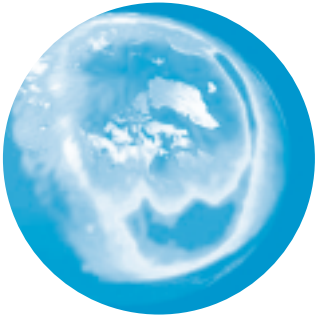
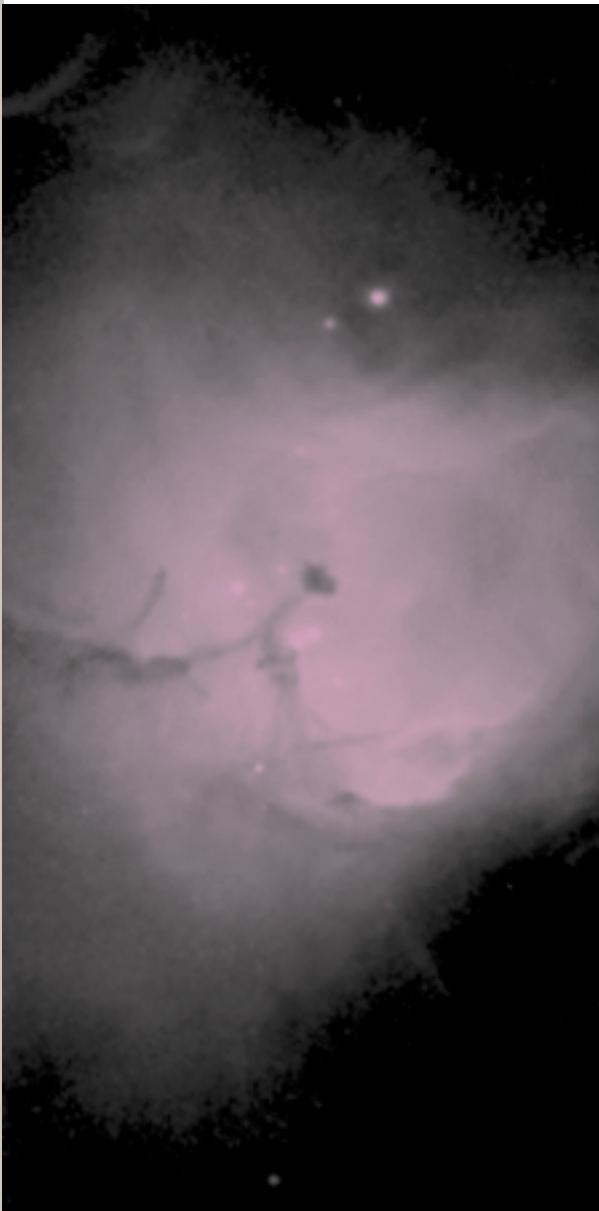


2000

Technology Transfer R e p o r t



a Technology
Commercialization
Office
publication



2000 Technology Transfer Report

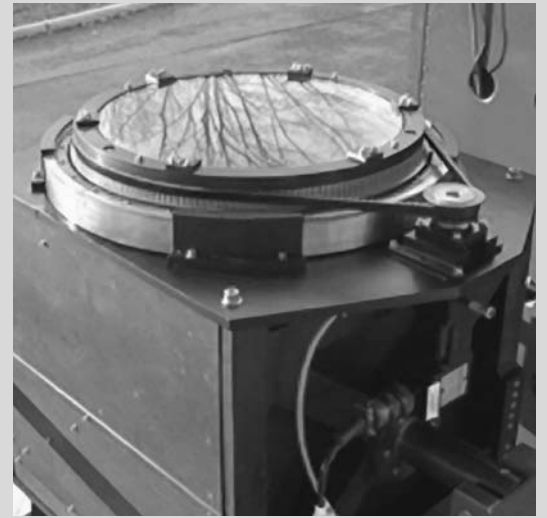
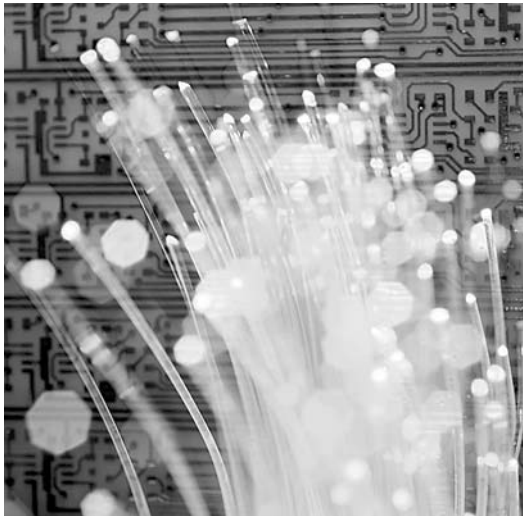
NASA's Goddard Space Flight Center

Table of Contents

| | |
|---|----|
| Who We Are | 2 |
| Activities in 2000 | 6 |
| Encouraging Researcher Involvement | 7 |
| Inventorying New Technologies | 8 |
| Patenting Goddard Technologies | 12 |
| Promoting Goddard Technologies | 12 |
| Establishing and Maintaining Agreements | 21 |
| Seeking and Bestowing Awards | 22 |
| How to Reach Goddard's Technology Commercialization Office | 24 |

Since its inception, Goddard has pursued a commitment to technology transfer and commercialization. For every space technology developed, Goddard strives to identify secondary applications. Goddard then provides the technologies, as well as its expertise and facilities, to U.S. companies, universities, and government agencies. These efforts are based in Goddard's Technology Commercialization Office (TCO).

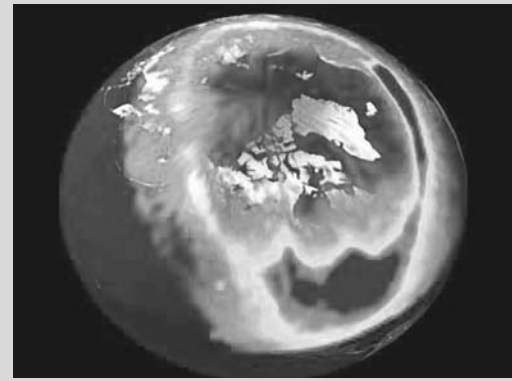
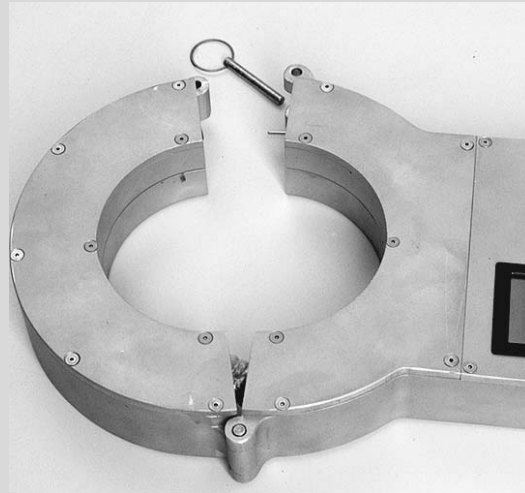
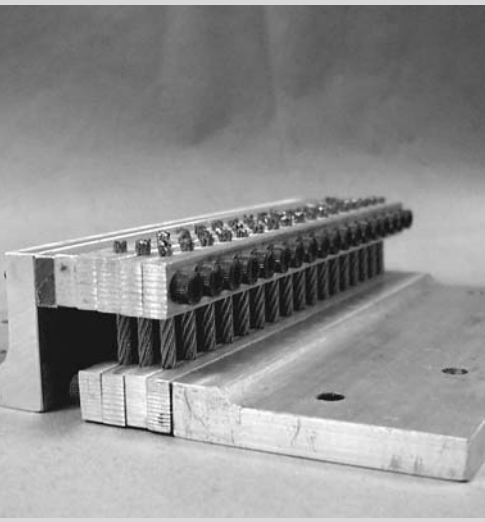
This report presents TCO's activities and accomplishments during calendar year 2000.



Who We Are

Technology transfer and commercialization are an important part of the mission at NASA's Goddard Space Flight Center. Goddard's technology, expertise, and facilities are a national asset that can be used to develop new products and processes that benefit the United States. These benefits include increasing the nation's competitiveness, creating jobs, improving the balance of trade, and enriching the lives of the citizenry. To ensure that these benefits are achieved, Goddard established the Technology Commercialization Office.

Technology Com^{G O}



d d a r d's *mercialization Office*

3

TCO leads Goddard's technology transfer efforts by

- Seeking out Goddard research and development that has the potential of being successfully transferred to meet industry and national needs
- Inventorying newly developed technologies
- Patenting Goddard-developed inventions
- Promoting Goddard technologies, facilities, and capabilities to potential partners
- Negotiating license agreements and partnerships with industry and academia
- Promoting successful transfer and commercialization efforts

These key activities, and the efforts that support their completion, are performed by four teams that work together to facilitate technology transfer and commercialization. For information on how to contact staff, please see page 24.

The collective and collaborative efforts of these four teams resulted in several accomplishments during calendar year 2000.



Commercial Technology Staff

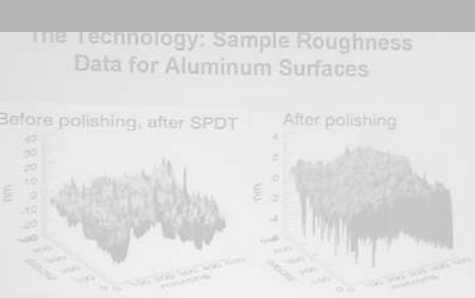
Commercial technology staff work with industry, academia, and other government agencies to transfer Goddard technologies and to help these organizations solve their technical problems that fall in six areas of Goddard's expertise:

- Environmental systems
- Guidance, navigation, and control (GNC)
- Information systems
- Optics
- Sensors and detectors
- Thermal and cryogenics

Staff also negotiate licensing or partnership agreements.

Patent Counsel

Goddard's Office of Patent Counsel prepares patent applications and other patent-related documents, and reviews Space Act, license, and nondisclosure agreements. Patent counsel also helps determine the patent potential of new Goddard technologies and oversees intellectual property issues.



Outreach and Integration Staff

Outreach and integration staff market Goddard-developed technologies that are available for commercialization and publicize technology commercialization successes. These outreach efforts are conducted using Technology Opportunity Sheets, *NASA Tech Briefs*, *Commerce Business Daily*, NASA Television, the Internet, news releases to and articles in trade journals, and presentations at conferences (see page 19). Staff also work to integrate Goddard researchers into the commercialization process (see page 7).

Small Business Innovative Research Staff

Extra efforts to involve smaller businesses are made under the auspices of the Small Business Innovation Research (SBIR) program. The SBIR program offers grants to small businesses to meet federal research and development needs. A similar program—the Small Business Technology Transfer (STTR) program—involves teams of small businesses and research institutions conducting research jointly.



Activities in 2000

The Technology Commercialization Office's overall mission is to introduce Goddard technologies, capabilities, and facilities into the commercial, academic, and government communities. To achieve this mission, TCO undertakes many activities:

- Encouraging researcher involvement in the technology commercialization process
- Inventorying new technologies developed at Goddard
- Patenting Goddard technologies
- Promoting available technologies and facilities
- Establishing and maintaining agreements with industry, academia, and other government agencies
- Seeking and bestowing awards for Goddard technologies

Encouraging Researcher Involvement

Technology transfer would not be possible without the participation of Goddard's scientific and technical staff. Every year, the Technology Commercialization Office undertakes many efforts to encourage researcher participation. For example, TCO hosts an annual reception to honor civil servants who report new technologies or provide outstanding contributions to commercialization. In calendar year 2000, more than 75 civil servants participated in the technology transfer process:

| | | | |
|---------------------|----------------------|---------------------|-------------------|
| Delmar Arbogast | D. Dalton | Jacqueline LeMoigne | Joseph Schepis |
| Jeannette Benavides | Gary T. Davis | John Leon | David Schwinger |
| Carlos Bernabe | Thomas Flatley | Douglas Leviton | Ashok Sharma |
| David Beverley | Edward Gaddy | Maurice Lewis | Edward Sittler |
| Thomas Bialas | Jerry Garegnani | Camilla Logan | James Tilton |
| Geoffrey Bland | John Godfrey | Thomas McGee | Carlos Trujillo |
| Kenneth Blumenstock | Claf Hakun | Ted Miles | John Vranish |
| Vincent Bly | Paul Haney | Brent Mott | Eugene Waluschka |
| William Braun | Michael Hartman | Quang Nguyen | Evan Webb |
| Julie Breed | Carlos Hernandez | Sharon Orsborne | Paul Westmeyer |
| Jamie Britt | Phyllis Hestnes | Carla Patterson | Charles Wright |
| Joseph Burt | Norden Huang | Leslie Payne | Charles Zakrzwski |
| Charles Campbell | David Israel | William Pence | William Zhang |
| William Campbell | Clarence Johnson | David Petrick | Nigel Ziyad |
| Cynthia Cheung | Karen Keadle-Calvert | Scott Pursley | |
| Michael Choi | Richard Katz | Glenn Rakow | |
| Michael Comberiate | John Keller | James Rash | |
| Patrick Coronado | Semion Kizhner | George Reinhardt | |
| Alan Cudmore | Robert Knox | Carolina Ridgeway | |
| William Cutlip | John Kolasinski | David Robinson | |
| | Kenneth Y. Lee | Jacob Rosenberg | |
| | | Christopher Rouff | |

Inventorying New Technologies

One of the primary ways that Goddard researchers participate in the technology transfer process is by identifying, documenting, and reporting their new technologies to the Technology Commercialization Office. TCO then maintains an inventory of these reported technologies. These pages list all of the technologies reported in calendar year 2000, categorized according to Goddard's areas of technical expertise.



Environmental Systems

Direct Readout Level-1 Processing System for the Terra MODIS Instrument Data

Electrostatically Clean Solar Array Panel

High-Altitude, Long-Duration Balloon Missions

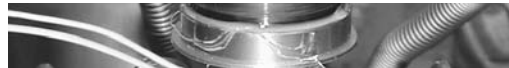
Minimum Cycle Slip Airborne Differential Carrier Phase GPS Antenna

Nadir Viewing System for Solar Wind Measurements by Solar Probe

Regional Application Center Software, RODIN

Small Electric Powered Uninhabited Aerial Vehicle

Spectral-Ratio Biospheric Lidar



Thermal and Cryogenics

Cutting Thin Glass Using Heat Stress

High-Temperature Thermal Blanket for Temperatures up to 2,100 °C

Innovative Manufacturing Procedure for Low-Cost and High-Quality Carbon Nanotubes

Low-Power Cryogenic Shutter Mechanism for Use in Infrared Images

NASA Internal Combustion Engine

Temperature-Control System to Keep the Heitronics IR Thermometer Working in Cold Conditions

Three-Phase Inverter for Small, High-Speed Motors



Guidance, Navigation, and Control

Attitude Determination System and Method
Autonomous Solar Navigation System
Development of Catalytic MEMS Thrusters
Dual Sorted Array Method for Determining Stars within or Near a Star Tracker Field of View
Electrostatic Torque Obtained from a Pair of Rapidly Moving Charge Spores
GPS-Enhanced Orbit Determination Experiment
Launch System with Long-Range Remote Fuel Delivery via Slingatrons and Explosive Blast Wave Man-Rateable Acceleration into Orbit
Magnetic Moment Reduction
Methods and Systems for the Calibration/Mitigation of the Inter-Star-Tracker Misalignments in a Stellar-Inertial Attitude Determination System
Shock Attenuation Technique for a Structurally Stiff Bolted Interface
Simple Approach to Ensure Spacecraft Onboard Kalman Filter Numerical Stability
Stellar Inertial Attitude Determination System with Weighted Noise Covariance Matrix Filter
Stellar Inertial Attitude Determination Systems with Variable Star Data Averaging Techniques
System for Stellar Inertial Attitude Determination
World-Wide Portable Animal Satellite Locator System



Optics

Absolute Cartesian Encoder
Absolute Frequency Locking Technique for Far-Infrared Pump Lasers
Apparatus that Divides and Coregisters Multiple Optical Beams with Ultra-High Accuracy and Vibration and Thermal Stability
Chemical Stripping Fixture for Ribbon-Type Optical Fiber Cables
Compact, Highly Efficient, and Rugged UV Source Based on Fiber Lasers
Fast All-Optical Switch
Holographic Memory Module with Ultra-High Capacity and Throughput
Laser Diode with High-Frequency Surge and Electrostatic Discharge Protection
Lightweight Optical Mirrors Formed in Single Crystal Silicon
Magnetically Suspended Optical Chopper Wheel with Six-Axis Control
Method of Producing Complex Valued Optical Modulation from Limited Range Light Modulating Arrays by Blending Error Diffusion with Pseudorandom Encoding
Minimizing Gravity Sag of a Large Mirror with an Inverted Hindle Mount
Novel Pupil for Detecting Faint Objects in the Presence of a Bright Source
Optical Design for Testing Grazing Incidence Optics
Quadruple Precision Optics Ray Trace Code (QRAYPKS)
Vibration Stable, Ultra-Precision Multiple Axes Rotational Optical Component Adjustment Mechanism



Information Systems

- 29KPL154: A Small, Configurable Processor
- Access to Space Interactive Mission Design Website
- Advanced Spacecraft Integration and Test Software (ASIST), Front End Data Systems/Digital History Data Store Software (FEDS/DHDS)
- All EOS PM
- Application of HHT for Sound Enhancement and Filtering
- Article-Application of Soft Computing in Coherent Communications Phase Synchronization
- Automated Multimodal Trend Analysis System
- DADS/EOS
- Deriving Formal Specifications and Code from Scenarios
- DIPS: Distributed Environment for Onboard Planning and Scheduling
- ECS Software
- Enhancement to Segmented Cold Cathode Display Panel Invention
- Extension of Discrete-State Hebbion Learning to Systems Having Continuously Valued States and Control Actions
- Flexible Image Transport Systems
- GLAS Altimeter Digitizer Software; Digital Signal Processor
- Goddard Trending Analysis System
- GUI for Schools to Use NASA Data Products Easily
- Interactive Image Spreadsheet
- Java-Based Cross-Platform Image Processing Tool Called Image2000
- KPP: A VHOL Processor
- Method for Artifact Reduction in Approaches to Data Segmentation that Employ Data Subdivision and Recombination
- Method for Processing Ranked Fuzzy Cartesian Queries
- Method for Recursive Hierarchical Segmentation by Region Growing and Spectral Clustering with a Natural Convergence Criterion
- Mobile Earth: A Secure GPS-Aware Internet Browser
- Moderate Resolution Imaging Spectroradiometer (MODIS) Production Software
- Mongoose V: VxWorks Board Support Package
- MOPPS, Version 10.3
- Multidimensional Indexing Structure for Use with Linear Optimization Queries
- Packaging of a Commercial Disk Drive for Space Environment
- Perl DataTools
- PGE16: Product Generation Executive Code for MODIS Land-Surface Temperature Products
- Programmable Telemetry Processor
- RBK4: A Fourth Generation Single Event Upset Test Software
- Region Labeling Tool for Use with Hierarchical Segmentation
- SCAT: Spacecraft Command and Telemetry Front-End Processor Software
- Security Information System
- Sensor-Independent Software for Construction of As-Built Models and Seamless 3-D Immersive Virtual Environments
- Sign Language Interpreter Scheduling System
- Software Telemetry Processing System
- Spacecraft Command and Telemetry Card
- Spacecraft Emergency Response System
- Standard Autonomous File Server
- Sun Solaris SCL
- System Design for a Hybrid Network Data Communications Terminal Using Asymmetric TCP/IP to Support Internet Applications

Text 2 Extensible Markup Language
Three-D Volumetric Mesh Integration
Package
Universal Extender for Processing
Multimedia Objects in Object-
Relational Databases
Wheel Widget



Sensors and Detectors

Circular Polarization Keying
Development of Low-Cost Adaptive
Computing Technology
Fast DC SQUID System Based on Flux
Modulation Technique
Fast Turn on Gating of Photomultiplier
Tubes
Ground Station Router Interface Device
Hyperspectral Polarization Profiler for
Remote Sensing
Invention 1 Multilayer Ball Grid Array
Encapsulation
Method of Indium Bump Deposition on
Cadmium Zinc Telluride Substrates
Using a Shadow Mask Technique
Miniature Addressable Pressure Transducer
Object Detection System for Autonomous
Fork Vehicles
Optical Extinctionmeter for Cloud Radiation
Measurements and Planetary
Exploration
Power System for Solar Probe
Turbotrap: A Method for Containing a Gas
in an Open Container
Two-Stage DC SQUID Amplifier System
Use of a Scanning Probe Microscopy
Wormhole Packet Router for Avions
Applications Using Modified IEEE-1355
and PCI



Other Technologies

3-D Interactive Display
Ceiling Tile Installer
Circularly Polarized Slot Antenna
Elemental Analysis with Scanning Probe
Microscopy
Fastener with Formable Handle
Immobilization of Individual Growing Cells
in Ordered Arrays
Mechanical Tube Bending Tool for Precise
Bends
Mechanism for Providing Low Impedance
Isolated Gate Drive in Ultra-Low
Voltage Switching Mode Regulators
Mechanism that Provides Nanometer-Level
Precision in Six Degrees of Freedom
Metal Doped Diamondlike Carbon Films
Method and Apparatus for Guiding Ablative
Therapy of Abnormal Electrical
Excitation
Method and Apparatus to Measure the
Cross-Sectional Area of an Object
Method to Improve Eyesight in Persons with
Myopia
Miniature Rotary Shape Memory Alloy
Actuator
Screw Latch for Spacecraft-Deployable
Applications
Selective Plasma Deposition of
Fluorocarbon Film on Self-Assembled
Monolayers
Split Tube Flexure
Super-Resolving Rotary Actuator
Tape Guide
Three-Dimensional Roller Clutch Reversible
Hand Socket Wrench
Thrust Rollers

Patenting Goddard Technologies

A key activity of Technology Commercialization Office's Patent Counsel team is protecting the intellectual property (IP) developed at Goddard. Because filing for and maintaining a patent can be costly, counsel carefully evaluate new technologies to ensure that filing for a patent is appropriate. During calendar year 2000, the Patent Counsel team filed 16 patent applications, 7 of which were provisional patents. Provisional patents provide temporary patent protection for 1 year. They are useful for protecting patent rights while decisions are made about whether to file for full patent protection. They also are useful to protect IP rights while allowing the inventors to disclose the technology at a conference or other event.

In addition, three Goddard technologies received patents in calendar year 2000:

U.S. Patent No. 6,123,512 Heat-driven pulse pump

U.S. Patent No. 6,114,995 Computer-implemented method and apparatus for autonomous position determination using magnetic field data

U.S. Patent No. 6,081,570 Parallel integrated frame synchronizer chip

12

Promoting Goddard Technologies

The Technology Commercialization Office successfully promotes Goddard's innovative technologies and unique facilities through:

- Publications and facility information
- Conferences, briefings, and symposia
- Establishing contacts with potential partners



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Publications and Facility Information

The Technology Commercialization Office prepared many promotional materials—both on paper and online—in calendar year 2000.

NASA Tech Briefs

NASA Tech Briefs helps NASA achieve its technology transfer goals. This monthly periodical reports any new, commercially significant technologies developed at NASA so that industry engineers, managers, and scientists can use this valuable information to improve their competitiveness and productivity. Staff in Goddard's Technology Commercialization Office wrote more than 30 articles for *NASA Tech Briefs* during calendar year 2000:

- **Segmented-Cold-Cathode Display Panels:** Compared to cathode-ray tubes, these panels are much wider and thinner.
- **Method of Measuring Encircled Energy for Imaging Optical Systems:** This improved method uses precisely micromachined apertures positioned with great accuracy to achieve unprecedented levels of specification and characterization.
- **High-Power, Wideband Laser-Diode Transmitter Module:** This technology's diffraction-limited operation affords long-range transmission.
- **Post-Processing Satellite Image Data in Secondary Schools:** Direct experience helps prepare children for participation in an increasingly technological world.
- **Return-Link Processor PCI Card:** Relative to prior return-link circuitry, this card is smaller, more energy-efficient, higher performance, more versatile, and much less expensive.
- **Integrated Test and Operations System:** This modular system is customized to specific applications through entries in a database.
- **Composite-Material Heat Sink for Printed Circuit Boards:** This technology is a light-weight alternative to aluminum heat sinks.
- **Software for Monitoring Remote Systems and Executing Planning:** Knowledge Server Tools (KST) software is easier to use, has higher capabilities, and is more portable than previous technologies.

- ***Special-Purpose Interface for Fast Writing on a Hard Disk:*** Size, weight, and power consumption are less than in a general-purpose hard disk drive interface.
- ***Forward-Link/Simulator PCI Card:*** Improvements provided by this technology include decreases in size, cost, and power consumption and increases in speed.
- ***Tunable, Single-Frequency, Fiber Fabry-Perot VCSEs:*** These vertical-cavity surface emitting lasers have been demonstrated at wavelengths of 850 and 1,300 nanometers.
- ***Fabricating Small Apertures in Silicon-on-Insulator Wafers:*** Apertures with features as small as 0.5 micrometers can be formed repeatedly with this technology.
- ***Higher Resolution Optoelectronic Shaft-Angle Encoder:*** This encoder is an improved version of an earlier related technology.
- ***High-Power Laser Illuminator:*** Wavelength selectivity enhances tracking in the presence of background light.
- ***Microwave Battery Charger:*** This technology allows batteries to be kept charged without wire connections.
- ***Spacecraft Solar-Wind Trim Panels for Pointing:*** This technology proposes that spacecraft assigned to orbits distant from Earth be equipped with trim panels that would intercept solar wind.
- ***Cadmium Zinc Telluride Detectors for Imaging of Gamma Rays:*** This technology achieves angular resolution of less than 1 arc-minute.
- ***Absolute Position Encoders Using Pattern Recognition:*** This technology won NASA's Government Invention of the Year Award for 2000 (see page 23).
- ***Software Facilitates Access to a Scientific Database:*** This program supports cooperative international scientific efforts.
- ***Mechanism for Planar Manipulation with Simplified Kinematics:*** This technology greatly simplifies the inverse kinematics to easily resolve end-effector motion.
- ***Designing Purging Flows of Clean, Dry Gases:*** Flow parameters can be chosen to reduce contamination to specified low levels.
- ***Gap Welding Preforms:*** This technology might enable ribbon radio-frequency connections to be made with greater consistency.
- ***Software for Ground Processing of Data from Landsat 7:*** These three computer programs were designed specifically to handle data from this satellite used to acquire remotely sensed images of Earth's land surface and surrounding coastal regions.

- ***Parallel Integrated Frame Synchronizer Chip:*** This chip can handle data in a variety of formats at rates up to 500 megabits per second.
- ***Glass Cure Plates for Fabricating Flat Composite Panels:*** Costs associated with this technology are lower than those of aluminum cure plates.
- ***Analyzing Time Series Using Empirical Mode Decomposition and Hilbert Spectra:*** This technology can be used to decompose complicated sets of data into finite collections of intrinsic mode functions.
- ***Range-Safety Smart System:*** RSSS was conceived to advance the Range Safety System technology used to make destruct/no-destruct decisions during vehicle flight.
- ***Quadruple Precision Optics Ray Trace Code:*** QRAYPKS is a general purpose optics-analysis computer program that enables exceptionally precise computations of path lengths.
- ***Computer-Controlled Power Tool:*** This updated version of the pistol-grip tool regulates torque or speed and analyzes operational history.
- ***Improved Infrared Imaging of Bulk Defects in Cadmium Zinc Telluride Wafers:*** Images generated with this technology guide the “mining” of large wafers for fabricating X-ray detectors.
- ***Microaltimeter:*** This instrument is smaller, lighter, less expensive, more robust, and more energy efficient than other laser altimeter systems.
- ***Reed-Solomon Forward Error Correction:*** This method increases the link margins of data-communication systems that must handle variable-length frames or packets of data.
- ***Fast NRZLM Encoding and Decoding Algorithm:*** These byte-oriented algorithms save encoding and decoding time for data-communications systems.

NASA Tech Briefs is available on the Internet at

<http://www.nasatech.com>



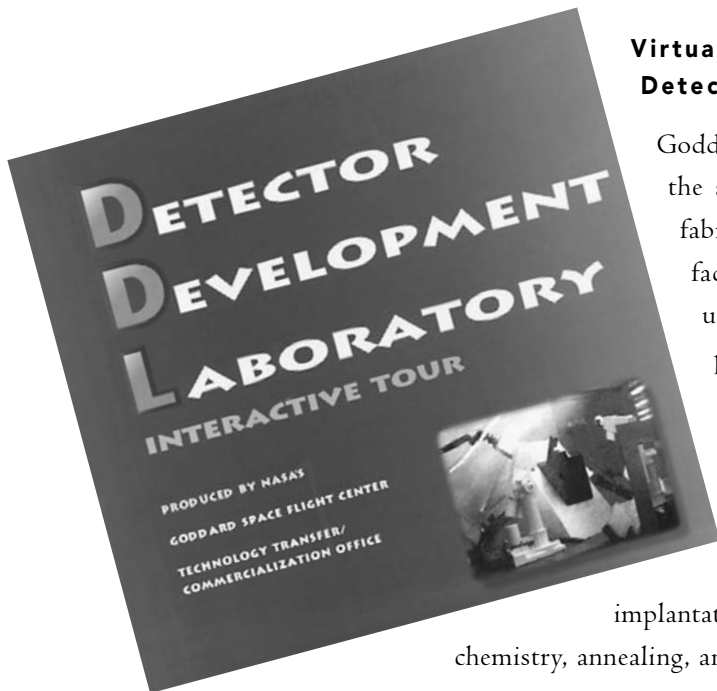
Technology Opportunity Sheets

These one-page announcements succinctly summarize a Goddard-developed technology, focusing on its potential commercial applications and benefits. The Technology Commercialization Office prepares and distributes these sheets through targeted mailings, at trade shows, and via TCO's Web site (<http://techtransfer.gsfc.nasa.gov>). TCO produced 16 of these sheets during 2000:

- A Breakthrough Technology for Lidar Systems
- Better Algorithms for Analyzing Nonlinear, Nonstationary Data
- Capillary Pumped Loop Body Warmer
- Clearer Images with New CCD Detector
- Flexible Wedge: New Design Enables Efficient and Effective Brake/Clutch Configurations
- Gear Bearings: New Gear Designs Eliminate Bearings and Other Parts in Gearsets
- Heat-Driven Pulse Pump: A Long-Lasting Device with Minimal Moving Parts
- High-Rate Digital Receiver
- New Automated Expert System and Development Tool
- New Chips Process Telemetry Data at 500 Mb/second
- New Manufacturing Devices for Improved Fiber Optic Assemblies
- New Nonlinear Mapping Function for Computer File Encryption
- New Optical Encoders with Higher Sensitivity
- New Sensors via Sol-Gel-Filled Fiber Optics
- Super Mirrors at Lower Cost
- Three-Dimensional Roller Locking Sprag

**Working with NASA's
Goddard Space Flight
Center: The Technology
Commercialization Process**

Published by TCO in calendar year 2000, this guidebook was designed to expedite the process of successfully doing business with Goddard. Targeted at potential industry, academic, and government partners, it summarizes the partnership and licensing options, provides answers to frequently asked questions, reviews the commercialization process, and describes how to initiate a licensing agreement and how to prepare a commercialization plan. This guidebook is distributed at technology briefings, at trade shows, and in response to inquiries.



**Virtual Tour:
Detector Development Laboratory**

Goddard's Detector Development Laboratory has all of the semiconductor processing equipment required to fabricate high-quality microelectronic devices. This facility is available for commercial and academic use, and the Technology Commercialization Office promotes its availability.

In the late 1990s, a "virtual tour" of the laboratory was prepared and distributed on CD-ROM. This tour presents the capabilities of the facility, including equipment for ion implantation, thin-film deposition, plasma etching, wet chemistry, annealing, and photolithography.

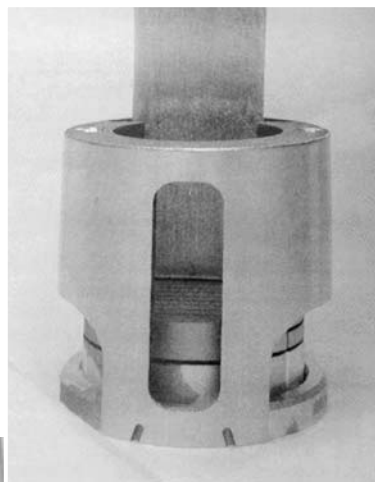
During calendar year 2000, an online version of this tour was posted to the Technology Commercialization Office's Web site (<http://techtransfer.gsfc.nasa.gov>). Other facility tours available on the Web site include the Environmental Integration and Testing Facility.



Another New Facility: Heat-Treating Furnace

In calendar year 2000, Goddard Space Flight Center acquired this new facility that will be of interest to commercial, academic, government users. And TCO will spend the coming year promoting its use.

The vacuum brazing furnace is ideal for joining various metals and ceramics. For example, the furnace can be used to join materials that are similar or dissimilar, such as copper to stainless steel, ceramic to metal, or carbon to metal. Joining such materials is useful for various applications, including instrument making.



The specification of the new facility include the following:

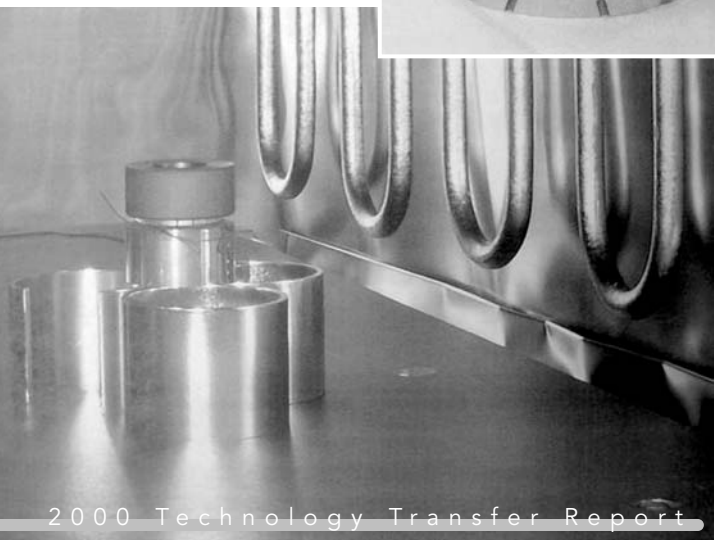
- 8" x 8" x 20" chamber
- 350 °C maximum temperature
- 10⁻⁷ torr vacuum

The equipment has been slightly modified for research. The modifications include:

- Improved visibility to see into the furnace
- Floor damping to eliminate vibrations
- Residual gas analyzer

TCO encourages companies to submit plans to use the facility. The vacuum brazing facility may be useful in the following industries:

- Aerospace
- Aviation
- Automotive
- Medical engineering



Conferences, Briefings, Symposia

The Technology Commercialization Office also disseminates information about its technologies and potential commercial applications by hosting and attending conferences, briefings, and symposia. At these events, staff demonstrate technologies, distribute informative literature, and offer one-on-one counseling to industry about partnership and commercialization opportunities at Goddard. Through these events, Goddard successfully reached many small and large companies, academic institutions, and trade and professional organizations during calendar year 2000.

Goddard-Sponsored Programs

- Community Day
- Goddard Alliance Community Evening
- Open House at NASA Wallops Flight Facility

Air and Space

- International Space Symposium
- Johnson Space Center's Inspection Day
- Space Business Conference and Exposition

Economic Development

- NASA Incubator Grand Opening
- Technology in the Zone Commercialization Training (Baltimore, Maryland)
- Technology in the Zone Commercialization Training (Newark, New Jersey)

Education and Environment

- Association of University Technology Managers Annual Meeting
- Johns Hopkins University Center for Talented Youth
- National Science Teachers Association Conference
- Texas Digitally Remastered Meeting

Engineering and Manufacturing

- National Design and Engineering Show
- Women in Science and Engineering Conference

Optics

- Technology Briefing on Goddard's Aluminum Polishing Technology

Sensors

- Instrument Society of America Expo 2000
- Next Generation Sensors Initiative

Small Business

- Association of Small and Medium Enterprises Inaugural World Summit on Small Business 2000
- Blacks in Government Convention
- Goddard's Annual Small and Small Disadvantaged Business Conference
- NASA Mentor-Protégé Conference and Annual NASA Technology and Business Conference

Technology Expos and Conferences

- American Institute of Aeronautics and Astronautics Baltimore Chapter Town Technology Meeting
- Internet Protocol Workshop
- Maryland Annual Legislative Briefing Reception and Technology Showcase
- Maryland Technology Showcase
- Prince George's County Technology Expo 2000
- Public Safety Technology Workshop
- Technology 2000
- The State of Technology in Maryland

Contacts with Potential Partners

The importance of TCO interactions with industry, academia, and other government agencies cannot be underestimated. Individuals from these organizations are the conduit through which licensing agreements and working partnerships can be created. By successfully establishing contact with potential partners, the Technology Commercialization Office advances toward achieving its mission.

In general, contacts are made through the following:

- Attendees at a technology briefing (i.e., meetings with industry where Goddard provides detailed information about a licensing opportunity)
- Reader requests on a technology advertised through various media (e.g., Web sites, *NASA Tech Briefs*)
- Requests for additional information on technologies and facilities promoted at trade shows and conferences
- Information requests submitted via TCO's Web site (<http://techtransfer.gsfc.nasa.gov>)
- Direct contacts initiated by TCO

The Technology Commercialization Office had much success in establishing contacts with industry, academia, and other government agencies during calendar year 2000.

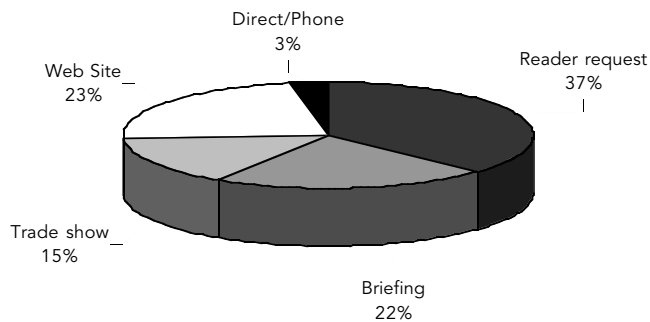


Exhibit 1. Staff Established 176 Contacts through Various Means

Of the 176 contacts established, 91 were from potential partners with various technology interests.

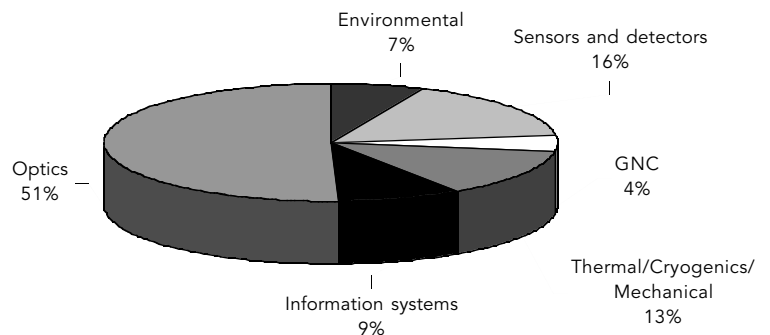


Exhibit 2. Technology Interest of 91 Potential Partners

Establishing New Agreements

The Technology Commercialization Office's efforts culminate in a variety of agreements. License agreements allow an outside organization to use a Goddard technology, often paying a licensing fee and/or a royalty. Space Act Agreements are established to jointly develop Goddard technologies while sharing costs.

During calendar year 2000, TCO licensed or established new agreements for five technologies:

- *Holographic Circle-to-Point Converter* was licensed to Scientific Solutions, Inc. (SSI), of North Chelmsford, Massachusetts. SSI will use the technology to enhance the signal-to-noise ratio of spectral samples.
- *Hilbert-Huang Transform* was licensed to Princeton Satellite Systems, Inc., in New Jersey. This technology will allow Princeton to conduct more precise analysis of signal data than can be obtained from Fourier-based methods.
- *Optical Fiber Cable Chemical Stripping Fixture* was licensed to RIFOCS Corp. of Camarillo, California. This technology helps to remove fiber coatings—particularly hard, thin coatings—without nicking the optical fiber.
- *GPS-Enhanced Orbit Determination Experiment (GEODE)* was licensed to Ball Aerospace and Technologies Corp., which is headquartered in Boulder, Colorado. This flight software provides highly accurate real-time spacecraft position and velocity information for high-precision instruments and on-orbit corrections.
- *3-D Sprag* was assigned to Honeybee Robotics, which is headquartered in New York City. The agreement involves an exchange of NASA technical know-how and royalties.

In addition, two previously established agreements were updated in calendar year 2000:

- *Data Trending and Analysis System* was transferred to Universal Space Ware, Inc., of Westminster, Colorado. The company will update and sell this software.
- *Shared Aperture Multiplexed Holographic Telescope* was transferred to TerraPoint, LLC, of Woodlands, Texas. The company used the technology to map Puget Lowland in Washington State.

Seeking and Bestowing Awards

Awards provide an excellent medium for promoting Goddard technologies to the public and potential partners and for encouraging researcher participation in commercialization. The Technology Commercialization Office submits Goddard inventions for awards bestowed by outside organizations, such as the Federal Laboratory Consortium, U.S. Space Technology, and *R&D Magazine*. NASA also recognizes innovations developed by researchers at the various Field Centers. And the Technology Commercialization Office has established an award for exceptional researcher participation in technology transfer activities.

During calendar year 2000, TCO identified promising technologies and submitted them for several awards. These pages list the awards that some of these technologies won.

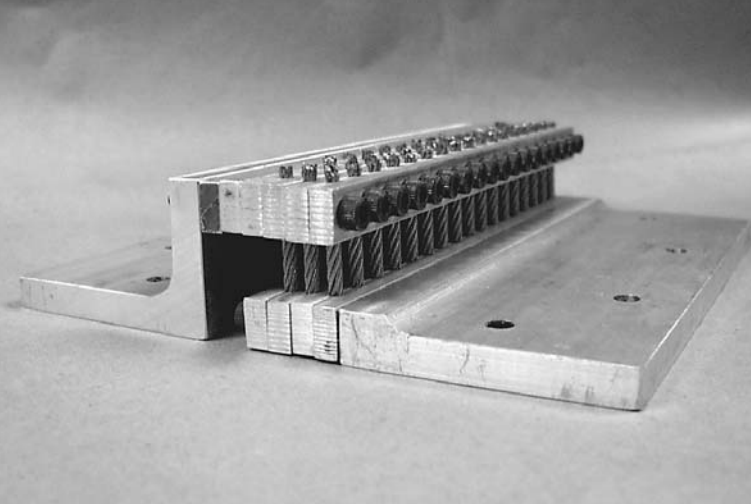
Federal Laboratory Consortium Award for Excellence in Technology Transfer: Honorable Mention

This award recognizes outstanding work in the process of transferring a technology developed by a federal laboratory. Two Goddard technologies received an honorable mention:

- *Geary Schwemmer of the Laboratory for Atmospheres for his Conically Scanned Holographic Telescope:* This technology advances the state of the art in optical remote sensing and opens the door to creative uses of holographic optics in laser optical and passive spectrally dispersive systems. As a replacement for conventional reflective (or refractive) telescope and scan mirror combinations, this holographic system reduces the size, weight, and cost of telescopes by a factor of 2 or more while increasing reliability.



Conically Scanned Holographic Telescope

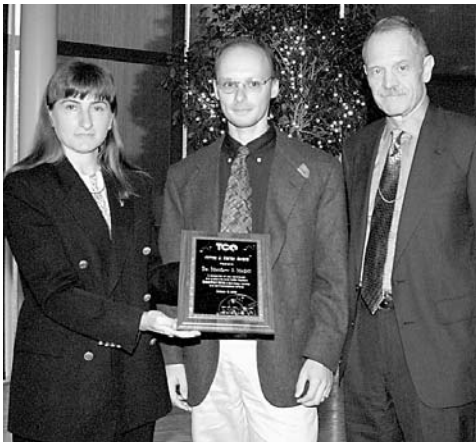


Four-Degree-of-Freedom Compliant Hinge

■ *Peter Rossoni and Wayne Eklund of the Mechanical Systems Center for their Four Degree-of-Freedom Compliant Hinge:* This technology was designed to connect marine semisubmersible platforms to form an offshore airport. The design employs compliant mechanism concepts in a high-strength, robust hinge-type interface that can accommodate large external forces induced by rough sea conditions. The hinge can accommodate and redistribute forces in excess of 1 million pounds, extend product life more than 100 times, save millions of dollars, and provide fine angular displacement control.

NASA's Government Invention of the Year

This prestigious award was presented to Doug Leviton of the Instrument Technology Center for his Method and Apparatus for Ultra-High Sensitivity Incremental and Absolute Optical Encoding. These linear and rotary encoders use a CCD array to detect the relative and absolute position of an object by reading a microlithographic scale on the object. The award-winning technology enables these encoders to have higher sensitivity, read over longer distances, provide better measurements, and resist damage—all in a smaller package at a lower price.



Kerley Award

Named after the late James Kerley, a Goddard technologist who championed technology transfer and commercialization, the Kerley Award is presented annually to recognize a Goddard researcher's commitment to new technology reporting and the technology transfer process. The 2000 award was presented to Matthew McGill (center) of the Laboratory for Atmospheres, who has worked closely with the Technology Commercialization Office to transfer his technologies to the marketplace.

Mr. McGill received this award for his support to TCO and for his Holographic Circle-to-Point Converter technology. Matt was instrumental in obtaining a license agreement with Scientific Solutions, Inc. (see page 21). A cooperative agreement for dual-use R&D with Sigma Research in Greenbelt, Maryland, also was completed in 2000.

How to Reach Goddard's Technology Commercialization Office



The staff of the Technology Commercialization Office welcome calls and e-mails from industry, academia, government, and the general public interested in learning more about Goddard technologies and partnership opportunities.

Commercial Technology Staff

For information on technologies in a specific technical field, please contact the staff member in your area of interest:

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Thermal and Cryogenics

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Outreach and Integration Staff

For information about how to partner with NASA's Goddard Space Flight Center, contact:

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Patent Counsel

For information about patents associated with Goddard technologies, contact:

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Small Business Innovative Research Staff

For information about opportunities for small and disadvantaged businesses, contact:

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