facilitate condensate return. To date, heat pipes have been fabricated that are one inch in diameter and two feet long. Estimates based on an all-aluminum version show performance in excess of 50 kW-m.

Applications: Ammonia heat pipes typically find their widest application in spacecraft thermal control. This product is a light-weight alternative to the aluminum/ammonia heat pipes currently being used on NASA, military, and commercial spacecraft.

Contact: Nelson Gauer
717-569-6551

Related SBIR Contracts:
NAS8-38437 MSFC PY 1989 Topic 09
"Composite Material Technology for Lightweight Heat Pipes"

O.08
MicroPCM Coolants and PCM Thermal Capacitors for Enhanced Heat Transfer and Storage
Firm: **Triangle R&D Corporation**
This new non-toxic, aqueous coolant consists of a two-component slurry of microencapsulated phase change materials (PCMs). It exhibits over 10 times the heat capacity of water, isothermal heat transport, and low pump work with application to both environmental thermal management as well as space suits. A PCM thermal capacitor can also provide significant thermal storage. These patented developments were discussed in NASA *Tech Briefs* and have been awarded two Technology Utilization Awards.

Applications: PCM coolants can transport significantly more heat isothermally than conventional coolants and are applicable to both avionic and spacecraft where system weight and volume are critical.

Contact: David P. Colvin
919-781-8148

Related SBIR Contracts:
NAS8-35840 MSFC PY 1983 Topic 09
"Energy Storage System Using Phase Change Materials"
NAS9-17952 JSC PY 1987 Topic 12
"Space Suit Thermal Control Using Non-Toxic, Microencapsulated-PCM, Two-Phase Fluids"

O.09
Nonazeotropic Heat Pump for Water Heating
Firm: **Foster-Miller, Inc.**
The coefficient of performance (COP) of a heat pump operating between two liquid systems can be increased by greater than 50 percent by using a nonazeotropic refrigerant mixture that exhibits non-isothermal boiling and condensing. Foster-Miller has designed and built an operating prototype for the Space Station Freedom which demonstrates this. Evaporator and condenser efficiency was greatly increased by tailoring the refrigerant's boiling and condensing temperature change to match that of the liquid-side temperature change. This resulted in COPs of 6.5 to 8.5 when tapping a 110°F waste heat source to raise the temperature of hygiene water from 70°F to 140°F. The heat pump utilizes a high-efficiency scroll compressor with an innovative microgravity-compatible lubricating system developed by Foster-Miller.

Applications: This product and its variations can be used to heat water or other liquids in residential or industrial environments and chemical processes. These include a wide range of temperature increases while recovering heat from a wide range of sources. The tools developed for the design of this heat pump can be applied to the design of many systems using nonazeotropic refrigerant mixtures.

Contact: David Walker
617-890-3200

Related SBIR Contracts:
NAS8-38407 MSFC PY 1987 Topic 09
"Nonazeotropic Heat Pump for Crew Hygiene Water Heating"

O.10

SCAPE-Suit Heater

Firm: **Mainstream Engineering Corporation**

The SCAPE-Suit Heater is a nontoxic chemical-heating system for use with the propellant handler's ensemble (SCAPE Suit). The SCAPE-Suit Heater heats secondary air that is being circulated within the SCAPE Suit during cold-weather conditions. This heater allows for longer suiting times during these cold-weather periods. The heater unit is designed to be used with the existing SCAPE Suit without modifications.

Applications: This technology could be applied to personal heating of any type, heating of foods and/or beverages, and any other application requiring passive heating.

Contact: Lawrence R. Grzyll
407-631-3550

Related SBIR Contracts:
NAS10-11672 KSC PY 1988 Topic 13
"Improved System for SCAPE Suit Heating"

O.11

Textile Fibers with Embedded Microencapsulated Phase-Change Materials for High Thermal Storage

Firm: **Triangle R&D Corporation**

Textile fibers with embedded microencapsulated phase-change materials (PCMs) have 10 times (1000 percent) the thermal capacitance of unfilled fibers and can be woven into fabric and clothing to provide novel and superior thin thermal barriers and superior comfort.

Applications: Ideal for transient exposure to extreme temperature environmental conditions where thin non-bulky clothing or fabric is essential. Also applicable to arctic clothing uniforms and blankets.

Contact: Yvonne Bryant
919-781-8148

Related SBIR Contracts:
NAS9-18110 JSC PY 1988 Topic 12
"Spacesuit Glove-Liner with Enhanced Thermal Properties for Improved Comfort"

P: Refrigeration and Cryogenics

P.01

Domestic Stirling Cycle Refrigerator

Firm: **Stirling Technology Company**

This product, a domestic Stirling-cycle refrigerator, is based upon technology for Stirling cryocoolers developed in the NASA SBIR program for cooling spacecraft instruments to extremely low temperatures. Demonstration of a prototype for domestic applications is being funded by a Phase II contract with the Department of Energy (DE-FG03-90ER80864). The Stirling heat pump does not use CFCs, is environmentally safe, and presents no fire hazards. The working fluid is helium, which is stable and non-reactive. Disposal of helium at the end of the refrigerator life presents no environmental problems. The Stirling heat pump will offer reliable, low-cost, efficient operation by employing non-contact, flexural bearings with clearance seals for the moving components. STC expects system efficiencies competitive with current CFC-based systems.

Applications: Cryogenic cooling, domestic refrigeration, and other heat pump or refrigeration applications.

Contact: Peter Riggle
509-375-4000

Related SBIR Contracts:
NAS5-31176 GSFC PY 1988 Topic 09
"Stirling Cryocooler with Extremely Low Vibration"
NAS5-30860 GSFC PY 1989 Topic 09
"A High-Efficiency, Low-Vibration, Long-Life, Stirling Cryogenic Pre-Cooler"

P.02

Helium Transfer Pump

Firm: **Creare, Inc.**

This transfer pump is designed to pump liquid helium from one tank to another to refill depleted dewars on satellites. The pump is designed to deliver 800 liters per hour of liquid helium against a pressure rise of 2.3 psi. High efficiency results in very small losses of liquid helium.

Applications: To refill dewars on satellites and in laboratories; to pump liquid cryogenies.

Contact: Jim Block
603-643-3800

Related SBIR Contracts:
NAS2-12950 ARC PY 1986 Topic 08
"A Long-Life Centrifugal Pump for Helium II Transfer"

P.03
Long-Life Cryocoolers
Firm: **Stirling Technology Company**
Cryocoolers for focal plane arrays or other sensors: very long maintenance-free life (5-15 years); very low vibration; high efficiency.

Applications: Spacecraft cryocooling; terrestrial cryocooling; specialty compressors--absolutely contamination-free.

Contact: Peter Riggle
509-375-4000

Related SBIR Contracts:
NAS5-31176 GSFC PY 1988 Topic 09
"Stirling Cryocooler with Extremely Low Vibration"

P.04
Non-Clogging, Self-Regulating, Joule-Thomson Cryostat
Firm: **General Pneumatics Corporation**
Joule-Thomson (J-T) cryostats liquefy gases by expansion from high pressure through a nozzle to produce cryorefrigeration (temperatures below -243°F). In many applications the cryostat must automatically regulate the flow to provide rapid cooldown and then adjust to match the heat load. WRC's patented anti-clogging, flow-regulating J-T cryostat was designed specifically to overcome the reliability shortcomings inherent in conventional J-T devices. These cryostats have exhibited remarkable resistance to clogging by particulate or condensed contaminants in the working fluid, while effectively regulating the flow according to applied heat load and maintaining exceptionally stable operating temperatures at the cold end.

Applications: The most significant application for WRC's J-T cryostat is for infrared systems used in heat seeking missiles guidance, night vision equipment, thermal imagers, telescopes, forward looking infrared (FLIR) systems, and a wide array of instruments employed for space-based experiments and monitoring in astronomy, climatology, geology and other electro-optical systems. Other applications include cooling systems for computers and recycling helium used to cool magnetic resonance imaging (MRI) machines.

Contact: Steven G. Zylstra
602-998-1856

Related SBIR Contracts:
NAS10-11322 KSC PY 1984 Topic 11
"Temperature Sensitive, Variable-Area Joule-Thomson Expansion Nozzles"

Q: Energy Conversion Devices

Q.01
Catalytic Engine Coating
Firm: **Precision Combustion, Inc.**
This catalytic engine coating offers emissions reductions for rotary and other internal combustion engines.

Applications: For catalytic reduction of emissions from internal combustion engines without efficiency losses normally experienced with after-treatment of exhaust.

Contact: Kevin Burns
203-786-5215

Related SBIR Contracts:
NAS3-25784 LeRC PY 1986 Topic 01
"Catalytic-Ignition, Rotary Combustion Engine"

Q.02
Catalytic Glow Plug
Firm: **Precision Combustion, Inc.**
A catalytic glow plug designed for use in low-compression diesels such as the John Deere SCRE rotary engine. This specially designed catalytic glow plug offers lower temperature operation for increased durability and reliability. It further increases efficiency in combustion while reducing white smoke and other emissions.

Applications: Improved ignition and ignitor durability in low-compression diesel engines, including SCRE rotary engines, compression ignition methanol fueled engines, and standard diesels. For use with rotary combustion engines offering great potential for small aircraft use.

Contact: Kevin Burns
203-786-5215

Related SBIR Contracts:
NAS3-25784 LeRC PY 1986 Topic 01
"Catalytic-Ignition, Rotary Combustion Engine"

Q.03

Chemical/Mechanical Heat Pump

Firm: **Mainstream Engineering Corporation**

The chemical/mechanical heat pump is an innovative, high-reliability, high-efficiency device for attachment to a spacecraft thermal bus. It allows equipment to operate at a temperature colder than the saturation temperature of a two-phase thermal bus. It combines the advantages of a mechanical vapor compression heat pump with those of chemical heat-pump systems.

Applications: Applications range from spacecraft thermal management to terrestrial heat pumps.

Contact: Muhammad Rahman
407-631-3550

Related SBIR Contracts:
NAS5-31167 GSFC PY 1988 Topic 09
"Modular Chemical-Mechanical Heat Pump for Spacecraft Thermal Bus Applications"

Q.04

Composite-Matrix Regenerators for Stirling-Cycle Engines

Firm: **Energy Science Laboratories, Inc.**

The product line consists of light-weight, high-performance, regenerative heat exchangers for use in Stirling-cycle engines and coolers. Carbon-fiber composite design permits tailoring the regenerator thermal-hydraulic characteristics to meet specific requirements. High-conduction anisotropy, low-pressure drop, enhanced heat capacity, low thermal expansion, and high-temperature stability are advantages over conventional metallic regenerators.

Applications: Regenerative heat exchangers for Stirling-cycle engines, heat pumps, and coolers. Low-cost microcooler design. Stationary and rotary regenerators for use in recuperated turbine systems.

Contact: Timothy R. Knowles
619-552-2034

Related SBIR Contracts:
NAS3-26249 LeRC PY 1989 Topic 10
"Composite Regenerator for Stirling Engine"

Q.05

Pyroelectric Converter

Firm: **Chronos Research Labs, Inc.**

This pyroelectric converter transforms heat directly into electrical energy. It provides an inexpensive (cheaper than utility wholesale rates) means of generating electricity from a variety of low temperature sources including: industrial reject-heat, geothermal heat, and even solar heat. This patented technology will be made available for licensing for a limited time in the United States.

Applications: Generation of electricity from several possible heat sources including geothermal, industrial, solar, and ocean thermal gradient.

Contact: Randall B. Olsen
619-455-8200

Related SBIR Contracts:
NAS7-998 JPL PY 1985 Topic 09
"Pyroelectric Bell Radiator"

Q.06

ReLi® Rechargeable Lithium Cells and Batteries

Firm: **EIC Laboratories, Inc.**

The ReLi® cell is a secondary lithium cell that has three times the energy density of NiCd cells. The nominal output voltage is 2.1 V, and the nominal capacity of an AA cell is 1 Ahr. The cell is capable of >300 cycles and will deliver 65 percent of its capacity at over 2 V providing 300 mA continuously. After 350 cycles the cell can still deliver 65 percent of its capacity at over 1.7 V as a series of 2-amp pulses with a 150-msec duration. At lower currents, almost 100 percent of the cell's capacity can be delivered at >2 V.

Applications: These cells can be used as AA cells or assembled into 9 V prismatic cells for use in portable computers, portable telephones, portable sensing equipment, flashlights, hand-held tools, and camcorders. One cell can keep 2 V memory circuity working.

Contact: Dennis N. Crouse
617-769-9450

Related SBIR Contracts:
NAS7-1100 JPL PY 1988 Topic 10
"Long-Cycle-Life, Rechargeable Lithium Batteries"

Q.07

STAR™ Reciprocating Alternator/Motor

Firm: **Clever Fellows Innovation Consortium, Inc.**

The STAR™ reciprocating alternator/motor is a compact, inexpensive device that converts ac electricity into reciprocating motion (motor) or vice versa (alternator) without any rotating parts or

bearings to wear out, giving the product an effectively unlimited service life.

Applications: Output convertor for solar-electric generators (has been sold), and drive motor for impact tools (electric jackhammer).

Contact: John Corey
518-272-3565

Related SBIR Contracts:
NAS3-26603 LeRC PY 1990 Topic 10
"A Robust, Manufacturable Alternator and Suspension for Free-Piston Stirling Engines"

Q.08

Ultra-Lightweight, All-Metal Mirror Facet for a Solar-Dynamic Power System

Firm: **Solar Kinetics, Inc.**

Solar Kinetics has developed a scaled parabolic mirror facet for a 2-meter solar-dynamic concentrating power system. This mirror has an all-metal honeycomb construction with a specific weight of 1.8 kg/m^2. The specular reflectivity has an rms value greater than 85 percent within a 4-milliradian cone angle of 632 nm. The optical surface performance is achieved by application of leveling, reflective, and protective coats. A surface-slope accuracy of better than 1 milliradian is achieved. Currently, a 1-meter, triangular mirror facet is being developed for the Space Station program.

Applications: Terrestrial and space reflectors and concentrators for solar dynamic power generation and lightweight antenna dishes.

Contact: Shabbar Saifee
214-556-2376

Related SBIR Contracts:
NAS3-25632 LeRC PY 1987 Topic 10
"Improved Mirror Facet for Space Applications"

R: Oceanographic Instruments

R.01

AOCI (Airborne Ocean Color Image)

Firm: **Daedalus Enterprises, Inc.**

This airborne imaging spectrometer is interchangeable with other spectrometers that use a Daedalus Model AB122 scan head and electronics package.

Applications: The AOCI has been developed to study biomass, chlorophyll content, and temperature, especially in offshore waters. It has been observed that the most probable location of large schools of fish can be determined when the physical properties of the waters can be defined.

Contact: Keith A. More
313-769-5649

Related SBIR Contracts:
NAS2-12116 ARC PY 1983 Topic 08
"Airborne, Multispectral Scanner to Measure Ocean Biomass"

R.02

MER-2020 Oceanographic Instrument

Firm: **Biospherical Instruments, Inc.**

BSI's MER-2020 represents a new type of oceanographic instrument allowing unattended monitoring of biological and optical variables over periods of up to several months. This instrument, ideal for installation on moorings or drifters, allows long-term monitoring of bio-optical variability in oceanic environments. The system features five channels of downwelling irradiance, five channels of upwelling radiance, temperature, two-axis tilt and roll, pressure (depth), battery voltage, and date/time. The MER-2020 can also be equipped with optical detectors to measure natural fluorescence, the solar-stimulated fluorescence of chlorophyll used to predict instantaneous, gross primary production in phytoplankton. Extensive data storage permits translates to over 100,000 complete sensor scans with full statistics: for example, an observation set every two minutes for 150 days. In addition to direct optical measurements at a variety of wavelengths, the MER-2020 provides measurements of spectral radiance (optionally, irradiance), reflectance, and when used in tandem, spectral-diffuse attenuation coefficient.

Applications: Oceanographic and biological research, including remote-sensing programs such as satellite ocean-color ground truth, long-term monitoring of optical and bio-optical variability, and studies using bio-optical moorings or drifters.

Contact: John H. Morrow
619-270-1315

Related SBIR Contracts:
NAS7-934 JPL PY 1983 Topic 08
"Moored Oceanographic Spectroradiometer"

R.03

PNF-300 Profiling Natural Fluorometer

Firm: **Biospherical Instruments, Inc.**

Natural fluorescence is the solar-stimulated fluorescence of chlorophyll-a in the phytoplankton crop, and is easily measurable throughout the euphotic zone even in the most oligotrophic waters. The PNF-300 uses this newly identified optical signal to measure both growth photosynthetic rate and chlorophyll-a concentration within the water column. Using the latest advances in integrated circuits and optical design, this compact instrument measures a wide variety of physical and biological variables: natural fluorescence (upwelled radiance at 683 nm), scalar irradiance (photosynthetically active radiation or PAR), computed primary production and chlorophyll-a concentration, temperature, and pressure/depth. The instrument is self-contained and compact enough to be deployed by hand from vessels as small as skiffs and inflatables.

Applications: Typical applications include oceanographic and biological research, as well as water quality monitoring. In addition to its profiling capabilities, the PNF-300 can be used when the time series of PAR and natural fluorescence is desired, such as to support measurements of photosynthesis using oxygen evolution or ^{14}C incorporation.

Contact: John H. Morrow
619-270-1315

Related SBIR Contracts:
NAS7-969 JPL PY 1984 Topic 08
"Measurement of Chlorophyll, Related Pigments, and Productivity of the Sea"

S: Atmospheric Sciences

S.01

200 MHz Surface Acoustic Wave Aerosol Particle and Chemical Vapor Sensor

Firm: **Femtometrics**

The piezoelectric-crystal, mass microbalance acts as a microgravimetric sensor as small changes in the mass on the surface of the crystal detune its oscillation. The change in frequency is proportional to the change in mass. The mass sensitivity is a function of the square of the operating frequency. Small increases in operating frequency give large increases in sensitivity. A 10 MHz bulk crystal has a mass sensitivity of 1.5 Hz/nanogram. Femtometrics has developed a 200 MHz surface acoustic-wave (SAW), piezoelectric, mass microbalance with a mass sensitivity of 1 Hz/picogram.

Applications: The SAW microbalance can be used in most applications where conventional bulk crystals are used. This includes the collection and mass determination of aerosols on its surface. Coating the SAW microbalance with a selective chemical allows detection of gas vapor.

Contact: W. D. Bowers
714-722-6239

Related SBIR Contracts:
NAS1-18653 LaRC PY 1986 Topic 08
"High-Sensitivity Particle and Gas Instrument Using the Acoustic-Wave Piezoelectric Crystal"

S.02

A Non-Optical, Real-Time Particle Fallout Monitor

Firm: **Femtometrics**

A vertical elutriator is used to reject fallout particles smaller than a specified size, and a quartz crystal piezoelectric microbalance is used to collect and detect the size segregated fallout. The instrument operates in real time with the change in frequency proportional to the mass of the particle.

Applications: The real-time particle fallout monitor can be used in the aerospace industry to monitor the size and number of particles falling on a payload's surface prior to launch. Other uses include the monitoring of specific size bands of particles for health and safety reasons in industrial manufacturing.

Contact: W. D. Bowers
714-722-6239

Related SBIR Contracts:
NAS10-11651 KSC PY 1989 Topic 13
"A Real-Time Particle Fallout Monitor"

S.03

Advance Warning Airborne System

Firm: **Turbulence Prediction Systems**

The Advance Warning Airborne System (AWAS) is a passive infrared spectrometer that provides a 20-60 second warning of low-altitude wind shear and a 4-6 minute warning of high altitude clear air turbulence (CAT). The AWAS weighs approximately 9 pounds and is 6" x 7" x 9". The system uses 28VDC @ 1.0 Amp.

Applications: Advance detection of low-altitude wind shear and CAT. It may also be used for detection of volcanic Ash and wake vortices. It may also be utilized as a sensor for temperature and humidity and other scientific applications.

Contact: H. Patrick Adamson
303-443-8157

Related SBIR Contracts:
NAS1-18854 LaRC PY 1987 Topic 03
"Airborne Advance Warning of Air Turbulence"

S.04
Atmospheric Trace Gas Fluxmeter
Firm: **Aerodyne Research, Inc.**
This instrument is designed to measure the production rates or surface fluxes of atmospheric trace gases such as methane and nitrous oxide, in order to characterize their sources and sinks. The method is based on the eddy correlation technique and uses a tunable diode laser-infrared light source combined with a unique open-path multiple-pass absorption cell for trace gas detection at the sub-ppb level.

Applications: Atmospheric chemistry research in biogenic trace gas flux measurements such as methane (CH_4) and nitrous oxide (N_2O); agricultural research; global-warming greenhouse gas research; tropospheric chemistry research.

Contact: Mark S. Zahniser
508-663-9500

Related SBIR Contracts:
NAS2-12433 ARC PY 1984 Topic 12
"An Open-Path-Diode-Laser Flux Meter for Trace Gases of Biogenic Origin"

S.05
Cloud Top Radiometer
Firm: **Space Instruments, Inc.**
The Cloud Top Radiometer (CTR) is a passive instrument that can measure cloud-top altitudes continuously from a single geostationary platform at a sufficiently high repetition rate to continuously watch for severe storms. The CTR utilizes the oxygen A-band technique with several different absorption channels to optimize performance. The CTR design eliminates scanning and complex cryogenic systems by use of an uncooled silicon CCD area-array camera. The staring array allows a long integration time, which produces a high SNR even at geostationary altitude. By operating in the visible region, the altitude measurements are independent of temperature and emissivity variations within the cloud. A linear dynamic range much larger than that possible within the CCD wells is obtained by means of a digital accumulator to cover all possible cloud and atmospheric conditions. A filter wheel allows a single detector array to make measurements at all wavelengths, thus assuring excellent calibration between wavelength measurements.

Applications: Prior to the outbreak of many severe thunderstorms, overshooting cloud tops rise at a very rapid rate. The vertical updraft rate of the cloud tops can therefore be used as an indicator of potential severe storms and tornadoes. Lead times of 14 minutes for storms and 25 minutes for tornadoes have been measured.

Contact: James W. Hoffman
619-944-7001

Related SBIR Contracts:
NAS5-30846 GSFC PY 1989 Topic 08
"Cloud Top Radiometer"

S.06
Conductive Polymer Hydrazine Sensor
Firm: **Spectral Sciences, Inc.**
COPES is a highly accurate sensor that can reproducibly detect hydrazine and monomethylhydrazine in the 1-100 ppb concentration range in either air or hard vacuum. It makes use of Spectral Sciences' proprietary technology for producing a very thin conductive polymer film doped in such a way that its conductivity is very sensitive to the presence of hydrazine. The active polymer sensing element is small in size and can be attached to clothing or devices. It responds within seconds to changes in concentration and is ideally suited to a number of applications including: real time or dosimetric monitoring of hydrazines in vacuum or ambient conditions, and monitoring the desorption of hydrazines from surfaces of vacuum chambers or equipment exposed to these fuels. The doped polymer system is quite stable and has an extended shelf life it maintained in a dry, frozen condition. The sensing elements are inexpensive and show good reliability. Their properties can be adjusted by varying thickness and dopant concentrations.

Applications: Detection of hydrazines in vacuum and atmosphere. Also can be modified to detect other chemicals containing the NH_2 - group, including amines, aniline, and ammonia.

Contact: Mitchell Zakin
617-273-4770

Related SBIR Contracts:
NAS9-18359 JSC PY 1988 Topic 13
"Conductive Organic Polymer Environmental Sensor"

S.07

Hydrogen Laser Monitoring System

Firm: **Spectral Sciences, Inc.**

The Hydrogen Laser Monitoring System (HLMS) is a new optical hydrogen sensor based on Raman scattering of laser light. Spectral Sciences has designed, built, and delivered to NASA a system intended for rugged field use. Compared to complex mass spectrometers, the system is simpler and less costly although comparably sensitive. It is more sensitive and faster in response than catalytic combustion sensors and its calibration is independent of the background gas. Its sensitivity is better than 100 ppm with a response time of 2 seconds or less thanks to highly efficient excitation and light collecting systems. The use of a commercial, air-cooled CW laser helps to simplify the sensor, which is packaged with a sampling system, in a self-contained cabinet measuring 5' x 2' x 1.5'.

Applications: Leak detection for hydrogen fuels and monitoring hydrogen in process streams.

Contact: Steven Adler-Golden
617-273-4770

Related SBIR Contracts:
NAS10-11514 KSC PY 1986 Topic 13
"Hydrogen Laser Monitoring System"

S.08

Pilot Weather Advisor

Firm: **ViGYAN Research Associates, Inc.**

The Pilot Weather Advisor processes weather and radar information from commercial vendors in real time. The processed information is then broadcast via satellite to aircraft. When received by the aircraft, the information is decoded and graphically displayed on a color display for the pilot's use.

Applications: Real-time weather/radar for aviation use; for on-the-ground preflight briefing and inflight weather monitoring.

Contact: Shashi Seth
804-865-6575

Related SBIR Contracts:
NAS1-19595 LaRC PY 1990 Topic 03
"Pilot Weather Advisor"

S.09

RSI 920 Radiometer

Firm: **Space Instruments, Inc.**

This product is an absolute measuring radiometer for calibrating blackbodies, solar simulators, and other sources from 0-to-2 solar constants in amplitude.

Applications: Space chambers, calibration labs.

Contact: James W. Hoffman
619-944-7001

Related SBIR Contracts:
NAS5-30090 GSFC PY 1985 Topic 08
"Nonscanning Climate Sensor"

S.10

Space Particulate Imaging Measurement

Firm: **SKW Corporation**

The Space Particulate Imaging Measurement Sensor (SPIMS) system provides low-cost, real-time data on the ambient particulate contamination present in space, vacuum, or ambient environments. In addition, the SPIMS sensor is also suited for in-process measurement of cross-section or diameter with an accuracy of ± 5 microns. Each sensor or laser imager module (LIM) can operate independently or be tied to a data server or command data handler (CDH). Each LIM detects, images, and sizes the particles present in a free-space detection zone. The sizes are "binned" with a total measurement range of less than 5 microns to over 1000 microns. The system uses a 670 nm laser-diode illumination source and a linear CCD array. A "bar" filter is used for obscuring the laser beam and generating a background against which particles are measured and detected. Real-time image processing is done within the LIM to provide particle measurements as a serial data stream. The data from the SPIMS system can be adapted to the user's choice of data bus/storage or display device.

Applications: SPIMS can be used in any environment: microgravity, vacuum, or ambient where the continuous monitoring of particulates is required in a gas flow or in static applications.

Contact: Scott Bartel
714-361-5660

Related SBIR Contracts:
NAS5-30636 GSFC PY 1987 Topic 08
"Free Space Particulate Contamination Sizing and Counting System"

S.11

Thermally Regenerable Airborne Trace Organic Contaminant Control Cartridge

Firm: **Umpqua Research Company**

Multi-media layered adsorbent beds have been developed as an effective means of removal of mixtures of toxic or odor-causing organic molecules from spacecraft air streams. The adsorbent beds are regenerated in situ by thermal desorption of the adsorbed vapors. Advantages over use of activated charcoal adsorption include enhanced contaminant removal efficiency in humid air, significantly reduced hardware volume, minimization of resupply expendables, reduction of manhours required for system maintenance, and more effective removal of a wider variety of contaminants.

Applications: This technology can be used to solve industrial and commercial airborne contaminant control problems, ranging from purification of gaseous effluent streams to remediation of "sick building" syndrome.

Contact: James E. Atwater
503-863-7770

Related SBIR Contracts:
NAS9-18337 JSC PY 1989 Topic 12
"Thermally Desorbable Toxin and Odor Control Cartridge"

S.12

Trace Atmospheric Carbon Monoxide Sensor (TACOS)

Firm: **Spectral Sciences, Inc.**

The Trace Atmospheric Carbon Monoxide Sensor (TACOS) uses a species-specific technique for detecting low concentrations of carbon monoxide in air. Using Spectral Sciences patented line lamp technology, a chamber filled with pure CO is energized to create a source of infrared radiation unique to that gas. Light from this source is passed through gas filters, then through a test chamber, which is continually sampling the atmosphere in question. Attenuation on the beam in its 6 m pathlength indicates absorption by CO in the sample stream. The device has onboard digital processing using SSI-developed software to convert the degree of beam attenuation to CO concentration in the sample stream. The CO concentration can be displayed on the built-in LCD panel or directed through a serial interface to a PC for long-term data acquisition and processing. The system, which is fully contained in a 10" x 8" box, can detect CO concentrations down to 1 ppm within ±5 percent.

Applications: CO monitoring in space vehicles (NASA contract); CO monitoring in other closed-environment vehicles: submarines, aircraft, environmental chambers, etc.; combustion detectors; and process stream analyzers.

Contact: Steven Richtsmeier
617-273-4770

Related SBIR Contracts:
NAS8-38491 MSFC PY 1988 Topic 08
"Trace Atmospheric Carbon-Monoxide Sensor"

S.13

VaporSep Systems

Firm: **Membrane Technology & Research, Inc.**

VaporSep systems--developed as a result of SBIR-funded projects from NASA, DOE, and EPA--remove 90-99 percent of organic vapor from an air stream. The vapor-laden air stream is introduced into an array of membrane modules. The membrane material is permeable to organic vapors, and relatively impermeable to air. After permeation, the organic vapor is condensed and removed as a liquid. The purified airstream is removed as the residue. Transport through the membranes is induced by maintaining the vapor pressure on the permeate side of the membrane lower than the vapor pressure on the feed side of the membrane.

Applications: Treatment of air streams containing 0.05-20 percent volatile organic compounds (VOCs), such as chlorinated hydrocarbons, for emissions control and VOC recovery.

Contact: Vicki Simmons
415-328-2228

Related SBIR Contracts:
NAS10-11405 KSC PY 1985 Topic 13
"A Membrane Process for Scrubbing Propellant Vapors"

S.14

Wildfire

Firm: **Daedalus Enterprises, Inc.**

This airborne infrared imaging spectrometer is interchangeable with other spectrometers that use the Daedalus AB122 scan head and electronics package.

Applications: Wildfire was developed for the study of the gases evolved, the nutrient transport, and the thermal profile of wildfires. Wildfire, an infrared imaging spectrometer, can also be applied to geologic and environmental studies.

Contact: William T. Baker
313-769-5649

Related SBIR Contracts:
NAS2-13036 ARC PY 1986 Topic 08
"Airborne Multispectral Scanner to Measure Characteristics of Fire"

T: Water Management

T.01

Catalytic Oxidizer for Removal of Aqueous Organic Contaminants

Firm: **Umpqua Research Company**

This process is used to oxidize a wide variety of organics including alcohols, amides, amines, ketones, halocarbons, and aromatics in an aqueous stream to their constituent gases and/or inorganic species. The system operates at low temperature (75 to 150 C) under sufficient pressure to prevent a phase change. The oxidant of choice is molecular oxygen introduced into the aqueous stream via a membrane saturator. The saturated aqueous stream is then fed into a plug-flow catalytic reactor maintained at the desired temperature. The product gases are removed downstream by a membrane gas/liquid separator. Using this technology, moderately contaminated streams containing 15 to 40 milligrams/liter of total organic carbon (TOC) can be purified to below 250 microgram/liter in a single pass. Recirculation for multiple passes permits similar reductions in much high TOC streams. When low TOC influent streams (i.e. TOC < 1 milligram/liter) are similarly processed, the aqueous stream's TOC can be reduced to below the 50 ppb detection limit of our analyzer.

Applications: Organic contaminant removal for water purification; ultrapure water production.

Contact: James R. Akse
503-863-7770

Related SBIR Contracts:
NAS8-38490 MSFC PY 1988 Topic 12
"Catalytic Methods Using Molecular Oxygen Treatment of PMMS and ECLSS Waste Streams"

T.02

Electrochemical Water Purification System

Firm: **Umpqua Research Company**

The electrochemical water recovery (EWR) technology utilizes three sequential processes to produce potable water from a variety of waste streams. Initially the organic contaminants are electro-oxidized to form oxidized gaseous species and organic acids. The remaining ionized organic and inorganic species are subsequently removed during the electrodialysis step. Waste streams such as urine, laundry, and hygiene water either singly or in combination have been treated in this fashion. The resulting water after the first two steps is sterile and contains only 30 to 50 mg/liter of total organic carbon (TOC). The third step in the production of potable water is the catalytic oxidation at moderate temperatures (125 to 150 C) and pressures (30 to 80 psi) of the remaining organics. In this way, the final TOC is reduced to below 500 ppb meaning that greater than 99.9 percent of the organic contaminants have been removed. The product water is sterile and can be made gas-free by the use of a membrane gas/liquid separator.

Applications: EWR technology provides a convenient treatment method which can sterilize such effluents as wastes from pleasure craft and commercial vessels, reduce their organic loads to less than 100 mg/liter, and decrease the residual that must be stored to 10 percent of the original volume.

Contact: James R. Akse
503-863-7770

Related SBIR Contracts:
NAS9-18528 JSC PY 1989 Topic 12
"Electrochemical Water Recovery Process for Direct Removal of Impurities"

T.03

Enzyme-Based Heterogeneous Oxidation Catalyst

Firm: **Umpqua Research Company**

An immobilized alcohol oxidase enzyme-based catalyst has been developed that displays very-long-duration operational activity compared to the free enzyme. Fixed bed reactors incorporating the catalyst have been designed and used for oxidation and subsequent removal of a variety of alcohols, glycols, and aldehydes from aqueous streams. The catalyst operates at ambient temperature and requires no energy. The catalyst is stable; virtually no secondary contamination of the water stream is observed. The catalyst and catalyst cartridges can be delivered sterile.

Applications: Production of aldehydes from alcohols, alcohol removal, analysis of alcohols and/or aldehydes in biological or process samples.

Contact: Clifford D. Jolly
503-863-7770

Related SBIR Contracts:
NAS8-38421 MSFC PY 1987 Topic 12
"Bio-Catalytic Reactors for Removal of Volatile Contaminants"

T.04
Flow-Through Device for Acid Gas Removal from Aqueous Solution

Firm: **Umpqua Research Company**

The product removes acid gases and their hydrolysis products from aqueous solution. It is a flow-through device consisting of a solid-phase, fixed bed acidification module integrated with a membrane gas/liquid separator in the hollow fiber, flat sheet or spiral wound configuration. The acidification module imparts a known level of acidity to a process stream, For example, a solution containing bicarbonates and/or carbonates is passed through the acidification module, converting all inorganic carbon species to dissolved CO_2 which is subsequently removed by the membrane separator.

Applications: Inorganic carbon removal from aqueous solution, removal of SO_2, NO_x and their hydrolysis products, controlled acidification of process steams or batch reactions without requiring chemical feed pumps and tanks.

Contact: Clifford D. Jolly
503-863-7770

Related SBIR Contracts:
NAS8-38460 MSFC PY 1989 Topic 12
"A Reagentless Separator for Removal of Inorganic Carbon from Solution"

T.05
Immobilized Enzyme Catalysts

Firm: **Umpqua Research Company**

A process has been developed that will immobilize enzymes onto a silica substrate for use as a heterogenous catalyst at ambient temperature. The advantage of this system is that it does not require separation of the reaction products from the enzymes. Fixed bed reactors have been prepared with urease and alcohol oxidase enzymes. These reactor beds have catalyzed the hydrolysis of urea to ammonia and the oxidation of ethanol to acetic acid respectively in a wastewater purification application over several months of continuous operation. The enzyme catalysts can be supplied as a cartridge or incorporated into a fixed bed reactor.

Applications: Wastewater treatment, organic chemical transformations, enzymatic degradations, bio-reactors.

Contact: Leonard J. Schussel
503-863-7770

Related SBIR Contracts:
NAS8-38421 MFSC PY 1987 Topic 12
"Bio-Catalytic Reactors for Removal of Volatile Contaminants"

T.06
Membrane-Based Wash-Water Recovery Unit

Firm: **Bend Research, Inc.**

The Membrane-Based Wash-Water Recovery Unit is a two-stage system utilizing fouling-resistant, ultrafiltration modules in the first stage to remove macromolecules (e.g., soap) and suspended solids, and a spiral-wound RO module in the second stage to remove low-molecular-weight species (e.g., organics, salts). The unit is designed to recycle at least 90 percent of the wash water, producing recovered water suitable for reuse as wash water.

Applications: Commercial applications for the unit include the recycle and reuse of laundry waste water, car-wash waste water, and dishwasher waste water.

Contact: Scott B. McCray
503-382-4100

Related SBIR Contracts:
NAS9-17306 JSC PY 1983 Topic 12
"Novel Reverse-Osmosis Module for Spacecraft Wash-Water Recycle"

T.07
Process-Control Water Quality Monitor

Firm: **Astro International Corporation**

The product is a new instrument for continuous on-line measurement for total organic carbon, biocide, pH, conductivity and turbidity of the quality of effluent process water.

Applications: Water quality analysis for waste water and in-process monitoring.

Contact: Robert Ashcraft
612-784-4995

Related SBIR Contracts:
NAS9-17612 JSC PY 1984 Topic 12
"Reagentless Water Quality Monitor (Organic Content)"

T.08

Regenerable Microbial Check Valve

Firm: **Umpqua Research Company**

A self-contained fully automated system has been developed for the controlled delivery of molecular iodine to a flowing water stream for use in the prevention of microbial growth. The system uses an iodinated polymer to impart a nominal 2 mg/l I_2 to the aqueous medium by equilibrium partitioning. Upon depletion, the polymer is re-iodinated in situ without interruption of flow. Advantages of the system include minimization of human interaction required for operation, minimization of system maintenance needs, and dramatic reduction in required resupply expendables.

Applications: This technology can be applied to the treatment of potable waters for prevention of growth of pathogenic microorganisms. The system can also be used with industrial aqueous process streams as a means for the prevention of biofouling.

Contact: James E. Atwater
503-863-7770

Related SBIR Contracts:
NAS9-18361 JSC PY 1988 Topic 12
"Regenerable Biocide Delivery Unit"

U: Life Science Instruments

U.01

Calorimeter and Waste Management System

Firm: **Geoscience Limited**

A direct animal calorimeter system to monitor metabolic heat releases from animals in space has been designed, fabricated, and tested in the laboratory and during KC-135 parabolic, zero-gravity flights. The system does not require the monitoring of $C0_2$, 0_2 and water vapor concentrations and their flow rates. The direct calorimeter measures all the radiant energy lost by the animal as well as part of its convective heat loss. Mini-psychrometers measure the remaining convective heat loss from the animal in addition to the total evaporative heat loss. A flowmeter determines the ventilating air-flow rate through the calorimeter. Geoscience has also developed a special waste removal and storage system. It consists of a high velocity air blower, inlet and outlet air valves that are actuated by controlled motors, and a waste separation and storage system for the feces and urine.

Applications: This system can be used to obtain metabolic heat releases (and the radiative, evaporative, and convective components) during space missions. The current complete calorimeter system has been designed to fit into a double, mid-deck locker on the Shuttle.

Contact: Heinz F. Poppendiek
619-755-9396

Related SBIR Contracts:
NAS2-12638 ARC PY 1985 Topic 12
"A Direct, Metabolic Calorimetry System for Orbital Laboratories"
NAS9-18095 JSC PY 1988 Topic 12
"A Whole-Body Calorimeter for Space Station Astronauts"

U.02

DELTA™

Firm: **Essex Corporation**

DELTA is an inexpensive and easy-to-use computer-based software system that measures small changes in a person's cognitive, psychomotor and perceptual performance using easily learned psychological tests. Once a person has established a normal level of performance, DELTA only needs minutes to administer and translate a measurement into meaningful information . In the workplace DELTA can be used to inexpensively screen for employees who might perform unsafely due to changes in their normal ability. In the research environment, DELTA can be used to measure the side-effects of drugs, environmental stressors such as fatigue and stress, or the cognitive effect of treatments.

Applications: In the commercial workplace DELTA can be used as a screening device to lower or eliminate other costly and invasive techniques to detect employee impairment. In the research environment DELTA can be used to conduct very objective measurements of cognitive change.

Contact: David A. Parry
410-730-1097

Related SBIR Contracts:
NAS9-17326 JSC PY 1990 Topic 12
"A Micro-Computer-Based Mental Acuity Tests for Repeated-Measures Studies"

U.03

Fiber-Optic pH Optrode and Electronics Interface

Firm: **Geo Centers, Inc.**

The product consists of a ph optrode (fiber-optic chemical sensor) and its support electronics. This system offers small sensor size, electromagnetic interference immunity, and less interference from the effects of solution flow and conductivity.

Applications: The pH measurement system has been designed to support NASA plant-growth experiments. When interfaced with NASA control systems, this measurement system becomes part of a system to actively control nutrient-solution pH. It will also find use in other agricultural applications, environmental monitoring, and controlling a variety of chemical and industrial processes.

Contact: Bruce N. Nelson
617-964-7070

Related SBIR Contracts:
NAS10-11671 KSC PY 1988 Topic 12
"Optrode Development for Environment pH Monitoring"

U.04

$Flur0_2$

Firm: **Biochem Technology, Inc.**

$Flur0_2$ emulsions are disposable, stabilized emulsions used as an additive for culture media. The advantages are twofold: (1) Enhanced oxygen supply - The PFC particles act as oxygen suppliers to surrounding cells grown in the aqueous phase. $Flur0_2$ Emulsions used as a media additive in a ratio of 10 percent by volume have dramatically increased the oxygen supply capacity of bioreactors. Results on hybridoma (ATTCCHB32) cultures in rotated cell culture tubes have increased maximum live cell density by approximately 80 percent. (2) Better cell suspension - Settling problems lead to uneven distribution and inefficient utilization of bioreactor capacity and/or other damage from cell accumulation on the bottom of the bioreactor. $Flur0_2$ emulsions, when mixed with culture media, can be matched to the density of cells and microcarriers to reduce the amount of agitation required to keep the cells in suspension.

Applications: Media supplement for cell culture.

Contact: William B. Armiger
215-768-9360

Related SBIR Contracts:
NAS9-17812 JSC PY 1985 Topic 15
"Use of Liquid Carriers in Tissue Culture for Aeration"

U.05

Ionizing Radiation Dosimetry System

Firm: **Radiation Monitoring Devices, Inc.**

The Ionizing Radiation Dosimetry System is a compact, self-contained dosimetry system for ionizing radiation. This system simultaneously monitors two or more types of radiation and covers a wide range of energies and dose rates. It is designed to operate unattended and with low power consumption while measuring, in real time, the individual dose from gamma rays, neutrons, high energy particles and electrons as well as the total dose received. The exposure is indicated on a digital display or can be read from the unit's RS-232 computer port.

Applications: High altitude flight, power plants, medical facilities, research laboratories.

Contact: Peter Waer
617-926-1167

Related SBIR Contracts:
NAS9-18515 JSC PY 1989 Topic 12
"Solid-State Neutron Dosimeter for Space Applications"

U.06

MRTA Model 1200

Firm: **Gait Scan, Inc.**

MRTA Model 1200 is a bone strength testing instrument that is portable, non-invasive, non-radiation-based, rapid, and quantitative.

Applications: Monitoring the effects of exercise, space flight, diet, medication, metabolic diseases and fracture healing on the function of long bones of the lower arms and legs.

Contact: Anthony Mauriello
201-652-8292

Related SBIR Contracts:
NAS2-13616 ARC PY 1990 Topic 12
"Non-Invasive Bone Strength Measurement by a Mechanical-Response Tissue Analyzer"

U.07

Non-Invasive Hemodynamic Management System

Firm: **Bomed Medical Manufacturing**

BoMed's CDDP System provides real-time recognition of a patient's hemodynamic profile and simplifies therapeutic management. Using a completely non-invasive, beat-by-beat, operator independent technology, the BoMed CDDP System, combined with arterial blood pressure data, measures stroke index, cardia output/index and nine other parameters with the same clinical accuracy as thermodilution.

Applications: Non-invasive real-time management of inpatients and pacemaker patients, outpatients, and in sports medicine.

Contact: Hevka Sramek
714-770-5322

Related SBIR Contracts:
NAS9-17809 JSC PY 1985 Topic 12
"Continuous Non-Invasive Determination of Ventricular Parameters"

U.08

Variable-Speed Mid-Deck Centrifuge

Firm: **Micro-G Research, Inc.**

The variable speed mid-deck centrifuge is, as its name suggests, a prototype for a flight unit designed to fit in the volume occupied by two shuttle middeck lockers. It is a twin-rotor centrifuge device capable of providing programmable g-force stimuli within the range 0.05 to 1.1 g to biological and other specimens. Specimens can be recorded by infrared-sensitive video cameras during rotation. The image data is compressed and stored on floppy disks for later analysis. The rotor compartment is temperature controlled to ± 0.4°C. Slip ring connections are provided for power, data, and signal lines.

Applications: Research tool for biologists and physical scientists conducting research over a range of g-levels from zero to a value somewhat above earth's gravity.

Contact: David K. Chapman
215-387-9339

Related SBIR Contracts:
NAS10-11404 KSC PY 1985 Topic 12
"Variable Speed, Mid-Deck Centrifuge"

V: Spacecraft Electromechanical Systems

V.01

Active Magnetic Micro-Gravity Isolator for Space Station

Firm: **Satcon Technology Corporation**

This product is a vibration isolation system used to isolate the experimental payloads from inherent Space Station vibrations. The vibration requirements are met by an active isolation system that has the capability to adjust to differing vibration environments, changes in payloads, and changes in desired isolator dynamics. This magnetic suspensions is an extremely promising approach to implementing these active isolation systems. Its desirable characteristics include high bandwidth, linearity, stability, high efficiency, multi-axis capability, and ease of integration with electronic control systems.

Applications: Semiconductor crystal growing isolation, pharmaceutical culture isolation, optical isolation and pointing.

Contact: Ralph C. Fenn
617-661-0540

Related SBIR Contracts:
NAS8-38418 MSFC PY 1987 Topic 15
"Active Magnetic Micro-Gravity Isolator for Space Station"

V.02

An Integrated Micro-Gyroscope

Firm: **Satcon Technology Corporation**

This micro-mechanical gyroscope is a device consisting of an electrically suspended, spinning rotor and integrated control and interface electronics. It provides linear and angular rate measurements in a small, low-power package.

Applications: The devices could be produced for low cost in large quantities and could see widespread use in integrated navigation and control systems for vehicles, personnel, or projectiles. A micro-gyroscope might also make possible very small autonomous airplanes, ground vehicles, or satellites for terrestrial, planetary, or space exploration.

Contact: Richard L. Hockney
617-661-0540

Related SBIR Contracts:
NAS1-19282 LaRC PY 1990 Topic 05
"An Integrated Micro-Gyroscope"

V.03
Inertial Linear Actuator
Firm: **Applied Technology Associates, Inc.**
Scheduled to be available in the 1990s, digital active materials processing platform effort (DAMPER) will culminate in a spaceborne active-isolation stabilization system suitable for materials processing. It will be hosted on a vehicle such as the Space Shuttle or Space Station and will isolate experiments from unwanted vibrations caused by the host vehicle and other low-level disturbances. The stabilized materials-processing platform resulting from this effort will be of commercial value to organizations wishing to exploit the micro-G environment of space. DAMPER has been successfully demonstrated in the laboratory through 3 degrees-of-freedom. The primary innovation of the inertial isolator configuration and design are the ATA-developed actuators that do not transmit reaction forces to external structures.

Applications: Development and manufacture of alloys, crystals, and polymers; manufacture of very large scale integration microelectronic components; performance of optical processes (e.g., strap-on vibration damper to be attached to optical benches and microscope stands; use in active and semi-active suspension systems; and use as a source of vibration excitation for modal testing of structures.

Contact: John Blackburn
505-247-8371

Related SBIR Contracts:
NAS3-25806 LeRC PY 1987 Topic 15
"Digital Active Materials Processing Platform Effort"

V.04
Integrated Power/Attitude Control Flywheels
Firm: **Satcon Technology Corporation**
This product uses a pair of high-speed carbon-fiber composite flywheels for energy storage and attitude control of spacecraft. The system incorporates magnetic bearing and a permanent magnet motor/generator in a low loss, high efficiency design. The product can also be used solely as an energy storage and/or pulse power supply. The energy densities targeted are 40 Whrs/kg.

Applications: Energy storage, pulse power systems, attitude control of spacecraft.

Contact: Vijay Gondhalekar
617-661-0540

Related SBIR Contracts:
NAS8-38461 MSFC PY 1989 Topic 10
"Integrated Power and Attitude Control Systems for the Space Station and Other Applications"

V.05
Low Vibration Momentum Wheel
Firm: **Satcon Technology Corporation**
This momentum wheel is aimed for the increasingly vibration-sensitive environment of modern satellites. This product incorporates magnetic bearings and a controller in a momentum wheel. The vibration specifications of this momentum wheel are an order of magnitude lower than a classical momentum wheel designed around mechanical bearings. The controller is designed to adaptively compensate for changes in mass imbalance of the rotating wheel, thus ensuring a consistent low-vibration performance over its lifetime.

Applications: Attitude control of spacecraft.

Contact: Vijay Gondhalekar
617-661-0540

Related SBIR Contracts:
NAS5-31397 GSFC PY 1990 Topic 05
"Magnetic Bearings to Remove Stiction and Reduce Vibrations in Momentum Wheels"

V.06
Magnetostrictive Active Members
Firm: **Satcon Technology Corporation**
These products are state-of-the-art actuators fabricated from the magnetostrictive material Terfenol-D for actively controlling truss-member motion (elastic vibration) to the submicron level in space structures. Room temperature and cryogenic designs are available, both of which produce more stroke and clamped force than do existing electrostrictive and piezoelectric designs. SatCon's actuators do not require high voltage to operate efficiently, and they perform well at cryogenic temperatures. The cryogenic active member includes a cryostat that allows operation in a space structure testbed.

Applications: In addition to numerous space applications, this assembly has manufacturing and industrial applications where extremely precise position and low vibration are required.

Contact: Richard L. Hockney
617-661-0540

Related SBIR Contracts:
NAS7-1151 JPL PY 1989 Topic 04
"Magnetostrictive, Active-Member Control of Space Structures"

V.07
Metal-Coated Kevlar Tether
Firm: **Fiber Materials, Inc.**
The tether is a Kevlar cable system which is jacketed to hold the fibers together. To make the tether electrically conductive, the Kevlar filaments are metal-coated so that an electrical conductive wire is not needed. The metal-coated Kevlar is extremely flexible and has an electrical resistance of around 0.5 ohm per foot.

Applications: The tether is used to support satellites in space; metal coated fiber/fabric can also be used for EMI/RFI shielding, to reflect heat, etc.

Contact: Ralph F. Orban
614-272-5785

Related SBIR Contracts:
NAS8-37256 MSFC PY 1984 Topic 09
"Metallized-Kevlar Space Tether System"

V.08
Superconducting Large-Angle Magnetic Suspension
Firm: **Satcon Technology Corporation**
This product is an advanced control moment gyro (CMG) type of momentum-exchange actuator sized for large spacecraft slew maneuvers. The key component of the CMG is a magnetic suspension system which combines the functions of conventional rotor bearings and mechanical gimbals. This product meets the needs of a demanding slew maneuver by incorporating a superconducting magnet. This product consists of a superconducting solenoid ("source coil") suspended within an array of non-superconducting coils ("control coils"), a five-degree-of-freedom position sensing system, switching power amplifiers, and a digital system.

Applications: Mirror pointing mount, telescope pointing mount, advanced control moment gyroscope (CMG), solar array gimbal, antenna gimbal.

Contact: James R. Downer
617-661-0540

Related SBIR Contracts:
NAS1-18853 LaRC PY 1987 Topic 09
"Superconducting Large-Angle Magnetic Suspension"

V.09
T-Reaction Wheel
Firm: **Ithaco, Inc.**
The momentum and reaction wheel contains an aluminum flywheel suspended on ball bearings and driven by an ironless-armature, brushless DC motor. Optimum power efficiency and maximum inertia-to-weight are realized with the large diameter motor components. The symmetrical housing provides dual mounting surfaces to allow the addition of the T-SCANWHEEL optics module and to expand mounting options on the spacecraft. Increased momentum capacity or redundancy can be obtained by bolting two assemblies together. The T-Reaction Wheel is unique because it can be used as a stand-alone momentum and reaction wheel or augmented with horizon-sensor optics to provide both attitude determination and angular momentum and control torque.

Applications: The T-Reaction Wheel is a fully capable momentum/bi-directional reaction wheel built specifically for small satellites. It is used for both three-axis reaction control and momentum-biased systems.

Contact: Richard G. Burton
607-272-7640

Related SBIR Contracts:
NAS5-30307 GSFC PY 1986 Topic 09
"Low-Cost, Attitude Control System"

V.10
T-SCANWHEEL
Firm: **Ithaco, Inc.**
The T-SCANWHEEL is a momentum and reaction wheel with an integral, high-accuracy, conical earth sensor. The scanwheel provides both angular momentum and control torque while the conical earth sensor obtains precise attitude information. T-SCANWHEELS are employed on either two- or three-axis stabilized spacecraft where their unique combination of attitude sensing and control capability reduces overall system cost, minimizes weight, and affords an order of magnitude reduction in power consumption.

Applications: A common application of the T-SCANWHEEL is to replace the earth sensor and the momentum and reaction wheel in a momentum-biased attitude control system. By aligning the T-SCANWHEEL spin axis with the

spacecraft pitch axis, gyroscopic stiffness in roll and yaw is provided. A simple, pitch-lead lag-loop controls the T-SCANWHEEL speed so that the spacecraft remains aimed at the earth.

Contact: Richard G. Burton
607-272-7640

Related SBIR Contracts:
NAS5-30088 GSFC PY 1985 Topic 09
"A Full Sky Scanner"

V.11

Video Monitoring System

Firm: **Applied Research, Inc.**

The video monitoring system is a low-powered, small-size, video digitizer, capable of acquiring and storing multiple video images in non-volatile memory. The system can be programmed to acquire the images at pre-set times or on command, and then transmit the compressed image's over a variety of communication interfaces.

Applications: Space flight hardware, remote monitoring and security systems, and environmental monitoring.

Contact: Scott Davis
205-922-8600

Related SBIR Contracts:
NAS8-38051 MSFC PY 1988 Topic 09
"Tethered Satellite Video Monitoring System"

PROSPECTIVE PRODUCTS

A: Computer and Communication Systems

A.11

Optical Ring Interconnect for Multiprocessors

Firm: **SCS Telecom, Inc.**

This novel optical ring interconnect (ORI) topology applies to digital multi-processor environments. The optical system is reconfigurable using rotationally invariant components and maintains identical latency for all elements and all channels. This system employs high-speed laser diodes and fast photodiode detectors and can operate at a rate greater than 500 MHz.

Applications: Interconnect processor for communication SIMD and computer architecture.

Contact: Gary Lomp
516-883-0760

Related SBIR Contracts:
NAS1-19589 LaRC PY 1990 Topic 07
"Novel Optical Interconnect Topologies for Digital Multiprocessors"

B: Information Processing and AI

B.19

DTS Scheduling Software

Firm: **Heuristicrats Research, Inc.**

DTS is designed to produce high utility solutions to over-subscribed project scheduling problems. It employs state-of-the-art probabilistic reasoning and decision-theoretic control technology to speed the search for efficient solutions to constraint-satisfaction problems.

Applications: DTS efforts are specifically targeted toward producing experiment scheduling systems for NASA's orbiting space telescopes.

Contact: Andrew Mayer
510-845-5810

Related SBIR Contracts:
NAS2-13340 ARC PY 1990 Topic 06
"Decision Theoretic Control of Artificial Intelligence Scheduling Systems"

B.20

I-Gate®

Firm: **I-Kinetics, Inc.**

Now PC/DOS Windows users can get personal access to important Unix data services whenever they need it, without re-keying and without relying on someone to run a report. The I-Gate enables MS Windows applications with these key features: direct access to Oracle or Sybase servers; data retrieved in background freeing the user to do other work; extended SQL support: stored procedures, aggregates and multiple selects; full DDE support for integration with other Windows applications; full Unix and TCP/IP networking support; I-Gate toolkit for accessing other Unix services: libraries and datafeeds.

Applications: System integration, database gateways, and telemetry feeds.

Contact: Bruce H. Cottman
617-661-8181

Related SBIR Contracts:
NAS9-18487 JSC PY 1990 Topic 05
"MetaAgents: A Framework for Intelligent Distributed Systems"

B.21

NetWorks!

Firm: **Symbiotics, Inc.**

NetWorks! is an innovative software tool that enables developers to connect programs across different languages, operating systems, and networked processors. NetWorks! uses object-oriented technology to conceal the complexities of networking protocols, hardware and software platform dependencies. This means that complex distributed systems can be constructed by developers that lack expertise in systems-level network programming and integration. Developers use NetWorks! to define objects called Agents for applications distributed across a computer network. Applications invoke Agents to pass messages to one another via simple calls to a high level Application Programming Interface (API). Message-passing is asynchronous (non-blocking) and fully peer-to-peer--a single Agent can act as both client and server for its application (i.e., both initiating and responding to requests). SOCIAL (see product #B.13) extends NetWorks! with a library of predefined Agent classes. With SOCIAL, developers integrate applications by making and customizing subclasses of library Agents. Agent

subclasses inherit generic behaviors for handling messages from library Agent superclasses. A developer customizes such subclasses by adding application-specific behavior, such as requesting particular pieces of information. SOCIAL Gateway Agents simplify the task of integrating programs implemented using DBMs, 4GLs, CASE tools, and AI shells. SOCIAL Manager Agents define distributed control models for coordinating activities of application Agents. For example, a Process-Planner Agent allow complex sequences of distributed interactions to be captured in high-level scripts, which can be executed with a single command. Together NetWorks and SOCIAL provide a high-level "building block" solution for distributed systems.

Applications: NASA is using NetWorks! and SOCIAL to integrate applications that detect, diagnose, and manage problems in the Space Shuttle and its launch processing system. A second project is connecting distributed tools for planning and scheduling Shuttle missions. Networks! and SOCIAL provide a generic development framework for distributed systems in concurrent engineering, office automation, decision support, process control, and operations support of computer or communication networks.

Contact: Richard M. Adler
617-876-3635

Related SBIR Contracts:
NAS10-11882 KSC PY 1990 Topic 06
"Integrating and Coordinating Intelligent Planning and Scheduling Tools"

B.22
NOISE Software
Firm: **Engineering Analysis, Inc.**
The NOISE software contains numerical procedures based on the principles of fractional calculus which allow for the generation of discrete time series with irrational spectral characteristics. The user can control the spectrum by simple changes to the input parameters.

Applications: Sonar, radar, infrared, and seismic data analysis.

Contact: Frank B. Tatom
205-533-9391

Related SBIR Contracts:
NAS8-38452 MSFC PY 1989 Topic 02
"The Application of Fractional Calculus to Noise Simulation"

B.23
TeamSchedule
Firm: **I-Kinetics, Inc.**
TeamSchedule™ is a complete environment for team-based interactive scheduling. Team Schedule supports "collaborative" scheduling by creating a common workspace for distributed users. Advanced features include complete organization workflow integration. Schedule status changes whether they be delays or changes in activity priority, are propagated automatically to database and scheduling tools, where they can be analyzed for re-scheduling.

Applications: Interactive team-based scheduling.

Contact: Bruce H. Cottman
617-661-8181

Related SBIR Contracts:
NAS9-18711 JSC PY 1991 Topic 06
"A Distributed Information System Architecture for Planning and Scheduling Tools"

F: Electronic Devices and Equipment

F.07
Avalanche Photodiode Scintillation Detector
Firm: **Radiation Monitoring Devices, Inc.**
The avalanche photodiode scintillation detector is a compact, lightweight, sensitive, solid-state optical detector. It has been optimized for the small amount of short wavelength light emitted by plastic scintillator anticoincidence shielding when irradiated by ionizing particles. This allows for much better performance of gamma ray telescopes. This detector is also useful for applications using plastic or inorganic scintillators where small size, high sensitivity, ruggedness or insensitivity to magnetic fields are needed.

Applications: Scientific research, gamma ray spectroscopy, background suppression.

Contact: Richard Farrell
617-926-1167

Related SBIR Contracts:
NAS1-31929 GSFC PY 1991 Topic 08
"Photodiode Scintillation Detector for Anti-Coincidence Shielding"

H: Optical Devices and Lasers

H.15

Ion Beam Optical Figuring

Firm: **Sandia Systems, Inc.**

Ion beam optical figuring is a non-contact, highly controlled means of machining optical surfaces. Surface material is removed by physical sputtering using a beam of energetic inert or reactive gas ions.

Applications: Production of precision optical surfaces that are difficult and expensive to fabricate using conventional techniques.

Contact: Scott R. Wilson
505-343-8112

Related SBIR Contracts:
NAS8-39356 MSFC PY 1990 Topic 08
"Automated, Deterministic Asphere Fabrication"

H.16

Photovoltaic Laser Power Converter

Firm: **Spire Corporation**

An InP-based, 1.3 μm photovoltaic laser power converter has been developed. Utilizing epitaxial layers of InAlGaAs grown on InP wafers by the MOCVD process, these devices are capable of converting 1.3 μm iodine laser radiation into electrical power. This allows energy to be transmitted from one platform to another via laser transmissions. The Phase II program presently in progress will provide a 50 percent conversion efficiency for incident laser power density levels of 500 to 1000 W/cm^2

Applications: Energy transmission in space, transmission of energy through optical fibers for driving circuits.

Contact: Kurt Linden
617-275-6000

Related SBIR Contracts:
NAS1-19592 LaRC PY 1990 Topic 10
"Photovoltaic Converters for Iodine Lasers"

H.17

Room-Temperature Near-Infrared InGaAs Camera

Firm: **Sensors Unlimited, Inc.**

By applying the results of several SBIR projects, Sensors Unlimited is developing an infrared camera that "sees in the dark," yet is moderately priced and requires no cooling. Present-day cameras for the near-infrared spectrum (wavelength range 1-3 microns) require liquid nitrogen cooling, which makes them bulky and expensive. This novel camera is based on an array of 128 x 128 detector pixels of indium gallium arsenide (InGaAs), which has high sensitivity and operates at room temperature, bonded to a hybrid silicon multiplexer "readout." This NASA-developed technology is being used to demonstrate a camera designed to "see" out to 1.7 microns in a SBIR project sponsored by the Strategic Defense Initiative Organization (SDIO). This effort will incorporate any advances made in multiplexer design and/or monolithic detector/amplifier "integrated circuits" that are being developed in other Sensors Unlimited research and development programs, and the latest InGaAs material for the 1-3μm spectrum.

Applications: Applications for the camera include remote sensing (satellite imaging) pollution monitoring, and night vision.

Contact: Gregory H. Olsen
609-520-0610

Related SBIR Contracts:
NAS7-1087 JPL PY 1989 Topic 08
"A 128 x 128 Element Indium-Gallium-Arsenide, IR Detector Array at 300K"
NAS7-1181 JPL PY 1991 Topic 08
"A Monolithic InGaAs FET/Detector Array for NIR Imaging"

I: Advanced Materials

I.12

Carbon-Carbon Composites

Firm: **MER Corporation**

Carbon-carbon composites have a plethora of applications because of low density and high strength to very high temperatures, but suffer from relatively low interlaminar shear strength and oxidation resistance. These difficulties have been overcome by converting the surface of the graphite reinforcing fiber to SiC with SiC whiskers (SiC_w) growing off the surface and gradation doping the carbon matrix with SiC to near 100 percent SiC at the surface followed by an SiC coating. This composite has over three times the interlaminar shear strength of carbon-carbon composites without SiC whiskers on the graphite fiber as well as substantially improved oxidation resistance.

Applications: Carbon-carbon composites including this improved composite have applications in aircraft engines, hypersonic aircraft structures and

skins, space and aerospace vehicles, energy conversion systems and transportation.

Contact: J. C. Withers
602-574-1980

Related SBIR Contracts:
NAS1-19528 LaRC PY 1991 Topic 04
"An Advanced Carbon-Carbon Composite with Improved Interlaminar and Flexure Properties and Oxidation Resistance"

I.13
Silicon Carbide Insulation
Firm: **MER Corporation**
A new SiC thermal insulation has been developed by MER. A net-shaped structure of SiC is produced by the CVR process using fibrous graphite insulation boards as precursors. The new material has a low density of 19 pcf, a compressive strength of 315 psi, and a relatively low thermal conductivity of less than 1.0 Btu-ft/ft^2-hr-°F at room temperature decreasing to 0.60-0.7 Btu-ft/ft^2-hr-°F above 600°F at 1.0 atm. A lower thermal conductivity was obtained in vacuum. Also, an excellent oxidation resistance and thermal shock resistance with a critical temperature of >3000°F was observed.

Applications: Thermal protection of reentry vehicles and hypersonic flight systems, thermal barrier coatings in gas turbine engines, spark ignition and diesel engines, high temperature furnace insulation, filtration systems of NBC aerosol.

Contact: R. O. Loutfy
602-574-1980

Related SBIR Contracts:
NAS9-18691 JSC PY 1991 Topic 04
"Novel Thermal Protection Materials"

J: Materials Processing

J.09
A Real-Time NVR Monitor
Firm: **Femtometrics**
A highly sensitive mass microbalance based on surface acoustic wave technology is used to measure less than 0.5 nanograms/cm^2 of non-volatile residue (NVR) contamination in real time. This enables early detection of contamination from activities around contamination-sensitive hardware. As the sensor is quite small, it could be used to monitor the contamination history of hardware during fabrication, transportation, and storage.

Applications: The product can be used to monitor clean rooms for molecular contamination and to measure the level of contamination generated from various activities. As well as self-contamination on the ground and in space.

Contact: W. D. Bowers
714-722-6239

Related SBIR Contracts:
NAS10-11865 KSC PY 1991 Topic 13
"A High-Sensitivity, Real-Time, Non-Volatile Residue Monitor"

J.10
Cathodic Arc Deposited Coatings
Firm: **MER Corporation**
Cathodic arc transfer deposition technology utilizes a vacuum arc to deposit material stoichiometrically from the cathode. Advances at MER Corporation in control of the arc have extended the range of suitable cathode materials to include materials with a lower thermal shock resistance.

Applications: MER is currently developing a novel composite ceramic coating, ZrO_2 and TiC, for use as a high temperature hydrogen barrier. This process can generically deposit complex ceramic or intermetallic coatings.

Contact: R. O. Loutfy
602-574-1980

Related SBIR Contracts:
NAS8-39372 MFSC PY 1990 Topic 04
"Protective Composite Coating Using Novel CATD Techniques"

J.11
In-Situ Interferometer for Diamond Turning Machine
Firm: **Laser Power Corporation**
Laser Power Research has developed a specialized interferometer designed for real-time surface characterization in diamond turning applications. The interferometer incorporates a computer-generated hologram at the image plane. To examine and test aspheric surfaces in real time, the interferometer is designed to be mounted directly on the diamond turning machine.

Applications: Incorporation of aspheric elements into optical systems is steadily increasing, especially in the area of infrared optical systems.

Contact: Grahm Flint
619-755-0700

Related SBIR Contracts:
NAS7-1173 JPL PY 1991 Topic 08
"Dynamic Evaluation of Aspheric Surfaces in Real Time"

J.12
Microgravity Sonic Pump Furnace
Firm: **Orbital Technologies Corporation**
The key aspect of this work was the successful development and demonstration of the sonic pump based (gas jet or aerodynamic) hardware and software for the for position/motion control of spherical samples. The MSPF-II test article was prepared and test flown on 11 test flights (~ 500 low-g parabolas) of the NASA KC-135. Flight tests conducted proved that the position control system worked and provided steady and smooth position/motion control of various sized samples of different densities. Best results were obtained during the free float of the experimental package for the experiment. Tests of a sample spin system showed that controlled sample spinning is possible. Fluid tests provided insight into the design of future fluid handling systems. Heating tests on fixed samples during low-g showed the effects of no convection. The MSPF technology when fully developed for space flight, should provide for microgravity equipment which can assist scientists in the research of and space commercial production of ceramics, glasses, new electronic materials, metal alloys, and electro-optical materials.

Applications: The MSPF, when fully developed for space flight, will provide for microgravity equipment which can assist scientists in the research of and space commercial production of ceramics, glasses, new electronic materials, metal alloys, and electro-optical materials. The MSPF technology can be adapted to conduct specific research in the following areas: protein crystal growth, crystal growth research in general, various fluid dynamics and fluid property investigations, combustion research investigations, and vibration isolation applications. Follow-on work has been recommended for space-based technology development and research on the Space Shuttle and later on the Space Station Freedom.

Contact: Eric E. Rice
608-833-1992

Related SBIR Contracts:
NAS8-38483 MSFC PY 1986 Topic 10
"Microgravity Sonic Pump Levitator Furnace"

J.13
Miniature Deposition System
Firm: **ISM Technologies, Inc.**
A miniature deposition system (MDS) is being developed that can deposit thin films of metals or ceramics. The system is to be a vital part of the proposed NASA CRAF mission. The CRAF mission is collect cometary-tail particulate matter. The MDS will be used to coat captured material so it can be examined by a scanning electron microscope.

Applications: The miniature deposition source can be used for coating complex surface that cannot be reached by conventional systems. It can also be used as an ion source, allowing ion implantation of complex shapes and interior surfaces as well. A large array of MicroMEVVA units could serve to replace larger sources where fibers and other objects require treatment over a circular area.

Contact: James R. Treglio
619-530-2332

Related SBIR Contracts:
NAS7-1146 JPL PY 1989 Topic 04
"Miniature Thin-Film Deposition System"

L: Materials Instrumentation

L.05
Resin Analyzer
Firm: **Radiation Monitoring Devices, Inc.**
The resin analyzer is a state-of-the-art analytical instrument for the analysis of graphite-fiber-reinforced composite materials. This rapid non-destructive test instrument determines the weight-percent of resin in composites. As opposed to the many hours required by standard chemical techniques such as acid digestion and solvent extraction, approximately five minutes is all this instrument requires to complete its analysis.

Applications: Aerospace components, structural materials, sporting goods, automotive parts.

Contact: Sia Afshari
617-926-1167

Related SBIR Contracts:
NAS1-19539 LaRC PY 1991 Topic 04
"Nondestructive Analysis of Graphite-Reinforced Materials"

M: Aerodynamics and Aircraft

M.11

Force and Moment Balance for Water Tunnels

Firm: **Eidetics International, Inc.**

This product will be a submersible five-component internal force and moment balance that measures roll, pitch and yaw moments, and normal and side force forces in water tunnels. Balance and calibration hardware can be provided. Software to acquire and reduce balance data, and a unique capability for dynamic as well as static tests are under development.

Applications: Measurement of forces and moments on scaled models of aircraft configuration in low-speed flow visualization water tunnels.

Contact: Gerald Malcolm
310-326-8228

Related SBIR Contracts:
NAS2-13302 ARC PY 1990 Topic 02
"Development of a Multiple Component Force and Moment Balance for Flow Visualization Water Tunnels"

O: Heat Transfer Devices

O.12

Nontoxic, Two-Phase, Heat Transport Fluid

Firm: **Mainstream Engineering Corporation**

Using a computational chemistry system, Mainstream is developing nontoxic heat transport fluids suitable for manned spacecraft habitats. The fluids being developed are nontoxic, nonflammable, inert to the habitat oxidizer, and have suitable thermodynamic performance properties.

Applications: Thermal systems aboard manned spacecraft, potential CFC replacements, other two-phase working fluid applications.

Contact: Lawrence R. Grzyll
407-631-3550

Related SBIR Contracts:
NAS9-18471 JSC PY 1990 Topic 09
"Nontoxic-Heat Transport Fluids for Habitat Two-Phase Thermal Control Systems"

S: Atmospheric Sciences

S.15

An Airborne Particle Imaging Nephelometer for Measuring Optical Phase Function

Firm: **SPEC, Inc.**

The digital holographic imaging system, when packaged into an airborne instrument for atmospheric research, provides digital images of small particles moving at speeds up to 200 ms. Images have 5 micron resolution and an image-repetition rate of 100 s^{-1}. They are analyzed in real time using a PC-486 with i860 image processor.

Applications: Measurements of ice crystals in cirrus clouds to provide improved understanding of radiative transfer and global climate change.

Contact: R. Paul Lawson
303-449-1105

Related SBIR Contracts:
NAS1-19591 LaRC PY 1990 Topic 08
"An Airborne Particle Imaging Nephelometer for Measuring Optical Phase Function"

T: Water Management

T.09

On-Line Process Ammonia Analyzer

Firm: **Umpqua Research Company**

The on-line process ammonia analyzer is capable of providing real-time determination of ammonia levels under continuous flow conditions in the presence of dissolved carbon dioxide. Carbon dioxide is degassed by membrane separation following acidification via a solid phase acidification module. Ammonia is then transported across a hollow-fiber porous hydrophobic membrane following acidification using a solid phase base. Ammonia concentration on the analytical side of the membrane is determined by either conductivity or electrochemical detection. Ammonia concentration between 0.040 and 20 mg/L (40 - 20,000 µg/L) have been successfully measured.

Applications: In addition to process control and water quality monitoring aboard spacecraft or other manned extraterrestrial habitations, this technology can be used to quantify ammonia nitrogen levels in a broad range of industrial process and effluent monitoring situations. The technology is also po-

tentially adaptable to quantitative analysis by flow injection techniques in a laboratory setting.

Contact: James R. Akse
503-863-7770

Related SBIR Contracts:
NAS9-18683 JSC PY 1991 Topic 12
"In-Flight Ammonia Monitor"

T.10

Recovery of Distilled Water from Gray Water

Firm: **Water Reuse Technology**

The developed evaporator will be a five-effect vapor compression unit with a capacity of 40 gal/hour of distilled water from gray water. The unit will be tested at NASA Ames and then tested at the Antarctic Analog Testbed.

Applications: Recovery of distilled water from saline waters; reduction of the volume of toxic waste water; food, dairy and pharmaceutical industries.

Contact: Badawi Tleimat
510-838-0369

Related SBIR Contracts:
NAS2-13563 ARC PY 1990 Topic 12
"A Multi-Effect Wiped-Film Rotating-Disk Evaporator"

FIRMS

The NASA SBIR participants who have submitted information for this catalog are listed below in alphabetical order. The listing gives the firms' own definitions of the nature of their businesses along with the names of company officials. The entries include the names and identifying numbers of the products described in this catalog.

Accurate Automation Corporation

1548 Riverside Drive, Suite B
Chattanooga, TN 37406

Accurate Automation Corporation specializes in the design and development of systems using neural network technology. These systems include control applications like robotics and avionics. Other applications include radar, signal processing, sensor fusion, and fault diagnosis with neural networks.

Contact: Robert M. Pap
615-622-4642

Product(s) Described:

B.07: Neural Net Toolbox

Advanced Decision Systems

1500 Plymouth Street
Mountain View, CA 94043-1230
(Note: The firm is now a division of Booz, Allen & Hamilton, Inc.)

The firm provides "high-end" information processing technologies, services, and products that address problems of national importance.

Contact: Betty G. Lester
415-960-7557

Product(s) Described:

C.12: Reactive Planning for EVA Retriever

Advanced Research and Applications Corporation

425 Lakeside Drive
Sunnyvale, CA 94086-4701

Advanced Research and Applications Corporation (ARACOR), founded in 1977, manufactures radiation-based, computer-automated instruments that support the measurement and inspection needs of research and manufacturing organizations. The firm offers a comprehensive spectrum of capabilities ranging from concept formulation, computer simulation, experimental evaluation, engineering design, software development, and system integration which lead to prototype demonstration, product manufacturing and post-warranty services. The current product line includes the Model 1500 family of industrial computed tomography systems and the Model 4100 Automatic Semiconductor Irradiation System. R&D areas include tomographic and radiographic imaging technology, radiation sensors, x-ray optics and analytical methods, and semiconductor material and device characterization.

Contact: R. A. Armistead
408-733-7780

Product(s) Described:

E.01: ARACOR VLSI Qualification Test System
K.05: High-Energy, Dual-Energy Computed Tomography Detector Package
K.08: QUEST Integrated Load-Frame and Computed-Tomography System
L.01: Miniature Materials Analysis X-Ray Laboratory

Advanced System Technologies

12200 East Briarwood Avenue, Suite 260
Englewood, CO 80112

Advanced System Technologies provides system engineering services and products for the performance and reliability analysis of real-time computer systems.

Contact: Robert T. Goettge
303-790-4242

Product(s) Described:

A.07: QASE®RT

Aerodyne Research, Inc.

Center for Chemical & Environmental Physics
45 Manning Road
Billerica, MA 01821

Aerodyne Research is engaged in basic research, computer modeling, field measurements and instrument development in the areas of electronic

materials, combustion, and atmospheric and environmental science.

Contact: Herman E. Scott
508-663-9500

Product(s) Described:

J.03: DIFKIN, A Coupled-Mass Transport and Chemical Kinetics Code for CVD Modeling

N.08: Rayleigh Scattering Diagnostic for Density and Temperature

S.04: Atmospheric Trace Gas Fluxmeter

Aerometrics, Inc.

550 Del Ray Avenue, Unit A
Sunnyvale, CA 94086-3528

Aerometrics offers a wide range of particle analysis equipment including laser Doppler velocimeter and phase Doppler particle analyzer one-, two- and three-dimensional, standard or fiber-optic systems. Since the initial development of the Phase Doppler Particle Analyzer (PDPA), Aerometrics has extended the capabilities of the PDPA by offering various system tools and accessories. Aerometrics will customize any system to fit the user's unique testing environment. The firm also provides services such as in-house and on-site testing as well as research and development.

Contact: W. D. Bachalo
408-738-6688

Product(s) Described:

N.11: The Phase Doppler Particle Analyzer

American Research Corporation of Virginia

P.O. Box 3406, 1509 4th Street
Radford, VA 24143-3406

American Research is engaged in contract research and grants in science and engineering for government, university, and industry.

Contact: Anne Churchill
703-731-0655

Product(s) Described:

M.07: Laser Speckle Correlator

ANCO Engineers, Inc.

9937 Jefferson Boulevard
Culver City, CA 90232-3591

ANCO's consulting engineers specialize in seismic testing and analysis, energy management, and vibration monitoring.

Contact: George E. Howard
310-204-5050

Product(s) Described:

K.06: Instrumented Torque Wrench (INTOWS)

AOTF Technology, Inc.

540 Weddell Drive #6
Sunnyvale, CA 94089

Design and manufacture of AOTFs (acousto-optic tunable filters) tunable optics filters that have no moving parts.

Contact: Patrick Katzka
408-734-5435

Product(s) Described:

H.01: Acousto-Optic Tunable Filters

APA Optics, Inc.

2950 NE 84th Lane
Minneapolis, MN 55449

APA Optics is a high-technology company engaged in precision optics design and fabrication, computer-generated holographic products, opto-electronic materials (III-V), opto-electronic device design and processing.

Contact: Anil K. Jain
612-784-4995

Product(s) Described:

A.03: Holographic Helmet-Mounted Display

H.06: Interferometer for Aspheric Testing

H.13: Solid State Laser Scanner

Applied Research, Inc.

P.O. Box 11220
Huntsville, AL 35814-1220

Applied Research, Inc. (ARI) is a high-technology research and development, professional services company. Technical staff includes engineers, physicists, scientists, technicians, and analysts supporting various agencies of the Department of Defense, NASA, Prime Defense/Aerospace Contractors and Commercial/Industrial Operations. The company presently has facilities located in Huntsville, AL and Arlington, VA with field offices located in Dayton, OH and Fort Walton Beach, FL. The research and engineering staff of ARI specializes in signal and image processing, electronic and optical hardware, sensor applications, flight test/mission operations planning, IR/optical design, analysis and test for defense, space, and commercial/industrial requirements.

Contact: Ken Creekmore
205-922-8600

Product(s) Described:
V.11: Video Monitoring System

Applied Technology Associates, Inc.

1900 Randolph, SE
Albuquerque, NM 87106

ATA is a 17 year-old company with facilities in Albuquerque, New Mexico and Austin, Texas. The company specializes in government services, components, and system integration. Serving both federal and industrial customers, the company's core technologies include innovative developments in sensors and actuators, control electronics, data systems, and imaging. Key markets include the automotive industry, precision motion control for manufacturing processes, and system integration for space.

Contact: John Blackburn
505-247-8371

Product(s) Described:
V.03: Inertial Linear Actuator

Astro International Corporation

Aerospace Division
100 Park Avenue
League City, TX 77573

Astro International Corporation produces analytical instrumentation and safety monitoring equipment for critical environments.

Contact: Robert Ashcraft
612-784-4995

Product(s) Described:
T.07: Process-Control Water Quality Monitor

Bauer Associates, Inc.

177 Worcester Road, #101
Wellesley, MA 02181

Bauer Associates performs consulting and R&D for electro-optical systems and produces an optical profilometer for ultra-accurate surface contour measurements of aspheric optics.

Contact: Paul Glenn
617-235-8775

Product(s) Described:
H.08: Model 100 Profilometer

Bend Research, Inc.

64550 Research Road
Bend, OR 97701-8599

Bend Research engages in contract research and development.

Contact: Rod J. Ray
503-382-4100

Product(s) Described:
T.06: Membrane-Based Wash-Water Recovery Unit

Bio-Imaging Research, Inc.
425 Barclay Boulevard
Lincolnshire, IL 60069

Bio-Imaging Research is the developer and manufacturer of radiographic imaging systems for industrial applications of nondestructive testing. Products include x-ray computed tomography and digital radiography inspection systems, high-efficiency x-ray detectors, and image processing hardware and software. The company also provides design services for a variety of medical, electronic, and industrial product development projects.

Contact: J. F. Moore
708-634-6425

Product(s) Described:
K.02: Dual-Beam Lens for Micro-NDE

Biochem Technology, Inc.
P.O. Box 1366, 100 Ross Road
King of Prussia, PA 19406

BioChem Technology develops technology for enhancing the productivity of bioreactors and biological processing. Its primary products are the FluroMeasure (R) System and the BioGuide™ System for monitoring and control of fermentation and waste treatment plants.

Contact: William B. Armiger
215-768-9360

Product(s) Described:
U.04: FlurO_2

Biospherical Instruments, Inc.
4901 Morena Boulevard, Suite 1003
San Diego, CA 92117

Biospherical Instruments specializes in the research, design, and manufacture of innovative optical instrumentation for the oceanographic and atmospheric sciences community and for general environmental monitoring.

Contact: Dennis P. Bryan
619-270-1315

Product(s) Described:
R.02: MER-2020 Oceanographic Instrument
R.03: PNF-300 Profiling Natural Fluorometer

Bomed Medical Manufacturing
3b Whatney
Irvine, CA 92718

BoMed has pioneered bio-impedance technology for noninvasive hemodynamic and cardiodynamic assessment, monitoring, and therapeutic management for use in hospitals and physicians' offices.

Contact: V. Pat Vysin
714-770-5322

Product(s) Described:
U.07: Non-Invasive Hemodynamic Management System

Bonneville Scientific, Inc.
918 East 900 South
Salt Lake City, UT 84105

Bonneville Scientific is a Utah corporation founded in 1981 to research, develop, and commercialize force and pressure distribution sensors, force torque sensors, and miniature piezoelectric motors.

Contact: Allen R. Grahn
801-359-0402

Product(s) Described:
C.14: Tactile Sensor

Cambridge Research Company
21 Erie Street
Cambridge, MA 02139

Cambridge Research is engaged in commercial sale of laser intensity stabilizers, absolute cryogenic radiometers, and liquid-crystal tunable optical filters and performs research in the field of solar astrophysics.

Contact: Peter V. Foukal
617-491-2627

Product(s) Described:
F.01: Auto-Cal Detector Calibration System

CFD Research Corporation
3325-D Triana Boulevard
Huntsville, AL 35805

CFD Research Corporation (CFDRC) provides research and development services and advanced analysis software for: fluid flow, heat transfer, combustion, solid-fluid interaction, and scientific

data visualization. CFDRC specializes in the development and application of computation fluid dynamics (CFD) techniques, computer codes, and experiments for the analysis of engineering problems.

Contact: Ashok K. Singhal
205-536-6576

Product(s) Described:
N.02: FASTRAN

Charles River Analytics, Inc.
55 Wheeler Street
Cambridge, MA 02138

Charles River Analytics performs advanced research and development for the various government agencies, and designs, develops and markets CASE tools for intelligent systems on workstation and personal computer platforms. Currently, the company is involved in research and development in the neural network, expert system, software engineering, and man/machine system areas. The company's commercial software products include CASYS™.

Contact: Alper K. Caglayan
617-491-3474

Product(s) Described:
B.09: NueX™
B.12: SDL CASE Tool

Chronos Research Labs, Inc.
41866 Sorrento Valley Boulevard #H
San Diego, CA 92121

Chronos Research Labs is an energy research firm.

Contact: Randall B. Olsen
619-455-8200

Product(s) Described:
Q.05: Pyroelectric Converter

Clever Fellows Innovation Consortium, Inc.
R.D. 1 Box 410
Melrose, NY 12121

Clever Fellows Innovation Consortium is an energy conversion research and development firm. It performs contract research.

Contact: John Corey
518-272-3565

Product(s) Described:
Q.07: STAR™ Reciprocating Alternator/Motor

Coleman Research Corporation
Digital Signal Division
6551 Loisdale Court, #800
Springfield, VA 22150-1808

Coleman Research Corporation is engaged in engineering research and development of coherent laser vision and metrology sensors and devices. Products include: contour mappers for precision volume metrology; vision systems for telerobotics and NDE; Hydras, a multiplexed sensor set, with up to 100 similar or dissimilar coherent optical sensors multiplexed off a single electronics/optics head and transmitted via fiber-optics; proximity fuses for weapon fusing; three-dimensional artificial vision system.

Contact: Richard L. Sebastian
703-719-9200

Product(s) Described:
H.04: Eagle 3004 Vision System

Complere, Inc.
P.O. Box 1697
Palo Alto, CA 94302

Complere conducts basic and applied research in fluid mechanics and energy systems. This work is primarily in the area of advanced flow-field diagnostics and includes the design and manufacture of two- and three-component laser velocimeters, hot wire turbulence and dynamic pressure measurement systems, and controllers, interfaces and software for data acquisition and analysis. Current projects range from water-tunnel, vortex-flow diagnostics to hypersonic flow experiments designed to improve the turbulence modeling data base for NASP.

Contact: F. K. Owen
415-321-5630

Product(s) Described:
M.02: An Optical Angle-of-Attack Sensor

Computational Mechanics Company
7701 North Lamar Street, Suite 200
Austin, TX 78752-1022

The Computational Mechanics Company develops state-of-the-art computer software for modeling computational solid mechanics and computational fluid dynamic applications. Special emphasis is directed toward the use of "smart" algorithms to optimize the numerical process and produce the best possible computational results for the least computational effort.

Contact: J. Tinsley Oden
512-467-0618

Product(s) Described:
N.06: PHLOW

Conax Buffalo Corporation
Aerospace Industrial Division
2300 Walden Avenue
Buffalo, NY 14225

Conax Buffalo Corporation, Aerospace Industrial Division, designs and manufactures fiber-optic and conventional sensors for the industrial and aerospace markets.

Contact: Algera Samuel
716-684-4500

Product(s) Described:
N.05: Optical-Fiber Temperature Sensor

Continuum Dynamics, Inc.
P.O. Box 3073
Princeton, NJ 08543

Continuum Dynamics carries out contract research, software development, and consulting engineering tasks for both U.S. government agencies and commercial customers. CDI has a wide range of projects currently underway, including work in rotorcraft and aircraft aerodynamics, computational aeroelasticity, aerosol modeling, road vehicle aerodynamics, and acoustics.

Contact: Barbara H. Hawk
609-734-9282

Product(s) Described:
M.04: EHPIC Mod 2.0
M.09: RotorCRAFT

Convolve, Inc.
One Quarter Mile Road
Armonk, NY 10504

Commercial applications of impulse shaping ™ technology.

Contact: Neil Singer
914-273-4042

Product(s) Described:
C.06: Impulse Shaping™ Software

Creare, Inc.
P. O. Box 71, Etna Road
Hanover, NH 03755

Creare is an advanced engineering firm established in 1961. Creare's services span applied research, engineering design, new product and process development, computational fluid dynamics, mechanistic analysis, large-scale testing, small model studies, software development, and problem-solving consulting.

Contact: Jim Block
603-643-3800

Product(s) Described:
O.05: High-Heat-Flux, Condensing Heat Exchanger
O.06: High-Heat-Flux, Single-Phase Exchanger
P.02: Helium Transfer Pump

Cybernet Systems Corporation
1919 Green Road, Suite B-101
Ann Arbor, MI 48105

Cybernet Systems Corporation focuses on high technology research, development, and derivative specialty products to make people safer and more productive. Through evolutionary application of advanced technology in human-computer interfaces and computer-aided instruction and training, robotics and automation, and artificial intelligence, Cybernet Systems integrates people-centered systems for industry, the military, and space. Cybernet Systems is qualified to carry out all types of military and civilian R&D and commercialization project categories.

Contact: Heidi N. Jacobus
313-668-2567

Product(s) Described:
C.01: Cyberimage
C.02: Cybernet Force-Reflecting Handcontroller
C.05: Holotrack

Daedalus Enterprises, Inc.
P.O. Box 1869
Ann Arbor, MI 48106

Daedalus Enterprises develops and manufactures airborne multispectral imaging systems for remote sensing.

Contact: Charles G. Stanich
313-769-5649

Product(s) Described:
R.01: AOCI (Airborne Ocean Color Image)
S.14: Wildfire

Delta Data Systems, Inc.
131 Third Street
Picayune, MS 39466

Delta Data Systems is engaged in commercial geographical information systems (GIS) and remote sensing systems (advanced GIS) development, remote sensing and GIS consulting, and remote sensing and GIS research and development.

Contact: Ferron Risinger
601-799-1813

Product(s) Described:
B.06: GIS-Multi-View

EIC Laboratories, Inc.
111 Downey Street
Norwood, MA 02062

EIC Laboratories' business includes battery development and limited battery production, and electrochromic display development, with limited production of displays.

Contact: A. C. Makrides
617-769-9450

Product(s) Described:
H.02: Alpha-Numeric Electrochromic Displays
Q.06: ReLi® Rechargeable Lithium Cells and Batteries

Eidetics International, Inc.
3415 Lomita Boulevard
Torrance, CA 90505

Eidetics is a fighter-aircraft design technology corporation focused on development of new aeronautical technologies in aerodynamics, propulsion, flight controls, avionics, structures, simulation and operational requirements. In addition, Eidetics manufactures and installs flow-visualization water tunnels for aeronautical research and supporting preliminary aircraft design tasks.

Contact: Andrew M. Skow
310-326-8228

Product(s) Described:
M.06: Forebody Vortex Control
M.11: Force and Moment Balance for Water Tunnels (Prospective Product)

Electroimpact, Inc.
2721 Northeast Blakeley Street
Seattle, WA 98105-3118

Electroimpact is the manufacturer of automated and robotic riveting machines for the aerospace industry. Developer of electromagnetic dent remover and in-flight aircraft deicing systems.

Contact: Samuel O. Smith
206-525-2403

Product(s) Described:
M.05: Eddy Current Repulsion De-Icing Strip

Electronic Associates, Inc.
Product Engineering
185 Monmouth Parkway
West Long Branch, NJ 07764-9989

Electronic Associates provides simulation computer products plus design and engineering services to private industry and government agencies.

Contact: Gary Long
908-229-1100

Product(s) Described:
A.08: STARLIGHT - The Ultimate Simulation Computer

Energy Science Laboratories, Inc.

Thermal Composites Division
6888 Nancy Ridge Drive
San Diego, CA 92121

Energy Science Laboratories engages in research and development in energy and aerospace materials, contracting with NSF, USAF, SDIO, NASA, Army, and aerospace firms. Its facilities are equipped for vacuum (evaporation, sputtering, amass spectrometry) CVD/CVI, materials preparation, microelectronic fabrication, chemistry, cryogenics, optics, thermal analysis, machining, and computing.

Contact: Timothy R. Knowles
619-552-2034

Product(s) Described:

Q.04: Composite-Matrix Regenerators for Stirling-Cycle Engines

Engineering Analysis, Inc.

715 Arcadia Circle
Huntsville, AL 35801-5909

Engineering Analysis engages in engineering research and development in explosive safety, turbulence quantification, and fractional calculus.

Contact: Frank B. Tatom
205-533-9391

Product(s) Described:

B.22: NOISE Software (Prospective Product)

ERC, Inc.

P.O. Box 417
Tullahoma, TN 37388

ERC focuses on aerospace research and development in applied artificial intelligence, computational and analytical fluid dynamics, aerospace testing (water tunnels), and magnetohydrodynamics.

Contact: Y. C. L. Susan Wu
615-455-9915

Product(s) Described:

M.10: Wind Tunnel Project Engineer's Intelligent Assistant

Essex Corporation

Information Systems Division
9170 Rumsey Road
Columbia, MD 21045

Essex's business includes human factors research, signal processing, and training device manufacturing.

Contact: Robert S. Kennedy
410-730-1097

Product(s) Described:

U.02: DELTA™

Femtometrics

1001 West 17th Street, Suite R
Costa Mesa, CA 92627-4512

Femtometrics' specializes in the development of highly sensitive sensors to detect chemical vapors, aerosols/particulates and contamination.

Contact: Margo Bowers
714-722-6239

Product(s) Described:

J.09: A Real-Time NVR Monitor (Prospective Product)

S.01: 200 Mhz Surface Acoustic Wave Aerosol Particle and Chemical Vapor Sensor

S.02: A Non-Optical, Real-Time Particle Fallout Monitor

Fiber Materials, Inc.

Space Technology Division
666 North Hague Avenue
Columbus, OH 43204-1492

Fiber Materials' performs research and development of high technological materials including metal coating of fibers and fabric, metal-matrix composites, and production of high purity quartz fiber.

Contact: Ralph F. Orban
614-272-5785

Product(s) Described:

V.07: Metal-Coated Kevlar Tether

Fluent, Inc.
10 Cavendish Court
Lebanon, NH 03766

Fluent Inc. conducts development, marketing, and support of CFD software for industry and research facilities world-wide.

Contact: Steve Rozov
603-643-2600

Product(s) Described:
N.04: NEKTON® Fluid-Flow Numerical Simulator

Fluid Dynamics International
500 Davis Street #600
Evanston, IL 60201-4622

Fluid Dynamics International provides engineers with computational and analytical tools and services for the solution of fluid flow problems. The computational fluid dynamics package FIDAP is at the focus of the company's activities.

Contact: Michael Engleman
708-491-0200

Product(s) Described:
N.03: FIDAP™ (Fluid Dynamics Analysis Package)

Foster-Miller, Inc.
350 Second Avenue
Waltham, MA 02154-1196

Foster-Miller is a 300-employee company specializing in new product development. Founded by a group from the Massachusetts Institute of Technology in 1956, it draws on the vast educational and technological resources of the Northeast to provide diverse expertise in thermal and energy technologies; robotics; special mechanisms and machinery; nuclear power plant inspection and maintenance equipment and services; polymer chemistry and processing; composite design and processing; structural/civil inspection and analysis tools and technologies; and fiber-optics and nonlinear optics technologies.

Contact: Adi R. Guzdar
617-890-3200

Product(s) Described:
C.13: Serpentine Truss Robot

I.01: Biaxially Oriented Liquid Crystal Polymer Film
I.06: Polyamide/Liquid-Crystal-Polymer Blend
I.08: Polymer Reaction Monitor

O.09: Nonazeotropic Heat Pump for Water Heating

Gait Scan, Inc.
P.O. Box 1550
Ridgewood, NJ 07451-1550

Gait Scan is a research and development firm.

Contact: Anthony Mauriello
201-652-8292

Product(s) Described:
U.06: MRTA Model 1200

Gamma Research, Inc.
904 Bob Wallace Avenue, Suite 212
Huntsville, AL 35801

Gamma Research conducts space and defense research and development, innovative development of high speed rail passenger train systems, ground transportation feeder networks, solar energy resource analysis, computer applications to educational software, and development of systems to control data entry accuracy in business practice.

Contact: John Woo Jr.
205-533-7103

Product(s) Described:
B.17: VODEM Manual Data Entry and Proofreading System

General Pneumatics Corporation
Western Research Center
7662 East Gray Road, Suite 107
Scottsdale, AZ 85260

The General Pneumatics Western Research Center was established in 1983 in Scottsdale, Arizona, to develop advanced cryo-refrigerators, Stirling systems, and innovative approaches to energy conversion and thermal management for commercial, medical, and aerospace applications.

Contact: Steven G. Zylstra
602-998-1856

Product(s) Described:

P.04: Non-Clogging, Self-Regulating, Joule-Thomson Cryostat

Geo Centers, Inc.

Sensor Systems Group
7 Wells Avenue
Newton Centre, MA 02159

Geo-Centers is a small business based in Newton, Massachusetts with offices in Washington, DC; Albuquerque, New Mexico; and Dover, New Jersey. Incorporated in 1973, Geo-Centers has been successfully developing fiber-optic sensors, geophysical instrumentation, remote diagnostic measurement systems, electromagnetic-based sensors and antennas, and other advanced instrumentation systems. Geo-Centers' primary business is in the government services area. However, significant in-house research and development is maintained by the corporation. Geo-Centers formed the Sensor Systems Group in 1987, to develop fiber- and optical-based measurement systems for commercial sale.

Contact: Edward P. Marram
617-964-7070

Product(s) Described:

H.09: Multimode Optical Switch and Control Unit

I.04: Distributed Fiber-Optic Composite-Material Cure Monitoring and Control System

U.03: Fiber-Optic pH Optrode and Electronics Interface

Geoscience Limited

410 South Cedros Avenue
Solana Beach, CA 92075

Geoscience Limited is a research and development firm that works in the areas of heat transfer, fluid mechanics, materials science and technology, and biophysics. In the biophysics area, one of the company's major activities relates to the measurement of metabolic heat releases (and their three components) for animals and humans at the Earth's surface and in space.

Contact: David J. Connelly
619-755-9396

Product(s) Described:

U.01: Calorimeter and Waste Management System

Heuristicrats Research, Inc.

1678 Shattuck Avenue, Suite 310
Berkeley, CA 94709-1631

Heuristicrats Research is a research and development firm that works in the areas of scheduling, planning, parallel processing, search and optimization.

Contact: Andrew Mayer
510-845-5810

Product(s) Described:

B.19: DTS Scheduling Software (Prospective Product)

High Technology Systems, Inc.

250 Jordan Road, Suite 210
Troy, NY 12180-8344

High Technology Systems (HTS) (formerly High Technology Services, Inc.) is a technology based entrepreneurial firm headquartered in Rensselaer Polytechnic Institute's Rensselaer Technology Park in the town of North Greenbush, Troy, New York. HTS was established in 1983 to capitalize on strengths in advanced polymeric materials and specialty chemicals. Founder, and Chief Executive Officer Milton L. Evans, was a former General Electric executive who spent 20 years at GE as a scientist, marketeer, new ventures manager, strategic planner, and product General Manager. The firm moved to the Rensselaer Technology Park to focus on opportunities in high performance plastics, resins, and composite materials.

Contact: Milton L. Evans
518-283-8072

Product(s) Described:

I.07: Polyimide Foam

I-Kinetics, Inc.

19 Bishop Allen Drive
Cambridge, MA 02139-3512

I-Kinetics develops and markets software for both small and large networked information systems. Products are targeted at organizations who want to integrate vital computing resources and databases with Unix and PC desktop applications. Each product reduces the cost of integration where previously there were no workable solutions. I-Kinetics products are being used in such areas as financial trading, concurrent engineering, CAD/CAM tool integration, network system

management, and relational and object DBMS gateways.

Contact: Bruce Cottman
617-661-8181

Product(s) Described:
B.05: MetaData
B.10: ObjectExpress®
B.20: I-Gate® (Prospective Product)
B.23: TeamSchedule (Prospective Product)

Infrared Laboratories, Inc.
1808 East 17th Street
Tucson, AZ 85719

Infrared Laboratories was established in 1967 to serve the research community throughout the United States and many foreign countries by supplying infrared and cryogenic equipment. The company's product list includes bolometers, bolometer arrays, discrete photoconductors, large-area infrared camera systems, a wide variety of standard and customized liquid nitrogen and liquid helium research dewars, ^{3}He cryostats, hybrid passive and mechanical coolers, custom optics, filters, and amplifiers.

Contact: A. W. Davidson
602-622-7074

Product(s) Described:
F.03: Cryogenic TIA Input Stage
F.05: JF-4 Integrating Cryogenic Amplifier

Integrated Systems, Inc.
3260 Jay Street
Santa Clara, CA 95054

Integrated Systems designs, develops, markets, and supports an integrated family of CAE/CASE software and hardware products that automate and accelerate the development of real-time software and systems. These products are used in the design, simulation, coding, implementation, and testing phases of development for real-time control applications in a variety of industries, including aerospace, automotive, industrial automation, and computer peripherals.

Contact: Michael G. Lyons
408-980-1500

Product(s) Described:
C.11: RT/Expert

Intelligent Automation Systems
142 Rogers Street
Cambridge, MA 02142

Intelligent Automation Systems' researches, designs, builds, and installs custom automated manufacturing systems. The company specializes in simple, creative solutions to difficult manufacturing problems using a variety of mechanical, electronic, and computer-related technologies. IA Systems also conducts research in new sensing, machine vision, and manipulation technologies under contract with the Department of Energy, the Department of Defense and NASA.

Contact: Steven J. Gordon
617-354-3830

Product(s) Described:
C.15: Zero-G Robotic Testbed

Interferometrics, Inc.
8150 Leesburg Pike, Suite 1400
Vienna, VA 22182

Interferometrics is devoted entirely to research, scientific investigation, technical analysis, and the design and construction of hardware associated with complex systems for NASA, the Department of Defense, the international radio astronomy community, and commercial space telecommunications companies.

Contact: Dino A. Lorenzini
703-790-8500

Product(s) Described:
D.03: Interferometric Satellite Tracking System

International Technical Associates
Robotics Division
2281 Calle De Luna
Santa Clara, CA 95054

The Robotics Division at International Technical Associates (INTA) specializes in custom applications of laser robotic workcells. As a systems integrator, INTA will combine laser, robot, vision, and control to provide a fully functional and optimized workcell. Some of the applications previously addressed include: cutting, welding, etching, and coatings removal.

Contact: Paul Lovoi
408-748-9955

Product(s) Described:
J.07: Real-Time, Adaptive-Vision Welding Guidance System

Irvine Sensors Corporation
3001 Redhill Avenue
Building 3, #203
Costa Mesa, CA 92626

Irvine Sensors specializes in three-dimensional IC packaging.

Contact: James Alexiou
714-549-8211

Product(s) Described:
E.05: Three-Dimensional Short Stack

ISM Technologies, Inc.
9965 Carroll Canyon Road
San Diego, CA 92131

ISM Technologies specializes in the fabrication of equipment for sale and services for modification of the surface properties of materials by metal ion implantation and vacuum arc deposition of metal and ceramic coatings.

Contact: Robert J. Stinner
619-530-2332

Product(s) Described:
J.13: Miniature Deposition System (Prospective Product)

ISTAR, Inc.
406 Alta Avenue
Santa Monica, CA 90402

ISTAR specializes in research and development in advanced propulsion systems for aeronautical applications.

Contact: A. Wortman
310-394-7332

Product(s) Described:
O.02: Gas Dynamic Compressor

ISX Corporation
4353 Park Terrace Drive
Westlake Village, CA 91361

ISX Corporation builds deliverable, intelligent systems that leverage advanced computing technology to solve real-world operational problems.

Contact: Bill Lieberman
818-706-2020

Product(s) Described:
A.04: Intelligent Computational Resource Management System
C.04: Ground Vehicle Manager's Associate

Ithaco, Inc.
Space Systems Division
P.O. Box 6437, 735 West Clinton Street
Ithaca, NY 14851-6437

The Space Systems Division of Ithaco designs and manufactures systems and components for satellite attitude control and determination. Products include earth sensors, reaction/momentum wheels, magnetic TORQRODS and magnetometers.

Contact: Edgar Seymour
607-272-7640

Product(s) Described:
V.09: T-Reaction Wheel
V.10: T-SCANWHEEL

Laser Power Corporation
12777 High Bluff Drive
San Diego, CA 92130

Laser Power Corporation produces optics for high-power lasers and FLIR systems. The corporation manufactures standard and special components including lenses, mirrors, beam expanders, polarizers, prisms, windows, beam splitters, and phase shifters. The research division specializes in the development of laser countermeasures and photon noise-limited imaging systems.

Contact: Douglas H. Tanimoto
619-755-0700

Product(s) Described:
D.02: Digital Image Profiler
J.11: In-Situ Interferometer for Diamond Turning Machine (Prospective Product)

Lightwave Electronics Corporation
1161 San Antonio Road
Mountain View, CA 94043

Lightwave Electronics Corporation designs, manufactures, and sells laser diode-pumped solid-state laser products on an end-user and original equipment manufacturer basis into a variety of markets including those for semiconductor manufacturing equipment and research and developments. Secondarily, the company carries out U.S. government contract research.

Contact: James Francis
415-962-0755

Product(s) Described:

H.11: Series 120 Diode-Pumped Solid-State Ring Laser

H.12: Series 122 Diode-Pumped Solid-State Non-Planar Ring Laser

Macrodyne, Inc.
P.O. Box 376, 4 Chelsea Place
Clifton Park, NY 12065

Macrodyne designs and manufactures a product line of laser Doppler velocimeters, optics, and processors, used by the fluids researcher to non-intrusively measure the velocity and frequency of micron-sized particles flowing across a laser-beam fringe pattern in a measuring volume of a complex flow field.

Contact: R. Jay Murphy
518-383-3800

Product(s) Described:

B.02: FDP 3107 Frequency Domain Processor

Mainstream Engineering Corporation
Thermal Systems Division
200 Yellow Place
Rockledge, FL 32955

Mainstream Engineering Corporation performs research and development on innovative thermal, fluid, and chemical systems for thermal management applications. Mainstream is extensively involved in research and development of thermal management systems and components, ranging from hardware development to working fluid research to computer simulation of thermal management systems. Applications range from personal cooling to spacecraft thermal management.

Contact: Robert Scaringe
407-631-3550

Product(s) Described:

O.10: SCAPE-Suit Heater

O.12: Nontoxic, Two-Phase, Heat Transport Fluid (Prospective Product)

Q.03: Chemical/Mechanical Heat Pump

Marko Materials, Inc.
P.O. Box 3, 19-1 Sterling Road
North Billerica, MA 01862

Marko Materials (MMI) was founded in 1979 in the state of Massachusetts as a materials research and development company. The Company is the sole producer of the advanced melt spinner equipment exclusively designed to process highly reactive titanium alloys, intermetallic titanium aluminides, nickel aluminides, niobium aluminides as well as hard magnetic alloys containing rare-earth transition metals. The Company focuses its entire efforts on supplying rapid solidification powder producing technology, equipment, spare, and consumable parts and services.

Contact: Ranjan Ray
508-663-2210

Product(s) Described:

J.02: Advanced Melt Spinner Equipment - Model 10TX

Marquest Group, Inc.
8 Otis Park Drive
Bourne, MA 02532

Marquest specializes in the design, fabrication and application of advanced underwater sensor systems. Marquest has developed several integrated sensor/positioning systems which combine ROB dynamic positioning with other instrumentation and an electric still camera (ESC), video camera or UT sensor to create a turnkey underwater inspection system.

Contact: Tagore Somers
508-759-1311

Product(s) Described:

D.04: SHARPS

Mayflower Communications Company
80 Main Street
Reading, MA 01867

Mayflower Communications Company is an advanced navigation and communications systems research and development firm. It develops hardware systems, including advanced signal processing boards, GPS-based systems, 80386/486 boards for avionics. Mayflower has developed Ada software systems ranging from RS232 modules to complete, real-time navigation systems. Mayflower also provides services to the FAA for its communications and ATC projects.

Contact: Triveni N. Upadhyay
617-942-2666

Product(s) Described:

B.11: Real-Time Integrated GPS/INS Navigation and Attitude Determination Software

McMahan Electro-Optics, Inc.
P. O. Box 14026, 79 T. W. Alexander Drive
Building 3301, Suite 219
Research Triangle Park NC 27709

McMahan Electro-Optics conducts research and development in non-conventional imaging, sensor fusion and multi-spectral imaging, optical neural networks, fuzzy logic, laser-based systems for NDT/E of composite materials and assemblies.

Contact: Tracy Frantz
919-549-7575

Product(s) Described:

K.03: Dynamic Laser Speckle Profilometer (DyLASP)

K.07: Model V-1701 Digital Image-Oriented Signal Processing System

Membrane Technology & Research, Inc.
1360 Willow Road, Suite 103
Menlo Park, CA 94025-1516

Membrane Technology and Research is a research and development company specializing in the development of membranes and membrane systems for industrially and environmentally significant separations. Membrane VaporSep systems for several applications of vapor separation have been successfully commercialized.

Contact: Richard W. Baker
415-328-2228

Product(s) Described:

S.13: VaporSep Systems

MER Corporation
7960 South Kolb Road
Tucson, AZ 85706

MER develops high technology advanced composite materials including reinforcement of ceramic fibers, ceramic, intermetallic and metal matrix composites, coatings on fibers and components, powders of ceramics and intermetallics, carbide components and Fullerenes ("Buckyballs").

Contact: J. C. Withers
602-574-1980

Product(s) Described:

I.09: Rigid Zirconia Fibrous Tile

I.12: Carbon-Carbon Composites
(Prospective Product)

I.13: Silicon Carbide Insulation
(Prospective Product)

J.10: Cathodic Arc Deposited Coatings
(Prospective Product)

Metadyne, Inc.
P.O. Box 242
Elmira, NY 14902

Metadyne develops and manufactures refractory metal alloys of molybdenum and tungsten for elevated temperature applications. The company also manufactures powder-metallurgy components of tungsten, tungsten-carbide, and molybdenum alloys.

Contact: Raman L. Daga
607-732-1300

Product(s) Described:

I.11: Tungsten and Molybdenum Alloys

Micro-G Research, Inc.
3401 Market Street, Suite 345
Philadelphia, PA 19014-3323

Micro-G Research designs and develops space flight or flight-related equipment for investigators interested in conducting research in microgravity. It provides technical assistance to other experimenters developing testing programs for flight hardware.

Contact: David K. Chapman
215-387-9339

Product(s) Described:
U.08: Variable-Speed Mid-Deck Centrifuge

Microwave Monolithics, Inc.
465 East Easy Street, Unit F
Simi Valley, CA 93065

Microwave Monolithics Incorporated develops and supplies GaAs monolithic microwave integrated circuits (MMICs) for a variety of systems applications, and components and subsystems based on these MMICs. Activities include custom MMIC component services, MMIC prototype services, and research and development. MMInc. has the in-house capability to design, fabricate, characterize, and optimize custom MMIC-based components, including non-standard processing not available via "foundry" services. The company also works in close consultation with OEMs to develop customer-specific prototypes for maximum systems leverage. MMInc. is also under contract with U.S. government agencies on a number of advanced components and technology development programs.

Contact: Daniel R. Ch'En
805-584-6642

Product(s) Described:
G.01: Custom, Fully Monolithic GaAs Switch Matrix Subsystems

Mid-South Engineering, Inc.
2131 Belcourt Avenue
Nashville, TN 37212

Mid-South Engineering is a engineering consulting and research firm with specialization in welding and control system design.

Contact: Kristinn Andersen
615-383-8877

Product(s) Described:
J.06: Model 1000 Welding Controller

Morton International, Inc.
Advanced Materials Division
185 New Boston Street
Woburn, MA 01801

Morton is a manufacturer of bulk infrared optical transmission materials, including polycrystalline zinc-sulfide and zinc-selenide for fabrication of laser components and thermal imaging and detection systems; high-purity organometallics including trimethyl gallium for making advanced gallium-arsenide semiconductors; and monolithic CVD-substrate reflective optics.

Contact: William R. Haigis
800-552-2283

Product(s) Described:
I.02: CVD Silicon Carbide™

Neocera, Inc.
335 Paint Branch Drive
College Park, MD 20742

Neocera develops and manufactures metal-oxide thin films for electronic and optoelectronic applications.

Contact: Roger Edwards
301-314-9937

Product(s) Described:
E.04: Superconducting YBCO Films on Sapphire
J.01: Accessories for Pulsed Laser Deposition

Netrologic, Inc.
5080 Shoreham Place, Suite 201
San Diego, CA 92122

Netrologic conducts research and development in the areas of neural network analysis, image compression, robotics, natural language processing, failure diagnosis, air traffic control, and optical character recognition.

Contact: Dan Greenwood
619-587-0970

Product(s) Described:
B.01: English Language Interface to the Geographical Information System GRASS
B.08: Neural Networks for Fault Monitoring
C.07: Manipulator Fast Motion Planner

Nielsen Engineering & Research, Inc.
510 Clyde Avenue
Mountain View, CA 94043-2287

Nielsen Engineering and Research conducts basic and applied research in aeronautics and aerospace for DOD and NASA, provide consultation services to the aeronautics and aerospace industry, and develop, market and license aerodynamic prediction computer codes worldwide.

Contact: Marnix F. E. Dillenius
415-968-9457

Product(s) Described:
M.08: NEARLEWICE
N.09: TMRCAA

Odetics, Inc.
1515 South Manchester Avenue
Anaheim, CA 92802-2907

Odetics develops and markets automation products that store and control information. The company's products include data records for space applications, remote surveillance and security systems, tape-library storage and retrieval systems, and precision time-measurement instruments.

Contact: Leonard W. Welsch
714-758-0300

Product(s) Described:
C.08: Motion Planning Algorithms for Dexterous Manipulator
C.09: Odetics Dexterous Manipulator
D.01: Adaptive Imager

Omitron, Inc.
6305 Ivy Lane, Suite 500
Greenbelt, MD 20770

Omitron specializes in aerospace systems engineering, software engineering, spacecraft and sensor operations, and specialized hardware development. Advanced products in preparation include an expert system for applications such as spacecraft anomaly investigation and diagnostics and ground-support equipment for instrument conditioning while at the launch pad.

Contact: Frederick J. Hawkins
301-474-1700

Product(s) Described:
A.10: Spacecraft Supercomputer
B.14: Sentinel

Optra, Inc.
66 Cherry Hill Drive
Beverly, MA 01915

Optra consists of two principal units: contract research and development (electro-optical instrumentation), and metrology systems for industrial applications.

Contact: James Engel
508-921-2100

Product(s) Described:
H.14: Ultra-Violet Fourier Transform Spectrome

Orbital Technologies Corporation
402 Gammon Place, #10
Madison, WI 53719

Orbital Technologies is an aerospace research and development company working on microgravity equipment, telerobotics, propulsion, crew, and life support.

Contact: Eric E. Rice
608-833-1992

Product(s) Described:
J.12: Microgravity Sonic Pump Furnace
(Prospective Product)

Photonic Systems, Inc.
1800 Penn Street #4B
Melbourne, FL 32901-2625

Photonic Systems (PSI) designs, manufactures, and markets optical information processing instrumentation. Founded in 1986, PSI has office and laboratory facilities located in Melbourne, Florida. Psi recently announced its first instrumentation products, the PSI AOS-1000 and the PSI AOS-1000X4 - 1 and 4 GHz bandwidth, 1 MHz resolution acousto-optic spectrum analyzer instrument which provide instantaneous frequency measurement for signal analysis, spectroscopic, and test and measurement equipment applications. PSI also performs photonic research development design and consulting for both government and industrial customers.

Contact: Dennis R. Pape
407-984-8181

Product(s) Described:
A.01: Acousto-Optic Spectrometer

Physical Research, Inc.
Instrumentation Group
25500 Hawthorne Boulevard, #2300
Torrance, CA 90505-6828

Physical Research scientists and technicians perform laboratory and field experiments in fluid mechanics, holographic interferometry, laser Doppler anemometry, non-destructive testing, fiber optics and electro-optics.

Contact: W. C. L. Shih
310-378-0056

Product(s) Described:
M.03: Burst Frequency Processor

Physical Sciences, Inc.
20 New England Business Center
Andover, MA 01810-7100

Physical Sciences performs research and development in advanced technologies comprising a wide diversity of areas including electro-optics and lasers, thermochemistry and electrochemistry as well as testing services. PSI has developed applications of advanced technologies for combustion, emissions control, process control and electromechanical and electrochemical systems, along with electro-optical instrumentation for precise measurement under harsh conditions. The company's business currently consists of three principal units: contract research and development, medical products, and environmental instrumentation products.

Contact: George E. Caledonia
508-689-0003

Product(s) Described:
K.04: Fast Atom Sample Tester (FAST™)
M.01: Aerospace Testing Services

Precision Combustion, Inc.
25 Science Park
New Haven, CT 06511

Precision Combustion is a research, development, application, and manufacture of tailored catalytic combustion technologies for high efficiency and reduced emissions.

Contact: J. Kevin Burns
203-786-5215

Product(s) Described:
Q.01: Catalytic Engine Coating
Q.02: Catalytic Glow Plug

Prospective Computer Analysts
1800 Northern Boulevard
Roslyn, NY 11576

Prospective Computer Analysts specializes in electronics troubleshooting and diagnostics software development.

Contact: R. Glenn Wright
516-484-4610

Product(s) Described:
B.04: Knowledge-Based Development Tool

PSI Technology Company
Physical Sciences Inc.
20 New England Business Center
Andover, MA 01810

The Electro-Optic Instrumentation Group of PSIT performs research, development, and application of specialized computer-coupled electro-optic instrumentation to serve defense, aerospace, industrial, and medical markets.

Contact: Anthony N. Pirri
508-689-0003

Product(s) Described:
L.02: Multi-Color Imaging Pyrometer
L.03: Optical Temperature Monitor

QCI, Inc.
P.O. Box 1067
Oak Ridge, TN 37831

QCI develops, manufactures, and markets quality control instruments to the plating industry and to inspection departments. It is an active exporter, with products in 30 countries. QCI is a winner of the R&D 100 award.

Contact: Roger W. Derby
615-483-6498

Product(s) Described:
K.09: Thermoelectric Microprobe

Radiation Monitoring Devices, Inc.
44 Hunt Street
Watertown, MA 02172

Radiation Monitoring Devices is a manufacturer of semiconductor devices and instruments based on nuclear radiation techniques.

Contact: Gerald Entine
617-926-1167

Product(s) Described:
F.07: Avalanche Photodiode Scintillation Detector (Prospective Product)
L.05: Resin Analyzer (Prospective Product)
K.10: Z Sensor
U.05: Ionizing Radiation Dosimetry System

Ribbon Technology Corporation
P.O. Box 30758
Gahanna, OH 43230

Ribbon Technology (Ribtec) is the world's largest manufacturer of stainless steel fibers used for reinforcing refractory concretes. Ribtec also provides contract research and development services for government and industry. Ribtec operates plasma arc furnaces for melting and casting reactive and refractory alloys to produce strip, ribbons, fibers and filaments through rapid solidification processing.

Contact: Lloyd Hackman
614-864-5444

Product(s) Described:
I.10: Titanium Fibers, Filaments, Strips, and Foils

Rocky Research
P.O. Box 61800, 1598 Foothill Drive
Boulder City, NV 89006-1800

Rocky Research specializes in product development of thermal equipment, and technology licensing.

Contact: Uwe Rockenfeller
702-293-0851

Product(s) Described:
O.04: High-Density Thermal Energy Storage System

Ross-Hime Designs, Inc.
1313 5th Street, S.E., #221
Minneapolis, MN 55414

Ross-Hime Designs engages in R&D of robotic mechanisms: wrists, hands, arms, legs, etc.

Contact: Mark Elling Rosheim
612-379-3808

Product(s) Described:
C.10: Omni-Wrist

S. R. Taylor & Associates
6105 Nowata Road
Bartlesville, OK 74006

Development of ultrasonic technologies for application to chemical and materials processing problems.

Contact: Scott R. Taylor
918-333-7052

Product(s) Described:
N.12: Ultrasonic Phase Separator

Sandia Systems, Inc.
2655-A Pan American Freeway, NE
Albuquerque, NM 87107

Sandia Systems is a research and development firm specializing in optical fabrication.

Contact: John R. McNeil
505-343-8112

Product(s) Described:
H.15: Ion Beam Optical Figuring (Prospective Product)

Satcon Technology Corporation
12 Emily Street
Cambridge, MA 02139-4507

SatCon is a research and development company concentrating on electro-mechanical control systems.

Contact: David B. Eisenhaure
617-661-0540

Product(s) Described:
A.05: Magnetic Bearings for Optical-Disk Buffer

V.01: Active Magnetic Micro-Gravity Isolator for Space Station
V.02: An Integrated Micro-Gyroscope
V.04: Integrated Power/Attitude Control Flywheels
V.05: Low Vibration Momentum Wheel
V.06: Magnetostrictive Active Members
V.08: Superconducting Large-Angle Magnetic Suspension

Schmidt Instruments, Inc.
2476 Bolsover, Suite 234
Houston, TX 77005

Schmidt Instruments focuses on three interconnected businesses. The first is instrumentation--expertise in the development, manufacture, and marketing of advanced control, data acquisition, and physical instrumentation components and systems, with specialization in time-of-flight mass spectrometers. The second is diamond growth--research efforts include heteroepitaxial diamond growth, N-Type doping of diamond, conversion of CFCs into diamond, low-temperature diamond growth, and DLC growth. Third is remote sensing--UV laser-induced fluorescence with lidar.

Contact: Lila R. Anderson
713-529-9040

Product(s) Described:
L.04: Space Rated, Rugged, Compact Time-of-Flight Mass Spectrometer

Schwartz Electro-Optics, Inc.
Solid State Laser Division
3404 North Orange Blossom Trail
Orlando, FL 32804

The Solid State Laser Division of Schwartz Electro-Optics designs and manufactures a line of solid state CW and pulsed lasers for a variety of scientific, medical, industrial, and OEM applications.

Contact: E. Adamkiewicz
407-298-1802

Product(s) Described:
H.03: Cobra 2000 Laser

Scientific Materials Corporation
P.O. Box 786 - 310 Icepond Road
Bozeman, MT 59715

Scientific Materials is a supplier of ND, CTH, Er:YAG laser rods and crystal research.

Contact: Ralph L. Hutcheson
406-585-3772

Product(s) Described:
H.07: Yttrium-Aluminum-Garnet Laser Rods

Scientific Research Associates, Inc.
P.O. Box 1058, 50 Nye Road
Glastonbury, CT 06033

Scientific Research Associates provides scientific software and consulting for the computational analysis of fluid dynamics, materials processing, and solid-state device applications. Experimental facilities are available to support design and analysis for these applications.

Contact: Stephen J. Shamroth
203-659-0333

Product(s) Described:
N.07: Particle Tracking Computer Software

SCS Telecom, Inc.
85 Old Shore Rd, Suite 200
Port Washington, NY 11050

SCS Telecom is a research and development firm.

Contact: Donald L. Schilling
516-883-0760

Product(s) Described:
A.12: Optical Ring Interconnect for Multiprocessors (Prospective Product)

SECA, Inc.
3311 Bob Wallace Avenue, Suite 203
Huntsville, AL 35805

SECA specializes in computational fluid dynamics code development and application to the solution of complex fluid mechanics problems.

Contact: Richard C. Farmer
205-534-2008

Product(s) Described:

N.10: The FDNS CFD Code

Sensors Unlimited, Inc.

3490 U.S. Route 1 North
Princeton, NJ 08540

Sensors Unlimited was organized in 1991 to exploit recent advances in III-V compound device technology for sensing and imaging applications in the 1000-3000 nm near-infrared (NIR) spectrum. Sensors Unlimited will perform applied research and development and do limited manufacturing of state-of-the-art sensing and emitting products such as infrared cameras, unique array structures and NIR lasers aimed at remote sensing, chemical analysis, and pollution monitoring applications.

Contact: Gregory H. Olsen
609-520-0610

Product(s) Described:

H.17: Room-Temperature Near-Infrared InGaAs Camera (Prospective Product)

Shason Microwave Corporation

1120 NASA Road 1, Suite 106
Houston, TX 77058

Shason Microwave is an engineering, technology, and manufacturing company supporting the commercial telecommunication market and federal and civil agencies. The market for these services and products is high-technology electronics systems such as radar system, solid-state (phased-array) antenna systems, satellite communication systems, and digital communication systems. Shason Microwave is involved in the custom application of microwave monolithic integrated circuits (MMICs) and the development of multi-function components for communication and radar systems.

Contact: Roland W. Shaw
713-333-1950

Product(s) Described:

F.02: Automated Reliability Test Set for Electronic Modules

G.02: Solid-State Active Ku-Band Antenna

SKW Corporation

1040 Calle Cordillera, Suite 105
San Clemente, CA 92672

SKW provides support to various government agencies in program management, system analysis and design, and advanced mathematical analysis. A particular strength is in infrared satellite development and related technologies.

Contact: Scott Bartel
714-361-5660

Product(s) Described:

S.10: Space Particulate Imaging Measurement

Software Productivity Solutions, Inc.

122 North Fourth Avenue
Indialantic, FL 32903

Software Productivity Solutions is a high-tech software company that specializes in advanced software products to improve software development productivity and increase software quality.

Contact: Edward R. Comer
407-984-3370

Product(s) Described:

B.03: InQuisiX

Solar Kinetics, Inc.

10635 King William Drive
Dallas, TX 75220

Solar Kinetics is a leading developer and manufacturer of various solar technologies. These include thermal, concentrating photovoltaic, and photochemical systems. The company has fabricated large, lightweight, stretched-membrane parabolic dishes ranging in diameter from 3 to 7 M. It has designed and installed turn-key parabolic trough fields for space and process heating and has developed concentrators for use in earth orbit. The company has also developed prototypes of 300-sun photovoltaic concentrators and plans to produce them.

Contact: David L. White
214-556-2376

Product(s) Described:

Q.08: Ultra-Lightweight, All-Metal Mirror Facet for a Solar-Dynamic Power System

Southwest Sciences, Inc.
1570 Pacheco Street, Suite E-11
Santa Fe, NM 87501

Southwest Sciences was established in 1985 to conduct basic and applied research in the physical sciences. The company addresses important research issues in combustion and energy science, atmospheric chemistry, and environmental trace species detection. The primary emphasis is on the development and use of state-of-the-are laser-based and mass spectrometric methods to attack these problems.

Contact: Alan C. Stanton
505-984-1322

Product(s) Described:
N.01: Diode Laser Oxygen Sensor

Space Instruments, Inc.
4403 Manchester Avenue, Suite 203
Encinitas, CA 92024

Space Instruments is engaged in electro-optical instrument design.

Contact: June Y. Hoffman
619-944-7001

Product(s) Described:
S.05: Cloud Top Radiometer
S.09: RSI 920 Radiometer

SPEC, Inc.
5401 Western Avenue, Suite B
Boulder, CO 80301

Stratton Park Engineering specializes in research and development of instrumentation for cloud physics and atmospheric research.

Contact: Donna Lawson
303-449-1105

Product(s) Described:
S.15: An Airborne Particle Imaging Nephelometer for Measuring Optical Phase Function (Prospective Product)

Spectral Sciences, Inc.
99 South Bedford Street, #7
Burlington, MA 01803-5169

Spectral Sciences performs contract research and development and sensor development.

Contact: Fritz Bien
617-273-4770

Product(s) Described:
S.06: Conductive Polymer Hydrazine Sensor
S.07: Hydrogen Laser Monitoring System
S.12: Trace Atmospheric Carbon Monoxide Sensor (TACOS)

Spire Corporation
Surface Engineering Division
One Patriots Park
Bedford, MA 01730-2396

The Surface Engineering Division of Spire Corporation performs surface modification services and builds equipment for ion-assisted coatings and ion implantation.

Contact: Richard S. Gregorio
617-275-6000

Product(s) Described:
E.02: III-V Compound Epi-Wafers
E.03: Indium-Phosphide Epitaxial Wafers and Solar Cells
J.04: IONGUARD®
J.05: Ion-Beam-Assisted Deposition

Spire Corporation
Optoelectronics Products and Services
One Patriots Park
Bedford, MA 01730-2396

The Optoelectronics Division of Spire Corporation is the leading merchant supplier MOCVD-grown GaAs, GaAlAs, InP, InGaAs and related epitaxial wafers for use in electronic, optoelectronic and microwave devices.

Contact: Richard S. Gregorio
617-275-6000

Product(s) Described:
H.05: High-Power Diode Laser for Solid-State Laser Pumping (SPI-LASE™ 50)
H.16: Photovoltaic Laser Power Converter (Prospective Product)

Springborn Laboratories, Inc.
Materials Science Division
One Springborn Center
Enfield, CT 06082

The Materials Science Division of Springborn Laboratories performs contract materials testing, research, development and engineering laboratory services, including product and process development, prototype manufacturing, plastics conversion via injection, compression and transfer molding and extrusion. It is also involved in the R&D of non-metallic materials including plastics, adhesives, coatings, and sealants, plus materials analysis and characterization through analytical and physical property determinations.

Contact: James P. Galica
203-749-8371

Product(s) Described:
I.03: Clean-Room Floor Tile Covering

Stanford Telecommunications, Inc.
System Engineering Division (SED)
1761 Business Center Drive
Reston, VA 22090

The System Engineering Division (SED) of Stanford Telecommunications has four business units: NASA Programs, Federal Aviation Administration (FAA) Programs, Department of Defence (DOD) Programs and Advanced Programs. Major areas of SED expertise include systems engineering, advanced concept hardware prototyping and development, software engineering, technology assessments, performance assessments, and trade-off analysis.

Contact: Aaron Weinberg
703-438-8022

Product(s) Described:
A.09: STel-9623 TDRSS User Transponder

Stirling Technology Company
2952 George Washington Way
Richland, WA 99352

Stirling Technology Company conducts research and development of technology related to long-life, maintenance-free Stirling cycle machines used in space and terrestrial power-producing and cryogenic cooling systems.

Contact: A. Bennett
509-375-4000

Product(s) Described:
P.01: Domestic Stirling Cycle Refrigerator
P.03: Long-Life Cryocoolers

Strainoptic Technologies, Inc.
108 West Montgomery Avenue
North Wales, PA 19454

Strainoptic manufactures and markets optical instruments for measuring strain, stress, and birefringence. The line includes optical polariscopes and polarimeters, polarizers and retarders, compensators and accessories for visual analysis, and PC-based Digital Image Analysis system. The spectral contents based birefringence measuring devices were recently incorporated, expanding the line.

Contact: Alex S. Redner
215-662-0100

Product(s) Described:
J.08: Stress Scanner Model SCA-1500

Symbiotics, Inc.
725 Concord Avenue
Cambridge, MA 02138

Symbiotics develops and sells software tools for "plug and go," program-to-program connectivity between applications running on heterogeneous hardware and software platforms. These distributed computing products are used by customers such as the government (NASA, DOD), system integrators, and independent software vendors to integrate application programs across computer networks.

Contact: Bruce H. Cottman
617-876-3635

Product(s) Described:
B.13: SOCIAL
B.21: NetWorks! (Prospective Product)

Systems Technology, Inc.
13766 South Hawthorne Boulevard
Hawthorne, CA 90250-7083

Systems Technology performs contract research and consulting in vehicle dynamics, control and human factors, and development of specialized, related software.

Contact: Jun Taira
310-679-2281

Product(s) Described:
A.06: Program CC, Version 4

Telenexus, Inc.
1410 Summit Avenue, Suite 1
Plano, TX 75074

Telenexus provides products and services in digital wireless communications. Products include wireless headset systems and wireless modems. Products can be modified for remote monitoring and control applications.

Contact: Lau Chuk
214-423-0667

Product(s) Described:
F.06: Wireless Headset Network

TeleRobotics International, Inc.
7325 Oak Ridge Highway, Suite 104
Knoxville, TN 37931

Extending man's capabilities through technology, TeleRobotics' designs, develops, and produces specialized robotics, remote viewing systems, and operator interfaces.

Contact: H. Lee Martin
615-690-5600

Product(s) Described:
H.10: Omniview

The Navtrol Company, Inc.
9204 Markville Drive
Dallas, TX 75243

The Navtrol Company designs and manufactures digital servo control, tracking, and instrumentation systems including gyro-stabilized systems.

Contact: Richard J. Brown
214-234-3319

Product(s) Described:
C.03: Dual-Axis, Digital Servo Controller

Thermacore, Inc.
780 Eden Road
Lancaster, PA 17601

Thermacore, a unit of DTX Corporation, is a heat-transfer company that specializes in the design, development, and manufacturing of heat pipes and thermal transfer devices for commercial and military customers.

Contact: Donald M. Ernst
717-569-6551

Product(s) Described:
O.01: Cryogenic Heat Pipe
O.03: HA4 Heat Pipe Cold Plate
O.07: Lightweight Ammonia Heat Pipe

TiNi Alloy Company
1144 65th Street, Suite A
Oakland, CA 94608

TiNi Alloy Company performs research and development in the area of shape-memory metals.

Contact: A. David Johnson
510-658-3172

Product(s) Described:
A.02: Digital Storage Device Prototype

Top-Vu Technology
2650 14th Street, NW
New Brighton, MN 55112

Top-Vu Technology specializes in microelectronics and computer sciences and researches, develops, and manufactures microsystems. The microelectronics services include design, layout and test of digital and analog integrated circuits; system integration of microcircuits; and signal processing of sensor data. In computer sciences, Top-Vu provides software programming. Top-Vu is an independent design center for Triquint and Vitesse GaAs foundries.

Contact: Tho Vu
612-633-5925

Product(s) Described:

F.04: GaAs Readout and Preprocessing Electronics

Triangle R&D Corporation

P.O. Box 12696
Research Triangle Park, NC 27709

Triangle R&D investigates new technologies related to thermal science and heat transfer, health care and medicine, impact and vibration control, optics, fiberoptics, and robotics. The company also develops new and innovative products that are marketed through joint ventures and licensing arrangements.

Contact: David P. Colvin
919-781-8148

Product(s) Described:

B.15: Smart Eyes for Bar Code Labels
O.08: MicroPCM Coolants and PCM Thermal Capacitors for Enhanced Heat Transfer and Storage
O.11: Textile Fibers with Embedded Microencapsulated Phase-Change Materials for High Thermal Storage

Turbulence Prediction Systems

3131 Indian Road
Boulder, CO 80301

Turbulence Prediction Systems engages in the design, development, and manufacturing of instruments including, but not limited to, infrared devices.

Contact: H. Patrick Adamson
303-443-8157

Product(s) Described:

S.03: Advance Warning Airborne System

Ultramet

12173 Montague Street
Pacoima, CA 91331

Ultramet specializes in research, development, and production of advanced high temperature (refractory) materials by chemical vapor deposition (CVD) and infiltration (CVI).

Contact: Robert H. Tuffias
818-899-0236

Product(s) Described:

I.05: Iridium/Rhenium Liquid Rocket Thrust Chamber

Umpqua Research Company

Aerospace Division
P.O. Box 791 - 125 Volunteer Way
Myrtle Creek, OR 97457

Contact: Gerald V. Colombo
503-863-7770

Product(s) Described:

S.11: Thermally Regenerable Airborne Trace Organic Contaminant Control Cartridge
T.01: Catalytic Oxidizer for Removal of Aqueous Organic Contaminants
T.02: Electrochemical Water Purification System
T.03: Enzyme-Based Heterogeneous Oxidation Catalyst
T.04: Flow-Through Device for Acid Gas Removal from Aqueous Solution
T.05: Immobilized Enzyme Catalysts
T.08: Regenerable Microbial Check Valve
T.09: On-Line Process Ammonia Analyzer (Prospective Product)

ViGYAN Research Associates, Inc.

30 Research Drive
Hampton, VA 23666-1325

ViGYAN performs aerospace research and development.

Contact: Paresh Parikh
804-865-6575

Product(s) Described:

B.16: VGRID3D
B.18: VPLOT3D
S.08: Pilot Weather Advisor

Water Reuse Technology

75 Ina Court
Alamo, CA 94507

Water Reuse Technology is presently engaged in the areas of desalting saline waters by distillation, the concentration of aqueous toxic waste solutions, the recovery of distilled water from waste oil well waters, and the use of solar energy for multiple effect distillation and is also a consulting firm in the areas of heat transfer and thermodynamic processes.

Contact: Badawi Tleimat
510-838-0369

Product(s) Described:

T.10: Recovery of Distilled Water from Gray Water (Prospective Product)

Winzen International, Inc.

Engineering
12001 Network Boulevard, Suite 200
San Antonio, TX 78249

Winzen International specializes in the construction of high altitude scientific balloons.

Contact: James L. Rand
512-690-3400

Product(s) Described:

K.01: Automated Seal-Flaw Detection

Index of Products by NASA Center

Ames Research Center (ARC)

Goddard Space Flight Center (GSFC)

Jet Propulsion Laboratory (JPL)

Johnson Space Center (JSC)

B.08: Neural Networks for Fault Monitoring
B.20: I-Gate® (Prospective Product)
B.23: TeamSchedule (Prospective Product)
T.09: On Line Process Ammonia Analyzer (Prospective Product)
C.02: Cybernet Force-Reflecting Handcontroller
C.12: Reactive Planning for EVA Retriever
C.15: Zero-G Robotic Testbed
F.02: Automated Reliability Test Set for Electronic Modules
G.02: Solid-State Active Ku-Band Antenna
H.02: Alpha-Numeric Electrochromic Displays
H.06: Interferometer for Aspheric Testing
H.13: Solid State Laser Scanner
I.09: Rigid Zirconia Fibrous Tile
I.13: Silicon Carbide Insulation (Prospective Product)
N.12: Ultrasonic Phase Separator
O.03: HA4 Heat Pipe Cold Plate
O.04: High-Density Thermal Energy Storage System
O.05: High-Heat-Flux, Condensing Heat Exchanger
O.06: High-Heat-Flux, Single-Phase Exchanger
O.08: MicroPCM Coolants and PCM Thermal Capacitors for Enhanced Heat Transfer and Storage
O.11: Textile Fibers with Embedded Microencapsulated Phase-Change Materials for High Thermal Storage
O.12: Nontoxic, Two-Phase, Heat Transport Fluid (Prospective Product)
S.06: Conductive Polymer Hydrazine Sensor
S.11: Thermally Regenerable Airborne Trace Organic Contaminant Control Cartridge
T.02: Electrochemical Water Purification System
T.06: Membrane-Based Wash-Water Recovery Unit
T.07: Process-Control Water Quality Monitor
T.08: Regenerable Microbial Check Valve
U.01: Calorimeter and Waste Management System
U.02: DELTA™
U.04: $Flur0_2$
U.05: Ionizing Radiation Dosimetry System
U.07: Non-Invasive Hemodynamic Management System

Kennedy Space Center (KSC)

B.04: Knowledge-Based Development Tool
B.10: ObjectExpress®
B.13: SOCIAL
B.21: NetWorks! (Prospective Product)
C.13: Serpentine Truss Robot
F.06: Wireless Headset Network
I.03: Clean-Room Floor Tile Covering
J.09: A Real-Time NVR Monitor (Prospective Product)
K.06: Instrumented Torque Wrench (INTOWS)
O.10: SCAPE-Suit Heater
P.04: Non-Clogging, Self-Regulating, Joule-Thomson Cryostat
S.02: A Non-Optical, Real-Time Particle Fallout Monitor
S.07: Hydrogen Laser Monitoring System
S.13: VaporSep Systems
U.03: Fiber-Optic pH Optrode and Electronics Interface
U.08: Variable-Speed Mid-Deck Centrifuge

Langley Research Center (LaRC)

A.06: Program CC, Version 4
A.11: Optical Ring Interconnect for Multiprocessors (Prospective Product)
B.02: FDP 3107 Frequency Domain Processor
B.03: InQuisiX
B.16: VGRID3D
B.18: VPLOT3D
C.10: Omni-Wrist
C.14: Tactile Sensor
D.01: Adaptive Imager
E.02: III-V Compound Epi-Wafers
H.03: Cobra 2000 Laser
H.04: Eagle 3004 Vision System
H.05: High-Power Diode Laser for Solid-State Laser Pumping (SPI-LASE™ 50)
H.07: Laser Rods: Yttrium-Aluminum-Garnet
H.10: Omniview
H.16: Photovoltaic Laser Power Converter (Prospective Product)
I.02: CVD Silicon Carbide™
I.06: Polyamide/Liquid-Crystal-Polymer Blend
I.07: Polyimide Foam
I.08: Polymer Reaction Monitor
I.10: Titanium Fibers, Filaments, Strips, and Foils
I.12: Carbon-Carbon Composites (Prospective Product)
I.13: Silicon Carbide Insulation (Prospective Product)
K.02: Dual-Beam Lens for Micro-NDE
K.03: Dynamic Laser Speckle Profilometer (DyLASP)
K.05: High-Energy, Dual-Energy Computed Tomography Detector Package
K.07: Model V-1701 Digital Image-Oriented Signal Processing System
K.08: QUEST Integrated Load-Frame and Computed-Tomography System
K.09: Thermoelectric Microprobe
L.05: Resin Analyzer (Prospective Product)
M.01: Aerospace Testing Services
M.07: Laser Speckle Correlator

N.01: Diode-Laser Oxygen Sensor
N.04: NEKTON® Fluid-Flow Numerical Simulator
N.09: TMRCAA
S.01: 200 MHz Surface Acoustic Wave Aerosol Particle and Chemical Vapor Sensor
S.03: Advance Warning Airborne System
S.08: Pilot Weather Advisor
S.15: An Airborne Particle Imaging Nephelometer for Measuring Optical Phase Function (Prospective Product)
V.02: An Integrated Micro-Gyroscope
V.08: Superconducting Large-Angle Magnetic Suspension

Lewis Research Center (LeRC)

E.03: Indium-Phosphide Epitaxial Wafers and Solar Cells
E.04: Superconducting YBCO Films on Sapphire
G.01: Custom, Fully Monolithic GaAs Switch Matrix Subsystems
H.09: Multimode Optical Switch and Control Unit
I.04: Distributed Fiber-Optic Composite-Material Cure Monitoring and Control System
I.05: Iridium/Rhenium Liquid Rocket Thrust Chamber
I.11: Tungsten and Molybdenum Alloys
J.01: Accessories for Pulsed Laser Deposition
J.02: Advanced Melt Spinner Equipment - Model 10TX
J.03: DIFKIN, A Coupled-Mass Transport and Chemical Kinetics Code for CVD Modeling
J.05: Ion-Beam-Assisted Deposition
L.04: Space Rated, Rugged, Compact Time-of-Flight Mass Spectrometer
M.01: Aerospace Testing Services
M.05: Eddy Current Repulsion De-Icing Strip
M.08: NEARLEWICE
N.03: FIDAP™ (Fluid Dynamics Analysis Package)
N.05: Optical-Fiber Temperature Sensor
N.08: Rayleigh Scattering Diagnostic for Density and Temperature
N.11: The Phase Doppler Particle Analyzer
O.02: Gas Dynamic Compressor
Q.01: Catalytic Engine Coating
Q.02: Catalytic Glow Plug
Q.04: Composite-Matrix Regenerators for Stirling-Cycle Engines
Q.07: STAR™ Reciprocating Alternator/Motor
Q.08: Ultra-Lightweight, All-Metal Mirror Facet for a Solar-Dynamic Power System
V.03: Inertial Linear Actuator

Marshall Space Flight Center (MSFC)

B.07: Neural Net Toolbox
B.09: NueX™
B.11: Real-Time Integrated GPS/INS Navigation and Attitude Determination Software
B.17: VODEM Manual Data Entry and Proofreading System
B.22: NOISE Software (Prospective Product)
C.05: Holotrack
D.04: SHARPS
H.15: Ion Beam Optical Figuring (Prospective Product)
J.04: IONGUARD®
J.06: Model 1000 Welding Controller
J.07: Real-Time, Adaptive-Vision Welding Guidance System
J.10: Cathodic Arc Deposited Coatings (Prospective Product)
J.12: Microgravity Sonic Pump Furnace (Prospective Product)
N.02: FASTRAN
N.06: PHLOW
N.07: Particle Tracking Computer Software
N.10: The FDNS CFD Code
O.07: Lightweight Ammonia Heat Pipe
O.08: MicroPCM Coolants and PCM Thermal Capacitors for Enhanced Heat Transfer and Storage
O.09: Nonazeotropic Heat Pump for Water Heating
S.12: Trace Atmospheric Carbon Monoxide Sensor (TACOS)
T.01: Catalytic Oxidizer for Removal of Aqueous Organic Contaminants
T.03: Enzyme-Based Heterogeneous Oxidation Catalyst
T.04: Flow-Through Device for Acid Gas Removal from Aqueous Solution
T.05: Immobilized Enzyme Catalysts
V.01: Active Magnetic Micro-Gravity Isolator for Space Station
V.04: Integrated Power/Attitude Control Flywheels
V.07: Metal-Coated Kevlar Tether
V.11: Video Monitoring System

Stennis Space Center (SSC)

B.01: English Language Interface to the Geographical Information System GRASS
B.06: GIS-Multi-View

Index of Products by NASA SBIR Solicitation Topic

This section lists the products according to the technical topics contained in NASA's annual program solicitation. These topics serve as the basis for requesting proposals that meet NASA's needs for research and development in aeronautics and space technology.

Topic 01: Aeronautical Propulsion and Power

Topic 02: Aerodynamics and Acoustics

Topic 03: Aircraft Systems, Subsystems, and Operations

Topic 04: Materials and Structures

Topic 05: Teleoperators and Robotics

C.09: Odetics Dexterous Manipulator
C.10: Omni-Wrist
C.12: Reactive Planning for EVA Retriever
C.13: Serpentine Truss Robot
C.14: Tactile Sensor
C.15: Zero-G Robotic Testbed
H.04: Eagle 3004 Vision System
K.10: Z Sensor
V.02: An Integrated Micro-Gyroscope
V.05: Low Vibration Momentum Wheel

Topic 06: Computer Sciences and Applications

A.02: Digital Storage Device Prototype
A.04: Intelligent Computational Resource Management System
A.07: QASE®RT
A.10: Spacecraft Supercomputer
B.03: InQuisIX
B.04: Knowledge-Based Development Tool
B.08: Neural Networks for Fault Monitoring
B.10: ObjectExpress®
B.13: SOCIAL
B.19: DTS Scheduling Software (Prospective Product)
B.21: NetWorksI (Prospective Product)
B.23: TeamSchedule (Prospective Product)
C.04: Ground Vehicle Manager's Associate
E.05: Three-Dimensional Short Stack
H.13: Solid State Laser Scanner

Topic 07: Information Systems and Data Handling

A.01: Acousto-Optic Spectrometer
A.11: Optical Ring Interconnect for Multiprocessors (Prospective Product)
B.01: English Language Interface to the Geographical Information System GRASS
B.06: GIS-Multi-View
B.09: NueX™
B.14: Sentinel
B.17: VODEM Manual Data Entry and Proofreading System
D.01: Adaptive Imager
D.03: Interferometric Satellite Tracking System
H.10: OmniView

Topic 08: Instrumentation and Sensors

A.05: Magnetic Bearings for Optical-Disk Buffer
A.09: STel-9623 TDRSS User Transponder
B.02: FDP 3107 Frequency Domain Processor
D.02: Digital Image Profiler
D.04: SHARPS
E.02: III-V Compound Epi-Wafers
F.01: Auto-Cal Detector Calibration System
F.03: Cryogenic TIA Input Stage
F.04: GaAs Readout and Preprocessing Electronics
F.05: JF-4 Integrating Cryogenic Amplifier
F.07: Avalanche Photodiode Scintillation Detector (Prospective Product)
H.01: Acousto-Optic Tunable Filters
H.03: Cobra 2000 Laser
H.05: High-Power Diode Laser for Solid-State Laser Pumping (SPI-LASE™ 50)
H.07: Laser Rods: Yttrium-Aluminum-Garnet
H.08: Model 100 Profilometer
H.14: Ultra-Violet Fourier Transform Spectrome
H.15: Ion Beam Optical Figuring (Prospective Product)
H.17: Room-Temperature Near-Infrared InGaAs Camera (Prospective Product)
I.02: CVD Silicon Carbide™
J.03: DIFKIN, A Coupled-Mass Transport and Chemical Kinetics Code for CVD Modeling
J.11: In-Situ Interferometer for Diamond Turning Machine (Prospective Product)
L.01: Miniature Materials Analysis X-Ray Laboratory
L.04: Space Rated, Rugged, Compact Time-of-Flight Mass Spectrometer
M.02: An Optical Angle-of-Attack Sensor
P.02: Helium Transfer Pump
R.01: AOCI (Airborne Ocean Color Image)
R.02: MER-2020 Oceanographic Instrument
R.03: PNF-300 Profiling Natural Fluorometer
S.01: 200 MHz Surface Acoustic Wave Aerosol Particle and Chemical Vapor Sensor
S.05: Cloud Top Radiometer
S.09: RSI 920 Radiometer
S.10: Space Particulate Imaging Measurement
S.12: Trace Atmospheric Carbon Monoxide Sensor (TACOS)
S.14: Wildfire
S.15: An Airborne Particle Imaging Nephelometer for Measuring Optical Phase Function (Prospective Product)

Topic 09: Spacecraft Systems and Subsystems

B.11: Real-Time Integrated GPS/INS Navigation and Attitude Determination Software
C.02: Cybernet Force-Reflecting Handcontroller
K.01: Automated Seal-Flaw Detection
O.01: Cryogenic Heat Pipe
O.03: HA4 Heat Pipe Cold Plate
O.04: High-Density Thermal Energy Storage System
O.05: High-Heat-Flux, Condensing Heat Exchanger
O.06: High-Heat-Flux, Single-Phase Exchanger
O.07: Lightweight Ammonia Heat Pipe

O.08: MicroPCM Coolants and PCM Thermal Capacitors for Enhanced Heat Transfer and Storage
O.09: Nonazeotropic Heat Pump for Water Heating
O.12: Nontoxic, Two-Phase, Heat Transport Fluid (Prospective Product)
P.01: Domestic Stirling Cycle Refrigerator
P.03: Long-Life Cryocoolers
Q.03: Chemical/Mechanical Heat Pump
Q.05: Pyroelectric Converter
V.07: Metal-Coated Kevlar Tether
V.08: Superconducting Large-Angle Magnetic Suspension
V.09: T-Reaction Wheel
V.10: T-SCANWHEEL
V.11: Video Monitoring System

Topic 10: Space Power

E.03: Indium-Phosphide Epitaxial Wafers and Solar Cells
H.16: Photovoltaic Laser Power Converter (Prospective Product)
J.12: Microgravity Sonic Pump Furnace (Prospective Product)
Q.04: Composite-Matrix Regenerators for Stirling-Cycle Engines
Q.06: ReLi® Rechargeable Lithium Cells and Batteries
Q.07: STAR™ Reciprocating Alternator/Motor
Q.08: Ultra-Lightweight, All-Metal Mirror Facet for a Solar-Dynamic Power System
V.04: Integrated Power/Attitude Control Flywheels

Topic 11: Space Propulsion

I.05: Iridium/Rhenium Liquid Rocket Thrust Chamber
J.04: IONGUARD®
N.02: FASTRAN
N.07: Particle Tracking Computer Software
P.04: Non-Clogging, Self-Regulating, Joule-Thomson Cryostat

Topic 12: Human Habitability and Biology in Space

A.03: Holographic Helmet-Mounted Display
H.02: Alpha-Numeric Electrochromic Displays
H.06: Interferometer for Aspheric Testing
N.12: Ultrasonic Phase Separator
O.08: MicroPCM Coolants and PCM Thermal Capacitors for Enhanced Heat Transfer and Storage
O.11: Textile Fibers with Embedded Microencapsulated Phase-Change Materials for High Thermal Storage
S.04: Atmospheric Trace Gas Fluxmeter
S.11: Thermally Regenerable Airborne Trace Organic Contaminant Control Cartridge
T.01: Catalytic Oxidizer for Removal of Aqueous Organic Contaminants
T.02: Electrochemical Water Purification System
T.03: Enzyme-Based Heterogeneous Oxidation Catalyst
T.04: Flow-Through Device for Acid Gas Removal from Aqueous Solution
T.05: Immobilized Enzyme Catalysts
T.06: Membrane-Based Wash-Water Recovery Unit
T.07: Process-Control Water Quality Monitor
T.08: Regenerable Microbial Check Valve
T.09: On Line Process Ammonia Analyzer (Prospective Product)
T.10: Recovery of Distilled Water from Gray Water (Prospective Product)
U.01: Calorimeter and Waste Management System
U.02: DELTA™
U.03: Fiber-Optic pH Optrode and Electronics Interface
U.05: Ionizing Radiation Dosimetry System
U.06: MRTA Model 1200
U.07: Non-Invasive Hemodynamic Management System
U.08: Variable-Speed Mid-Deck Centrifuge

Topic 13: Quality Assurance, Safety, and Check-Out for Ground and Space Organizations

E.01: ARACOR VLSI Qualification Test System
F.06: Wireless Headset Network
J.09: A Real-Time NVR Monitor (Prospective Product)
K.03: Dynamic Laser Speckle Profilometer (DyLASP)
K.06: Instrumented Torque Wrench (INTOWS)
K.07: Model V-1701 Digital Image-Oriented Signal Processing System
K.09: Thermoelectric Microprobe
O.10: SCAPE-Suit Heater
S.02: A Non-Optical, Real-Time Particle Fallout Monitor
S.06: Conductive Polymer Hydrazine Sensor
S.07: Hydrogen Laser Monitoring System
S.13: VaporSep Systems

Topic 14: Satellite and Space Systems Communications

C.03: Dual-Axis, Digital Servo Controller
F.02: Automated Reliability Test Set for Electronic Modules
G.01: Custom, Fully Monolithic GaAs Switch Matrix Subsystems
G.02: Solid-State Active Ku-Band Antenna
H.11: Series 120 Diode-Pumped Solid-State Ring Laser
H.12: Series 122 Diode-Pumped Solid-State Non-Planar Ring Laser

Topic 15: Materials Processing, Micro-Gravity, and Commercial Applications in Space

J.02: Advanced Melt Spinner Equipment - Model 10TX
L.02: Multi-Color Imaging Pyrometer
L.03: Optical Temperature Monitor
N.03: FIDAP™ (Fluid Dynamics Analysis Package)
N.04: NEKTON® Fluid-Flow Numerical Simulator
U.04: FlurO_2
V.01: Active Magnetic Micro-Gravity Isolator for Space Station
V.03: Inertial Linear Actuator

Index of Firms by State

Mississippi
Delta Data Systems, Inc.

Montana
Scientific Materials Corporation

Nevada
Rocky Research

New Hampshire
Creare, Inc.
Fluent, Inc.

New Jersey
Continuum Dynamics, Inc.
Electronic Associates, Inc.
Gait Scan, Inc.
Sensors Unlimited, Inc.

New Mexico
Applied Technology Associates, Inc.
Sandia Systems, Inc.
Southwest Sciences, Inc.

New York
Clever Fellows Innovation Consortium, Inc.
Conax Buffalo Corporation
Convolve, Inc.
High Technology Systems, Inc.
Ithaco, Inc.
Macrodyne, Inc.
Metadyne, Inc.
Prospective Computer Analysts
SCS Telecom, Inc.

North Carolina
McMahan Electro-Optics, Inc.
Triangle R&D Corporation

Ohio
Fiber Materials, Inc.
Ribbon Technology Corporation

Oklahoma
S. R. Taylor & Associates

Oregon
Bend Research, Inc.
Umpqua Research Company

Pennsylvania
Biochem Technology, Inc.
Micro-G Research, Inc.
Strainoptic Technologies, Inc.
Thermacore, Inc.

Tennesee
Accurate Automation Corporation
ERC, Inc.
Mid-South Engineering, Inc.
QCI, Inc.
TeleRobotics International, Inc.

Texas
Astro International Corporation
Computational Mechanics Company
Schmidt Instruments, Inc.
Shason Microwave Corporation
Solar Kinetics, Inc.
Telenexus, Inc.
The Navtrol Company, Inc.
Winzen International, Inc.

Utah
Bonneville Scientific, Inc.

Virginia
American Research Corporation of Virginia
Coleman Research Corporation
Interferometrics, Inc.
Stanford Telecommunications, Inc.
VIGYAN Research Associates, Inc.

Washington
Electroimpact, Inc.
Stirling Technology Company

Wisconsin
Orbital Technologies Corporation

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