National Aeronautics and Space Administration

Aerospace Technology Spinoffs

March 1997

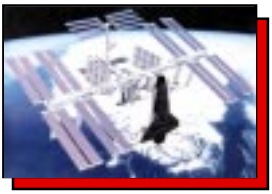
NASA's Enterprises

Aeronautics

Pioneers the identification, development, verification, transfer, application, and commercialization of high-payoff aeronautics technologies.

Human Exploration & Development of Space

Brings people and machines together to overcome the challenges of distance, time, and environment to increase human knowledge of nature's processes.

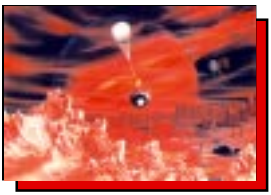


Mission to Planet Earth

Dedicated to understanding the total Earth system and effects of natural and human-induced changes on the global environment.

Space Science

Endeavors to seek answers to fundamental questions about the galaxy and the universe; develop, use, and transfer technologies; and use discoveries to enhance education.



Space Technology

Provides a program of leading-edge exploratory and focused technology to ensure continued U.S. preeminence in space.

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ACKNOWLEDGMENTS
With deep gratitude for your contributions

DIATEK CORPORATION, A WELCH ALLYN COMPANY
HASBRO, INC.
JOHNSON SPACE CENTER
KRAUTKRAMER BRANSON
LANGLEY RESEARCH CENTER
LORAD CORPORATION
MARSHALL SPACE FLIGHT CENTER
PACESETTER, A ST. JUDE MEDICAL COMPANY
RED PEPPER SOFTWARE COMPANY
RESEARCH TRIANGLE INSTITUTE
SCIENTIFIC IMAGING TECHNOLOGIES, INC.
SPECTRANETICS
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Space...It's Our Future!!

NASA is an investment in America's future. As explorers, pioneers, and innovators, NASA boldly expands frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.

NASA's mission is to 1) advance and communicate scientific knowledge and understanding of the Earth, the solar system, and the universe, and use the environment of space for research; 2) explore, use, and enable the development of space for human enterprise; and 3) research, develop, verify, and transfer advanced aeronautics, space, and related technologies.

The outcomes of NASA's activities contribute significantly to the achievement of America's goals in four key areas:

1) Economic Growth and Security: NASA conducts aeronautics and space research to develop technology in partnership with industry, academia, and other Federal agencies to keep America capable and competitive.
2) Preservation of the Environment: NASA studies the Earth as a planet and as a system to understand global change, enabling the world to address environmental issues.
3) Educational Excellence: NASA involves the educational community in its endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds.
4) Peaceful Exploration and Discovery: NASA explores the universe to enrich human life by stimulating intellectual curiosity, opening new worlds of opportunity and uniting nations of the world in this quest.

NASA aerospace technologies have had and continue to have a profound effect on America and its people. Many of the products used in homes, used in the workplace, and used for health, fitness, and recreation are the direct result of aerospace technology spinoffs. These spinoffs contribute toward making lives safer, more comfortable, more efficient, and more enjoyable.

America's return on its investment in the aerospace program continues to climb. As a result of leveraging aerospace technology for applications that benefit America economically and socially, beneficial private sector jobs are being created, the quality of life is improving, and natural resources and the environment are being protected. NASA's aerospace program - unlike many other government programs - contributes to the American economy via the commercial successes that evolve from NASA aerospace technology. These contributions, in the number of prod-

ucts produced, jobs created, lives saved, resources preserved, and environments protected, impact lives daily. America's competitiveness has been bolstered in the global marketplace and the quality of its citizens' lives have been improved. Some secondary applications have resulted in entirely new industries. The keys to maximizing these returns are continuing to push the technological boundaries through our space programs, and increasing the awareness of America's entrepreneurs and innovators about aerospace technologies, so they will continue to develop other practical applications for down-to-earth benefits.

How Spinoffs Occur

There are six principal means by which NASA technology is spun off to other uses:

Direct Use: NASA technology is incorporated directly into a product or process.

Making a Market: NASA, because of its own requirements, stimulates the development and economic production of a technology which, with little or no modification, has broader use.

Facilitating Commercialization: NASA testing and use make commercialization more rapid since the technology becomes more of a "known" quantity.

Indirect NASA Assistance: Industrial applications centers, sponsored by NASA, may provide the technology or further understanding of its use.

Employee Spinoff: NASA or contractor employees may take a technology, with or without modification, and develop it for commercial use, as a private endeavor. Spinoff to public NASA technology frequently is picked up, sometimes with NASA agency assistance, by agencies of state and local government or by sister federal agencies.

Spinoff Resulting From Regular NASA Activity: Professional activities of NASA scientists and engineers such as presenting papers, authoring journal articles, or responding to inquiries can lead to transfers of technology.

Questions for Discussion

Why explore space?

The following are but two compelling arguments among many for the exploration and development of space. These were printed in *The Futurist*, Jan. Feb. 1996 issue, page 24.

The first argument focuses on the economy. "The greatest good a government attempts to achieve for its people is to provide them with the conditions in which they may work to create a better life for themselves." The second one lies in protecting our home planet. "Humans are exerting great pressures on the ecosystems of Mother Earth." By exploring space, we can make better decisions about how to sustain and improve life on Earth in the future.

What are aerospace technology spinoffs?
Aerospace technology spinoffs are secondary applications derived from meeting initial space exploration needs that are applied on and benefit planet Earth.

How much of the gross domestic product does our civil space program cost?
One percent or $14 billion. Approximately 16 cents per day per person, or $5.84 per person per year.

How much of the federal budget is spent on space?
Civil federal space budget - $14 billion or less than 1 percent.
Defense federal space budget - $20 billion or slightly more than 1 percent.

In terms of economics, what has been the return on America's aerospace program investment?
Space is a major component of the United States aerospace industry, which supports nearly one million jobs. The industry posted a record positive trade balance of $24 billion in 1996, an increase of $2.4 billion from 1995. It is estimated that in 1996, aerospace industry employment reached 806,000. Net profits are expected to reach a record $7.6 billion for 1996, up from 1995's $4.6 billion. It is projected that U.S. aerospace industry sales will jump 11% in 1997 to $125 billion. It is impossible to put a true dollar figure on all of the benefits from aerospace technology in terms of dollars that return to the economy. For instance, one could also include the economic impact of the lives saved with one of the technologies derived from aerospace research.

Does the public support America's aerospace program?
Data from a March 18, 1992 published study conducted by Yankelovich Clancy Shulman reveals that the majority of registered voters support the government's role in space. They expressed that private sector involvement is acceptable in space, but at the same time, they still want government involvement. When made aware of the percent of gross domestic product that is allocated to the United States space program, the majority favor an increase in NASA's budget. Support for expanding the program continues to grow by a two-to-one margin. Americans still believe that the most important benefit of space exploration is "new and important scientific and medical discoveries" providing new product breakthroughs that can, among other things, improve America's competitiveness in the world.

Carbon-Carbon Piston

Fast Facts

Industries affected: Transportation / Recreation

Environmental factors: Lowers engine emissions

Carbon-Carbon Piston

Description

The carbon-carbon piston is a new piston concept that is being developed to overcome a number of shortcomings of aluminum pistons. There are several advantages for using carbon-carbon pistons: they can operate at higher temperatures without failure; they will not gall or scar cylinder liners; they can be designed to have less reciprocating mass because carbon-carbon is lighter than aluminum; and they can tolerate leaner fuel-air mixtures to achieve higher fuel economy and much lower hydrocarbon emissions.

Space Application

Carbon-carbon is used as part of the thermal protection system on the Space Shuttle and is used in the Space Shuttle brakes.

Commercial Development

This technology opportunity is part of the NASA Technology Transfer Program. The program seeks to stimulate commercial applications of NASA-developed technology. Carbon-carbon pistons have been fabricated and tested by Langley Research Center as part of a program to evaluate the application of advanced composites for internal combustion engines and compressors. The program goal is to advance the state of the art by developing ringed and ringless carbon-carbon pistons, carbon-carbon liners, valves, and other high temperature carbon-carbon engine components. Patent applications for this technology are in various stages of processing. NASA is seeking applicants to license the technology and/or partnerships to further refine and commercialize the technology.

Social / Economic Impact

Several patents and applications for patents have been filed for the use of carbon-carbon in internal combustion engines and compressors. NASA is seeking applicants to license the technology and/or partnerships to further broaden and refine the technology. With so many engine and compressor applications around the world, the economic possibilities are tremendous.

Key Participant

- NASA Langley Research Center is still in the process of commercializing the engine piston technology and is sponsoring research to reduce the cost of producing carbon-carbon parts.

Advanced Pacemaker

Fast Facts

Industries affected: Medical

Economic potential: Over $1 billion / year

Advanced Pacemaker

Description

A pacemaker is a small implantable electronic device that restores an appropriate heart rhythm in people whose native rhythm is too slow or irregular. The pacemaker, or pulse generator, monitors the heart's rate and, when necessary, delivers low-energy electrical impulses that stimulate a suitable heartbeat. An external programming unit (telemetry transceiver) enables a physician to set the pacemaker to provide a particular type of therapy and also to retrieve information about ongoing cardiac activity and pacemaker performance.

Space Application

Over the years, Pacesetter, a St. Jude Medical Company, has incorporated three NASA-developed technologies into its pacemakers, resulting in significant advances in pacing therapy. Using technology for spacecraft electrical power systems, Pacesetter developed the first rechargeable, long-life pacemaker battery. The company drew on space microminiaturization technology to produce the first single-chip pacemaker. Pacesetter also designed the first pacing system to utilize bidirectional telemetry, the NASA-developed technology for two-way communication with satellites. This means of communicating with an implanted pacemaker and reprogramming it without the need for surgery is now the industry standard.

Commercial Development

A key factor in the commercial development of pacemakers was the above-referenced application of aerospace technology to pacing, which began in 1969, when Pacesetter Systems was formed for this purpose and worked in collaboration with NASA and the Applied Physics Laboratory of Johns Hopkins University. The automatic and intelligent *Trilogy*7 *DR+* pacemaker represents a fourth-generation advancement of the programmable unit that resulted from that historic collaboration.

Social / Economic Impact

Pacemakers enable many people with heart rhythm disorders to make a greater contribution to society. In addition to Pacesetter, several other U.S. companies are currently manufacturing pacemakers, including Medtronic, Inc.; Guidant Corporation/Cardiac Pacemakers (CPI); and Intermedics, Inc. According to investment firm Cowen & Company's May 1996 Industry Strategies Report on Cardiac Rhythm Management, the U.S. pacemaker market totaled approximately $1.15 billion in 1995 and is growing at a rate of 8 percent annually.

Key Participants

- Pacesetter, a St. Jude Medical Company
- NASA Goddard Space Flight Center

Piezo Intelligent Bolts

Fast Facts

Industries affected: Construction, Airline, Engineering, Automotive

Economic potential: $150 million by 2000

Piezo Intelligent Bolts

Description

"Intelligent" bolts are manufactured with piezoelectric thin film coatings that act as load measuring transducers. The film allows bolts to be tightened to a load of plus or minus three percent compared to plus or minus 30 percent for conventionally torqued bolts.

Space Application

In 1992, Ultrafast, Incorporated, submitted a proposal to the Space Structures and Dynamics Group and subsequently received funding under a NASA SBIR Phase I program with the NASA Marshall Space Flight Center. This program, along with their involvement in NASA's *Pathfinder* in-space assembly and construction program, allowed Ultrafast to prove the feasibility of their technology and to demonstrate its capability. Ultrafast currently has a Space Act Joint Development agreement with NASA to produce quality Ultrafast products for various NASA programs. Ultrafast bolts will be used in applications requiring fastening on shuttles and the space station. NASA provides Ultrafast with bolts, which are then coated and installed using the Ultrafast process.

Commercial Development

Precision instruments, tools, and high-tech construction will benefit from the close tolerance load specifications that Ultrafast bolts can deliver.

Social / Economic Impact

This newly developed Ultrafast technology allows for repeated tightening of critical bolts and permits inspection and monitoring of bolted joints. Because of this ability, the technology has the potential to save lives due to the decreased possibility that the tightened bolts would loosen. Calculated figures for Ultrafast indicate that 300 new jobs will be created along with an economic impact of over $150 million by the year 2000.

Key Participants

- Ultrafast, Inc.
- NASA Marshall Space Flight Center

Excimer Laser Angioplasty System

Fast Facts

Industries affected: Medical

Economic potential: Over $17.3 million / year

Social impact: Longer, healthier lives for thousands of individuals

Excimer Laser Angioplasty System

Description

The excimer laser angioplasty system, Dymer 200+ (updated version called CVX-300), was designed to vaporize blockages in coronary arteries without damaging arterial walls. The system is comprised of a probe that houses a laser, and two large rectangular boxes that hold the electronics and other hardware. In January 1992, the system received Food and Drug Administration approval for treatment of coronary disease.

Space Application

The laser system's origin is with satellite-based atmospheric studies. The laser technology pioneered at the NASA Jet Propulsion Laboratory (JPL) was used for remote sensing of the ozone layer. JPL scientists invented the excimer laser to measure gases in the Earth's atmosphere.

Commercial Development

The excimer laser incorporates NASA-developed switching technology to produce a uniform laser beam that can be controlled and pulsed in as little as 200 billionths of a second to maintain a low working temperature. Since clinical tests began in 1988, more than 2000 coronary angioplasty procedures have been performed with the system at 30 hospitals nationwide. It also can be used to treat peripheral vascular disease and vision correction, has applications in neurosurgery and orthopedics, and is being tested in other medical fields.

Social / Economic Impact

By helping prevent cardiac arrest in many patients, this technique positively impacts patients' recovery time, costs, and productivity; its success rate in opening blocked coronary arteries is 85 percent. Spectranetics, a 135 person company that produces the angioplasty system, reported 1995 revenues of $17.3 million. The same technology is also used to correct myopia (nearsightedness) in a one-minute procedure. Crystal Vision Associates was the first U.S. medical facility to use a cold laser to vaporize matter without harming surrounding tissue in the eye. They offer the procedure for $2,000 per eye. There is an estimated 60 million nearsighted Americans who will not need glasses if they undergo the operation.

Key Participants

- Advanced Interventional Systems, Inc.
- NASA Jet Propulsion Laboratory
- Perceptive Scientific Instruments, Inc.
- Spectranetics
- Cedars-Sinai Medical Center

Self-Nulling Eddy Current Device

Fast Facts

Industries affected: Transportation, Aircraft, Engineering

Economic potential: $1.5 million / year

Self-Nulling Eddy Current Device

Description

The self-nulling eddy current device is a compact, hand held instrument and probe designed for rapid, nondestructive evaluation (NDE) of metal surfaces to detect surface-breaking cracks. It requires little calibration and no reference or balance circuitry.

Space Application

An eddy current is the electrical current induced by an alternating magnetic field that detects cracks in electrically conducting metals. Self-nulling means that the device automatically recalibrates to zero so that each imperfection produces a reading or reaction when detected. This principle is used in building and inspection of spacecraft to ensure the safety and integrity of their structures.

Commercial Development

In an effort to enhance the air worthiness of America's aging commercial airline fleet, NASA Langley Research Center investigated ways to advance the conventional eddy current techniques. The self-nulling eddy current device uses a unique driver pickup coil configuration to produce the zero output voltage when unflawed material is inspected. Where a fatigue crack is present a large output voltage is recorded. Krautkramer Branson (KKB), a subsidiary of the Emerson Electric Company, was selected as Langley's industrial partner to commercialize this product. The versatile CrackFinder has applications beyond the aging aircraft market, for example, steel structures, ski lifts, and other structures where detection of fatigue is critical. The CrackFinder is affordable, costing about one-third the price of a conventional eddy current instrument package. Its small size and simplicity allow installation of multiple probes in inaccessible locations for periodic monitoring of crack growth in critical infrastructures and it requires minimal operator training.

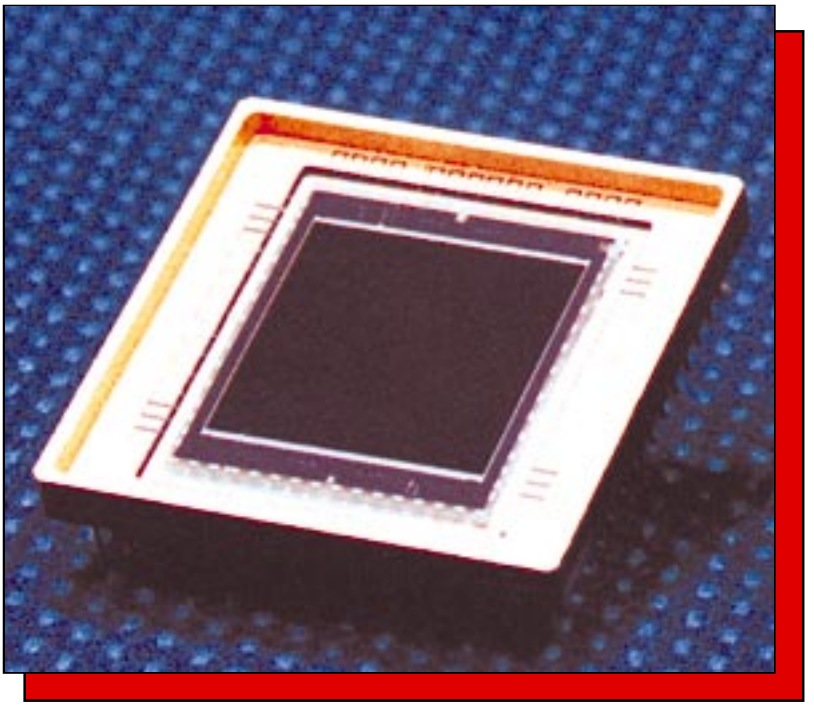
Social / Economic Impact

Product introduction has only been in North America. Introduction to Europe, Asia, and the rest of the world will begin in 1997. At this point, Krautkramer is not able to estimate the total potential sales of the device.

Key Participants

- NASA Langley Research Center
- Krautkramer Branson (KKB)
  a subsidiary of Emerson Electric Company

Breast Biopsy System



Fast Facts

Industries affected: Health and Medicine

Economic potential: Over $1 billion / year

Social impact: Less pain and scarring for women

Breast Biopsy System

Description

The charge coupled device, a high technology silicon chip, converts light directly into electronic or digital images that can be manipulated and enhanced by computers. This chip is incorporated as part of a digital camera system that "sees" breast structures with x-ray vision. This system, the LORAD StereoGuide[7] Breast Biopsy System, is non-surgical and less traumatic than surgical biopsy. The procedure is known as stereotactic core needle biopsy and is performed under local anesthesia with a needle instead of a scalpel, leaving a small puncture wound rather than a large scar.

Space Application

The charge coupled device was developed for NASA's Hubble Space Telescope by Scientific Imaging Technologies, Inc., because NASA realized that existing charge coupled device technology could not meet the demanding scientific requirements for the instrument. The Space Telescope Imaging Spectrography was installed on the Hubble Space Telescope in early 1997.

Commercial Development

Having developed an advanced charge coupled device that could be manufactured at a lower cost, Scientific Imaging Technologies applied many of the NASA-driven enhancements to manufacture charge coupled devices for the digital spot mammography market. The resulting device images breast tissue more clearly and more efficiently than conventional x-ray film screen technology. The Hubble-derived charge coupled device is leading the field of digital breast imaging.

Social / Economic Impact

This new technique, which is replacing surgical biopsy as the method of choice in many cases, is saving women time, pain, scarring, and money. The new procedure, which can be performed in a physician's office for about $850, is just as effective as traditional surgery, which costs about $3,500. Experts predict that the needle biopsy technique will reduce national health care costs by $1 billion a year. More than 1000 units have been installed. The LORAD Corporation now controls 60 percent of the stereotatic breast biopsy market.

Key Participants

- NASA Goddard Space Flight Center
- LORAD Corporation
- Scientific Imaging Technologies, Inc.

Nerf Glider

Fast Facts

Industries affected: Toy

Economic potential: Not available

Nerf Glider

Description

The Nerf 7 glider is a safe, polyethylene foam toy glider that a child can fly without the knowledge of aeronautics. With the Nerf glider, children are able to achieve outstanding glider performances that include loop-to-loop and banking stunt maneuvers.

Space Application

Over the years, NASA has continually pioneered the identification and development of high-payoff aeronautics technologies to further humanity's reach across not only the planet, but the solar system. The basis of the Nerf glider spinoff is the knowledge and technology that NASA designers have obtained in designing and engineering aircraft and spacecraft.

Commercial Development

Already successful with its Nerf toy products, Hasbro, Incorporated, wanted to design a toy glider that a child could fly, so they turned to the NASA Center for Technology Commercialization for help. Hasbro needed assistance in improving the flying distances and loop-to-loop stunts of their prototype gliders. With the help of Langley engineers, Hasbro toy designers learned where to best locate the wings on the glider's fuselage and the proper angle for its tail surfaces.

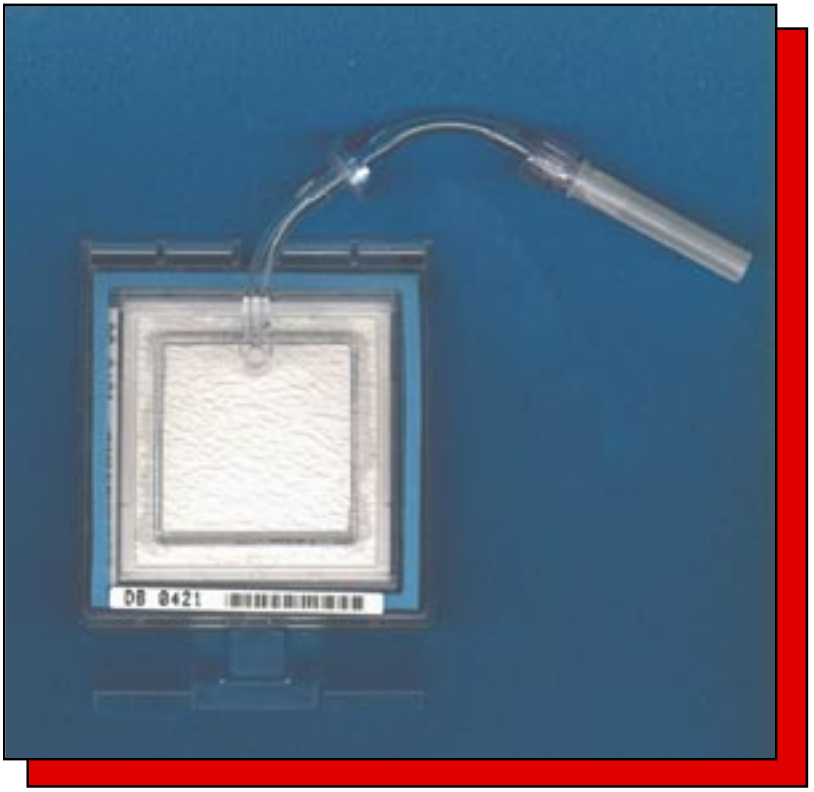
Social / Economic Impact

The economic impact of this toy looks positive. Four Nerf gliders in total - two stunt and two long distance - are retailing in Wal-Mart and K-Mart stores between $7.99 and $10.99, depending on the model.

Key Participants

- Hasbro, Inc.
- NASA Langley Research Center

Blood Separation Storage Device



Fast Facts

Industries affected: Medical, Veterinary

Blood Separation Storage Device

Description

This new method for taking and preserving blood samples uses a fiberglass paper treated with a patent-pending coating of sugar and protein to filter blood cells out, allowing blood serum to pass through to a sample collection paper. The collection paper is then removed and dried. In the dried condition, the serum sample can be stored for months. To analyze the sample, the collection paper is rehydrated and the reconstituted serum is squeezed off the paper for analysis.

Space Application

Current methods of taking and preserving blood samples are not optimum in space due to the difficulties associated with the process including the size, mass, and power consumption of freezers and centrifuges as well as the fragile nature of the glass tubes. A new method developed by NASA Johnson Space Center uses a passive filter to separate the serum from the blood cells and then stores the serum in a dried form on a paper card. This technique does not require the use of a centrifuge or a freezer and the collection device is made from plastic, not glass. The significant difference is the separation of the serum from the whole blood. Most chemical analysis performed on blood is done on the serum, because as red blood cells die and break apart, they release chemicals that change the levels of analysis or make it impossible to measure them. Since this new technique removes blood cells, the levels of dozens of different chemicals can be analyzed and the serum sample can be stored for months without deteriorating.

Commercial Development

Two overall industries are relevant to this device - invitro diagnosis is estimated to be a $6.83 billion industry and the clinical laboratory industry is estimated at $42 billion. The benefits to rural medicine and disease control in undeveloped nations will far exceed the original NASA need of a serum storage method for long-duration spaceflights not requiring a centrifuge or a freezer. In addition to the uses for blood screening and human disease diagnosis, there are also huge potentials for use in veterinary medicine and screening for disease in livestock.

Social / Economic Impact

This technique can be used to take blood samples in rural areas or in third world nations and has the ability to be then mailed to the nearest laboratory for analysis. In the dried form, the serum sample is safe for standard postal system mailing.

Key Participant

- NASA Johnson Space Center

ResponseAgents Software

Fast Facts

Industries affected: Industrial, Computer

Economic potential: To be determined

ResponseAgents Software

Description

ResponseAgents™ software products from Red Pepper™ have revolutionized the manufacturing industry. Built using object-oriented technology, the software serves as an intelligent assistant, enabling manufacturers to better plan and schedule their increasingly complex daily operations. ResponseAgents initiates a detailed software model of a company's supply chain, including material and capacity constraints. It then generates optimized plans or schedules, constantly monitors data networks, and advises users on optimal schedule adjustments.

Space Application

Red Pepper got its start from work on NASA's Space Shuttle Ground Processing Scheduling System (GPSS), an advanced system designed to optimize the refurbishment of the Space Shuttle. The system is also used by Kennedy Space Center to manage the massive, mission-critical refit programs for its orbiters. The computerized scheduling system delivers significant cost savings by reducing Shuttle turn-around time and increasing operational efficiency resulting in savings of about $500,000 per shuttle mission, or $4 million per year.

Commercial Development

Red Pepper was founded in 1993 to realize the ResponseAgents commercial benefits and to enable manufacturers to make daily operations more efficient. The software lowers inventory and labor costs, shortens lead times, and prevents infeasible plans and schedules. Most importantly, the ResponseAgents enables reliable, on-time delivery at a low cost. The introduction of this technology was enabled by NASA's Technology Reinvestment Program, which provides small and start-up entrepreneurs a chance to move technology to the commercial sector.

Social / Economic Impact

Red Pepper's success led to its 1996 acquisition by PeopleSoft, Inc., in a stock swap valued at $225 million. Even though ResponseAgents has only been commercially available since early 1995, customers are already experiencing exciting results. Productivity has been shown to increase by 25% or more, order promise times have been shown to decrease, and accuracy levels in scheduling have consistently exceeded 95%. The ability to increase asset utilization while maintaining or increasing throughput powerfully impacts companies' bottom lines.

Key Participants

- NASA Ames Research Laboratory
- NASA Kennedy Space Center
- Red Pepper™ (a division of PeopleSoft, Inc.)

Infrared Thermometer

Fast Facts

Industries affected: Medical (Acute and Alternate Care)

Economic potential: $126 million / year

Social impact: Better and more efficient health care

Infrared Thermometer

Description

The infrared thermometer is placed inside the ear canal to provide a body temperature reading. Because there is a direct correlation between heat energy radiated from the tympanic membrane and core body temperature, the infrared thermometer is able to provide an accurate reading in two seconds or less.

Space Application

The thermometer's origins are with the NASA Jet Propulsion Laboratory (JPL) remote infrared sensors used to view distant stars and planets, and remotely measure planet and star temperatures by reading their emitted infrared radiation.

Commercial Development

In 1990, clinical testing for the model 7000 optical sensor thermometer was completed. In 1991, it was introduced to the commercial market by Diatek Corporation and refined with help from NASA Jet Propulsion Laboratory. Diatek's researchers turned to infrared optical technology because it offered quick results and extreme accuracy. This almost instantaneous method of taking body temperatures is easier and much faster (1 second as compared to 30 seconds) to administer than previous oral or rectal methods. Disposable probe covers are automatically loaded onto the sensor lens thus preventing contact with mucous membranes and reducing chances of cross contamination. The thermometer's development was undertaken as part of NASA's Technology Affiliates Program, which seeks to improve the competitiveness of American industries by facilitating the transfer of government-developed technology to the private sector.

Social / Economic Impact

The economic potential for the thermometer worldwide for acute care hospitals is approximately $126 million a year. A roughly similar value is predicted for sales to alternate care facilities such as clinics, physician's offices, and nursing homes as well as to individuals. The aural device enhances the comfort of critically ill, incapacitated or newborn patients, and requires very little patient compliance. Frequent routine temperature taking is less intrusive to the patient. Furthermore, it saves considerable valuable time for hospital personnel who take many body temperature readings in the course of a day, allowing them to spend more time providing patient care.

Key Participants

- Diatek Corporation, a Welch Allyn Company
- NASA Jet Propulsion Laboratory
- Communicore

Technology Transfer and Recognition

To meet the technological needs of American industry and boost U.S. international competitiveness, NASA operates a technology transfer network, composed of a National Technology Transfer Center (NTTC) and six Regional Technology Transfer Centers (RTTCs).

The hub of the national technology transfer network is the National Technology Transfer Center. Located at Wheeling Jesuit College, Wheeling, West Virginia, NTTC serves as a clearinghouse for federal technology transfer, linking U.S. firms with federal agencies and laboratories, the RTTCs, and state/local agencies. The NTTC also provides training and educational services to government and industry to develop the skills essential to effective technology transfer, and it conducts outreach and promotional activities to improve private sector awareness of technology transfer opportunities.

The RTTCs generally provide their clients a range of information, technical and commercialization services of similar nature, but each RTTC offers certain specialized services and each has close relationships with a particular NASA center or centers. They are geographically located to provide an equal distribution of services throughout the U.S. The regional deployment of the centers and their alignments within the Federal Laboratory Consortium allows the RTTCs to work closely with federal, state, and local programs in serving the technology-related needs of business and industry.

A new resource of the national network, introduced in 1996, is a special client/server database known as TechTracS, which is designed to monitor network-wide technology transfer activities. The database links the 10 NASA field centers in a client/server structure that communicates across the Internet on a regular basis with the main database server at NASA Headquarters in Washington, D.C.

Support for all the elements of the National Technology Transfer Network is provided by the Technology Transfer Office at the Center for Aerospace Information (CASI). This office executes a wide variety of tasks, among them maintenance of a document request list for and mailout of Technical Support Packages (TSPs), which provide details of new technologies available for more than 70 percent of the listing published in *NASA Tech Briefs*. The CASI Technology Transfer Office is responsible for research, analysis, and other work associated with the annual *Spinoff* book, for distribution of technology transfer publications, and for retrieval of highly detailed technical requests to appropriate offices. In addition, they are responsible for developing reference and biographical data, and for public relations activities connected with the media, industry, and trade show interest in technology transfer matters and commercialization.

Space Technology Hall of Fame

The mechanisms are firmly set in place for the development and commercialization of aerospace spinoffs. A challenge that NASA and the aerospace industry face is getting the general pubic to recognize aerospace spinoffs that affect them everyday. There are programs which have been developed to help with this problem. One such program is the Space Technology Hall of Fame sponsored by the United States Space Foundation.

The Space Technology Hall of Fame program is designed to recognize successful commercial applications of space technology, the innovators for their contributions to America's economic security and quality of life, and to encourage further research, development, and innovation. Since 1988, 23 technologies have been inducted along with some 60 commercial companies and government organizations. Additionally, more than 160 individuals have been recognized. The Space Technology Hall of Fame induction ceremony is held in conjunction with the United States Space Foundation's annual National Space Symposium held in Colorado Springs, Colorado.

Mr. Dan Goldin recognizes a 1996 inductee to the Space Technology Hall of Fame. The recognition honors the efforts of companies and individuals who have applied NASA-derived technology to the commercial sector.

NASA's Technology Transfer & Commercialization Network

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