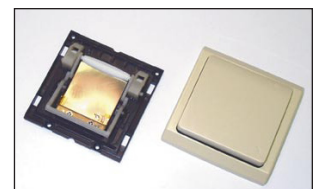


# Top 20 New NASA Spinoff Technologies

*Spinoff* is NASA's premier annual publication, featuring successfully commercialized NASA technology. For more than 40 years, NASA has facilitated the transfer of its technology to the private sector. The resulting commercialization contributes to the development of products and services in the fields of health and medicine, consumer goods, transportation, public safety, environment and resources management, computer technology, and industrial productivity.

The following is a list of the top 20 spinoff technologies produced over the past 5 years, based on factors such as quality of life, economic benefit, and value back to NASA.

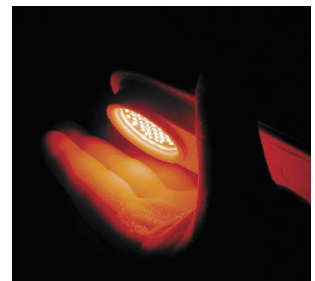
- A water filtration system providing safe, affordable drinking water throughout the world is the result of work done by Marshall Space Flight Center engineers who are creating the Regenerative Environmental Control and Life Support System, a complex system of devices intended to sustain the astronauts living on the International Space Station. The devices, available through Water Security Corporation Inc., of Sparks, Nevada, make use of the available resources by turning wastewater from respiration, sweat, and urine into drinkable water.
- Remote-controlled tractors with a margin of error of one centimeter are the result of work done at the Jet Propulsion Laboratory by scientists working to design ultra-precise GPS for use on a satellite probe sent into orbit to test two unverified predictions of Einstein's theory of relativity. These tractor-steering systems, sold by Menlo Park, California-based Novariant Corporation, are in use around the world, and their precision and ability to run unmanned for long stretches of time yield increased crops, reduced chemical use, and less wasted water. A Small Business Technology Transfer (STTR) grant through Langley Research Center facilitated the product's development.
- A bacterial spore-detection system developed at the Jet Propulsion Laboratory for cleaning Mars-bound spacecraft is now employed by Universal Detection Technology of Beverly Hills, California, as an anthrax detection system. It requires very little in the way of operating costs, and has a high reliability factor, with low susceptibility to false alarms. The Anthrax Smoke Detector is in use worldwide in government buildings, offices, airports, convention centers, hotels, casinos, and postal facilities.
- Langley Research Center engineers developed a low-cost device that creates electrical energy out of mechanical energy. It is now in widespread use as a wireless light switch and contributing to renovation and reconstruction efforts in areas affected by Hurricane Katrina. Face International Corporation, of Norfolk, Virginia, holds several of the NASA licenses, and is mass-producing the devices at a new, dedicated plant in Taiwan.
- Advances in space suit design by ILC Dover Inc., of Frederica, Delaware, have resulted in such widespread applications as therapeutic cooling and heating suits; safe, efficient pharmaceutical manufacturing; new, simple-to-use, life-saving gas and chemical masks; and lighter-than-air (LTA) vehicles. Since the early Apollo contract, ILC Dover, in conjunction with Hamilton Standard, of Windsor Locks, Connecticut, has designed and produced space suits for Johnson Space Center-based astronauts.



- A environmentally friendly remediation solution developed at Kennedy Space Center to restore grounds contaminated by chemical compounds used during rocket launches in the early days of the Space Program is now cleaning up areas around the United States that have been impacted by high concentrations of harmful chlorinated solvents. Commercially, the remediation solution applies to contamination sites created by dye and paint manufacturers, dry cleaners, chemical manufacturers, metal cleaning and degreasing facilities, leather-tanning facilities, pharmaceutical manufacturers, adhesive and aerosol manufacturers, among others. The solution was developed with collaborative support from the U.S. Department of Energy, the U.S. Department of Defense, the U.S. Environmental Protection Agency, GeoSyntec Inc., and NASA's Small Business Technology Transfer (STTR) Program. It has been licensed to several companies, including Weston Solutions of West Chester, Pennsylvania, and Toxicological and Environmental Associates, of Baton Rouge, Louisiana.



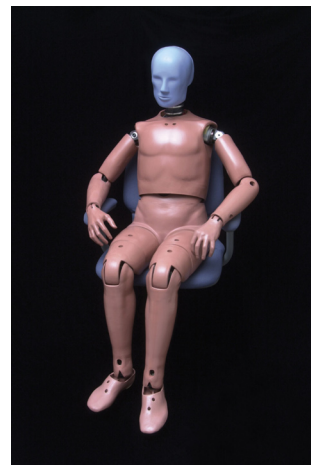
- Tiny light-emitting diode (LED) chips used to grow plants on the space shuttle and the International Space Station are lighting the way for wound healing and chronic pain alleviation on Earth. Developed with Small Business Innovation Research (SBIR) support from Marshall Space Flight Center, the LED chips have made their way into a non-invasive, handheld, portable medical device called WARP-10. This device is intended for the temporary relief of minor muscle and joint pain, arthritis, stiffness, and muscle spasms, and was initially designed to provide armed forces personnel with immediate first aid care for minor injuries and pain. A consumer version sharing the same power and properties of the military model is also available, from Quantum Devices Inc., of Barneveld, Wisconsin.



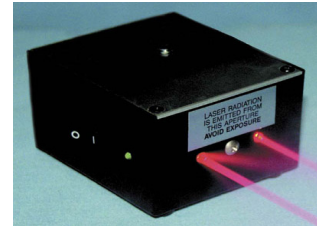
- A Goddard Space Flight Center researcher developed cable-compliant mechanisms for use in sounding rocket assemblies and robotics which have now been implemented into an adjustable patient harness system used to treat patients recovering from traumatic brain injury, stroke, spinal cord injury, and hip or knee replacement, as well as aid U.S. service personnel with spinal cord or traumatic brain injuries at Walter Reed Army Medical Center in Washington, D.C. The device provides patients with the opportunity to stand and walk in a safe and controlled environment without constant assistance from a therapist. The product is available through Enduro Medical Technologies, of East Hartford, Connecticut.



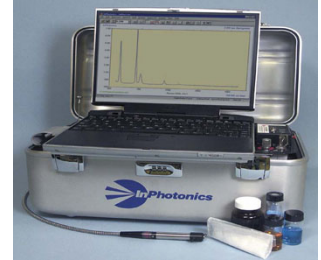
- A robotic vision system designed at Goddard Space Flight Center to determine the position and orientation of bar code targets without the use of lasers led to the development of sophisticated crash test dummies and computer crash test models that provide repeatable, computerized evaluations of laceration injuries. Triangle Research & Development Corporation, of Research Triangle Park, North Carolina, collaborated with Goddard through a Small Business Innovation Research Grant (SBIR). These dummies and models are now being used by automobile and component manufacturers in vehicle testing worldwide.



- After a hailstorm damaged the foam insulation covering the external tank on the space shuttle (while on the launch pad), Kennedy Space Center developed a scaling and measurement imaging device to determine the exact scale of the damage incurred. This device, manufactured by Armor Holdings Inc., of Jacksonville, Florida, is now very helpful in law enforcement, as it is being used to shoot scaled photos of blood patterns, graffiti, and other criminal evidence.



- A mineral identification tool that was developed under a Small Business Innovation Research (SBIR) grant for NASA's Mars Rover Technology Development program is now serving as a powerful tool for U.S. law enforcement agencies and military personnel to identify suspicious liquid and solid substances. The tool can measure unknown substances through glass and plastic packaging materials. The device, a portable Raman spectrometer and fiber-optic probe that could be used on a Mars exploration rover, was designed by EIC Laboratories Inc. in collaboration with NASA's Jet Propulsion Laboratory. The commercial product, the InPhotote, is manufactured and distributed by InPhotonics Inc., a spinoff company of EIC Laboratories, co-located in Norwood, Massachusetts.



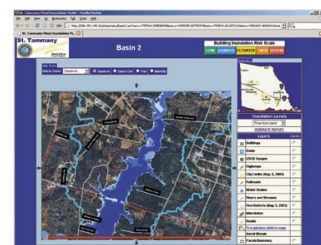
- Marshall Space Flight Center testing of metallic materials in an undercooled state has contributed to the development of Liquidmetal, a new type of metal that is twice as strong as titanium but behaves more like a plastic with its flexible, moldable properties. Liquidmetal is found in many commercial products, including sporting goods (baseball bats and hockey sticks), jewelry and wristwatches, cell phones, orthopedic implants, and coatings for industry. Swiss luxury watchmaker TAG Heuer features the high-performance alloy as the casing of a special edition, state-of-the-art chronograph timepiece, while Vertu Limited, a luxury personal communication company, features the alloy in the bezel and battery cover of its Vertu Ascent phone collection. Liquidmetal is manufactured by Liquidmetal Technologies Inc., of Lake Forest, California.



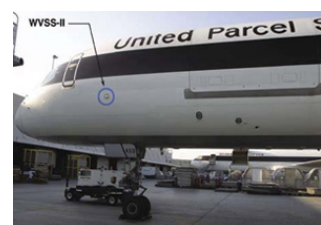
- A collaborative effort between Langley Research Center, other government agencies, and private industry resulted in an advancement in aviation safety that provides pilots with a synthetic vision system. This system provides a real-time, forward-looking depiction of terrain in 3-D, directly on the primary flight display, regardless of the time of day or weather conditions. It is sold by Chelton Flight Systems, of Boise, Idaho, and is flying in hundreds of small planes all over the United States and abroad.



- A geospatial information systems company, NVision Inc., of Stennis Space Center, Mississippi, harnessed NASA's remote-sensing satellite information to provide innovative geospatial solutions for a variety of applications, including: a crop prescription service for farmers; a disaster management networking tool for local, state, and Federal governments; and an educational service for young farmers.



- A tunable diode laser-based gas sensor developed by the Jet Propulsion Laboratory to explore the possibility of life-giving elements on Mars is now employed on flying aircraft as a means to measure water vapor and thus deliver real-time weather forecasting and help pilots avoid dangerous weather conditions. The sensor, manufactured by SpectraSensors Inc., of San Dimas, California, is used by major airlines and is installed on United Parcel Service (UPS) planes, which have been responsible for providing wind and temperature data to meteorologists since 1994.



- A remote command and control system designed by Glenn Research Center engineers to help NASA run experiments on the International Space Station is the core technology behind an intelligent oven that consumers can program to start cooking dinner before they get home, via a cell phone, PDA, or Internet connection. With combined cooling and heating capabilities, the ConnectTo stainless-steel professional series oven provides convenience and healthy living for today's active lifestyles. The technology, manufactured by TMIO LLC of Cleveland, Ohio, was recognized as one of TIME magazine's "Coolest Inventions" and has made numerous appearances on television programs, including CNBC's "Power Lunch," "Good Morning America," "The View," and ESPN's "Cold Pizza."



- A low-cost, lightweight parachute developed with Small Business Innovation Research (SBIR) assistance from Langley Research Center is being used to lower small airplanes safely to the ground in emergency situations. Manufactured by Ballistic Recovery Systems Inc., of St. Paul, Minnesota, the parachute has helped save many lives, according to the company's Website.



- A Mars Exploration Rover prototype robot and an autonomous stair-climbing robot created at the Jet Propulsion Laboratory have been further developed into commercial tactical reconnaissance robots that are being used in Afghanistan and Iraq to help U.S. troops clear caves and bunkers, search buildings, cross live antipersonnel mine fields, and deal with the dangers posed by improvised explosive devices. Several systems have been damaged or completely destroyed in seeking out improvised explosive devices in Iraq, but have been credited with saving lives in doing so. The commercial offspring, known as the PackBot Tactical Mobile Robot, is manufactured by iRobot Inc., of Burlington, Massachusetts.



- A Johnson Space Center-private industry Small Business Innovation Research (SBIR) partnership to develop technology for autonomous rendezvous and docking of space vehicles to service satellites has resulted in a new eye-tracking device for LASIK surgery, called LADARTracker. Eye-tracking devices must be able to sample the eye's position at a rate of at least 1,000 times per second to keep up with saccadic movements, which do not stop during LASIK surgery. LADARTracker measures eye movements at a rate of 4,000 times per second, 4 times the established safety margin. The device is manufactured by Alcon Laboratories, of Fort Worth, Texas, and is used in conjunction with the company's LADARVision 4000 system for LASIK surgery, which is being used by eye surgeons across the country.



- Supercomputer experts from Ames Research Center and engineers from Johnson Space Center teamed up with famed cardiologist Dr. Michael DeBakey to develop a ventricular assist device that functions as a "bridge to heart transplant" by pumping blood throughout the body to keep critically ill patients alive until a donor heart is available. The consortium analyzed blood flow through the battery-powered heart pump using NASA supercomputers and the same methodologies used to analyze fuel and oxidizer flow through rocket engines. NASA patented the heart pump and licensed it exclusively to MicroMed Technology Inc., of Houston, Texas. The 400th patient implant was performed on October 20, 2006, by Dr. Matthias Loebe of Methodist Hospital in Houston.

