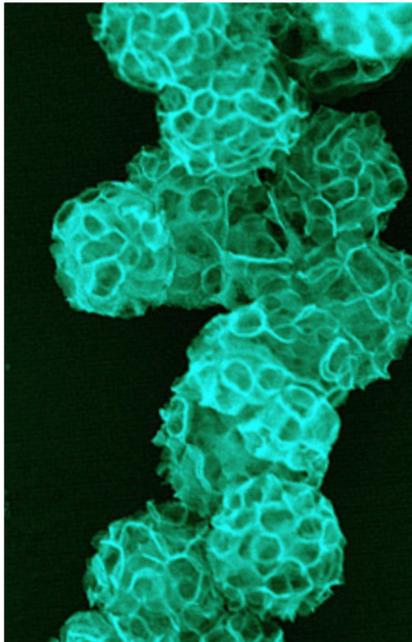
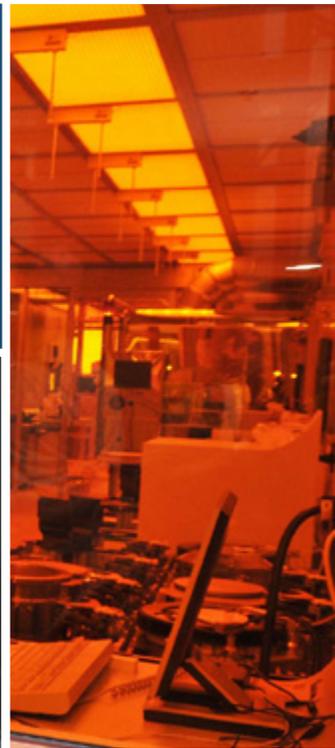


# Sandia's INNOVATION MARKETPLACE

A QUARTERLY UPDATE OF AVAILABLE TECHNOLOGIES FOR INDUSTRY



# Welcome to Sandia National Laboratories' Intellectual Property Showcase

Sandia's Innovation Marketplace is a quarterly e-magazine published by Sandia National Laboratories. This publication highlights exceptional opportunities for licensing Sandia's intellectual property, including patents, copyrights (generally software), trademarks, and mask works. Listings within should not be construed as an offer to license technology. All licenses are subject to negotiation and availability of the intellectual property for licensing. This publication is intended for indications of interest only.

## Why Work with Sandia?

### Leverage World-Class Technology and Research

For more than 60 years, Sandia has delivered essential science and technology to resolve the nation's most challenging security issues. A strong science, technology, and engineering foundation enables Sandia's mission through a capable research staff working at the forefront of innovation, collaborative research with universities and companies, and discretionary research projects with significant potential impact.

### The Best and Brightest

In keeping with our vision to be the nation's premier science and engineering laboratory for national security and technology innovation, we recruit the best and the brightest, equip them with world-class research tools and facilities, and provide opportunities to collaborate with technical experts from many different scientific disciplines. The excitement and importance of our work, an exemplary work environment, partnerships with academia, industry, and government, and our record of historic contributions help us attract exceptional staff. Our employees are recognized by their professional peers for their outstanding contributions.

*Exceptional service  
in the national interest*



 CONTACT US

To discuss licensing opportunities, please send inquiries to: [ip@sandia.gov](mailto:ip@sandia.gov)  
Or for more information, visit our website: <https://ip.sandia.gov>

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## Technology Categories



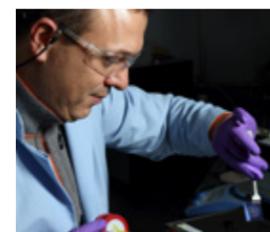
### 4 Bioscience, Materials, Chemistry, & Nanoscience

- Microelectroporation Device for Genomic Screening
- Solid-State Lithium Battery
- ZnO Buffer Layer
- Porphyrins



### 7 Security & Asset Management

- Multi-factor Authentication
- Time Encoded Radiation Imaging
- Sandia Cyber Omni Tracker (SCOT)



### 10 Microsystems, Engineering & Manufacturing

- Thin Film Electrode Synthesis
- Cold Cathode Vacuum Switch Tubes
- Apparatus for Integrated Circuit Defect Testing
- Scanning Fluorescent Microthermal Imaging
- Chemical Mechanical Polishing
- Vibrational Energy Harvester
- Resistive Switching Device



### 14 Highlights From Past Issues

- Microsystems Enabled Photovoltaics (MEPV): Solar Glitter™ Photovoltaic Technology
- Wireless Passive Radiation Sensor
- Embedded Fiber Optic Sensors



### 18 Technology Retrospective



**Microelectroporation Device for Genomic Screening** enables testing of thousands of oligonucleotides while preventing cross contamination

Sandia's microelectroporation device is capable of high-throughput screening with thousands of host genes per slide, all the while minimizing reagent consumption. The device combines microarrays of oligonucleotides, microfluidic channels, and electroporation, allowing the user to deposit and test thousands of different oligonucleotides in microscopic spots. The microfluidic channels allow efficient loading of cells while preventing cross-contamination. Furthermore, the process of electroporation enables optimal transfection of nucleic acids into the cell, thereby minimizing cell death. Sandia's device represents a more efficient and low-cost alternative to other technologies on the market.

*Applications and Industries*

- Bioscience
- Healthcare
- Medical devices
- Pharmaceutical



**Solid-State Lithium Battery** is a thin-film electrolyte layer that enables more efficient energy generation

All-solid-state high-voltage lithium batteries possess the potential to surpass the capabilities of conventional liquid/gel based batteries. Not only are solid-state lithium batteries leak-proof, but they also exhibit high safety performance and can withstand a wide range of temperatures. Furthermore, they also demonstrate high power and high capacity. To further maximize the potential of the solid-state lithium battery, Sandia developed a thin-film electrolyte layer that can endure consistent stress from charge-discharge cycles. The thin-film is made from a combination of lithium, lanthanum, and tantalum, which is then heated to around 900°C to achieve crystallization. The end result is an electrolyte layer that is inexpensive, flexible, and efficient.

*Applications and Industries*

- Electronics
- Microelectronics
- Remote autonomous sensors
- Automotive

**ZnO Buffer Layer** minimizes the interfacial energy between various layers of metal films for silicon substrates

Current efforts revolve around the use of platinum-silicon as a substrate due to its flexibility in being chemically inert when it comes into contact with various oxides, compatible with moderate processing temperatures, and is relatively inexpensive when used in thin layers. Sandia created an adhesion layer made of ZnO that is compatible with platinum-silicon while withstanding high temperature processing. Conventional platinum-silicon substrates have its limitations—mainly its inability to remain stable at temperatures of over 700°C, resulting in the delamination and diffusion of adhesion layers through platinum. Using Sandia's ZnO buffer layer not only minimizes the interfacial energy between the metal film layers, but also improves the metallization integrity of the platinum-silicon substrate.

*Applications and Industries*

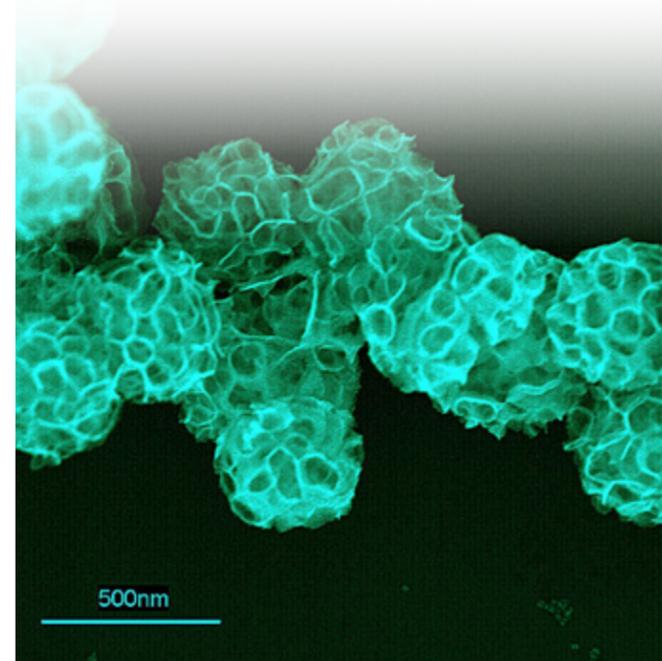
- Electronics
- Microelectronics
- Semiconductor manufacturing



*Synthesized **Porphyryns** are light-absorbing molecules that can be used to make nanodevices with a wide range of optical and electronic properties*

**P**orphyrins are a class of organic molecules comprised of four subunits of pyrrole rings, which are pentagon-shaped rings made of four carbon atoms and one nitrogen atom in the corner. They are similar to chloroplasts in its light-absorbing properties, which plays an active role in photosynthetic proteins and light-harvesting nanostructures. Continue reading to learn more about Sandia's porphyryns:

Sandia developed a method of synthesizing metal nanostructures composed of porphyryns. These nanostructures have wide applicability, especially in the realm of electronics due to advantages such as: increased surface area, low density, low material cost, and special optical properties. Sandia's method of growing nanoshells requires a photocatalytic reduction of metal ions at the interface between the dispersed and continuous phases of an emulsion. The emulsion droplet serves as a template for hollow-nanoshell growth. The photocatalytic reaction is carried out by a specialized porphyryn and causes subsequent growth of the nanoshells. The size of the shell is controlled by the size of the emulsion droplet, while the wall thickness depends on metal ion availability.



Furthermore, Sandia also created a nickel-porphyrin derivative that can be used in optical memory applications that require fast-switching times and long data-retention times. The nickel-porphyrin derivative is comprised of a lower-energy-state and high-energy-state isomer and suspended in a gel or solvent matrix. The energy states are analogous to "on" and "off" switches, providing the user with the ability to controllably switch from energy state to another, making it appealing for molecular-scale optical memory applications.

*Applications and Industries*

- Electronics
- Microelectronics
- Photonic devices
- Chemical sensor

***Multi-factor Authentication** provides users with multiple layers of protection to prevent spoofing of one's identity*

**I**n situations where it may be necessary for users to access and authenticate themselves to a certain system (i.e. atm machine, access to a certain facility, etc.), multi-factor authentication plays a huge role in security. Sandia developed a process designed to augment the trustworthiness of information processing systems by creating a multi-factor authentication process in order to prevent spoofing by an adversary. The highlight of this invention is the cryptographic fingerprint unit, which incorporates an internal physically unclonable function (PUF) disposed onto a hardware device. The use of a biometric, in conjunction with the use of a personal identification number and a smart card offers users multiple layers of protection to provide maximum security.

*Applications and Industries*

- Computing
- Financial
- Healthcare
- Nuclear power
- Public Safety



***Time Encoded Radiation Imaging** detects the presence of gamma-rays and neutrons in special nuclear materials*

**T**he ability to detect special nuclear material from far distances has application in fields such as nuclear security and counter-terrorism. While conventional detectors can detect gamma-rays, neutrons are not as understood and represent an ideal regime for the detection of nuclear material. Sandia's method utilizes time-encoded imaging (TEI) that measures the presence of a nuclear source as a time varying neutron rate as it is modulated by a shielding material moving around each detector. As a result, TEI detectors offer users a simple design, thereby reducing the cost and complexity of the detector, while maintaining a high efficiency by requiring only single scatters.

*Applications and Industries*

- Medical devices
- Medical imaging
- Homeland security
- Treaty verification



**Sandia Cyber Omni Tracker (SCOT)**  
*incident response collaboration capture tool focuses on flexibility and ease of use*

Cyber Security Incident Response (IR) teams use a variety of systems to detect, collect and analyze cyber security data. Unfortunately, these systems often fail to work together to provide the analyst with the entire picture of what is occurring. To address these shortcomings, Sandia developed the Sandia Cyber Omni Tracker (SCOT) to coordinate incident response efforts, capture the team’s knowledge, and to automate common incident response task.

SCOT is a security incident response management system and knowledge base that aims to improve analyst effectiveness. A new approach to handling cyber security incident data, SCOT provides users with the ability to manage security alerts, coordinate team efforts, capture team knowledge, and analyze data for deeper patterns. SCOT also integrates with existing security applications, providing a consistent and easy-to-use interface that encourages greater sharing of cyber security analysis results. Analysts are able to document and share their research and response efforts, providing real time updates of the team’s work to keep team members informed and coordinated.

Designed to be scalable and easy to maintain and use, SCOT has processed over 1.6 million alerts since its deployment, while maintaining 99.9% availability on modest server hardware. In just over four years, SCOT has amassed a database of over 700,000 indicators from analyst and alert input, aiding the IR team in spotting an adversary’s methods and tactics, while highlighting common targets within the enterprise. The knowledge in SCOT has helped Sandia’s IR team train new members, detect subtle attacks by advanced adversaries, and manage the rising tide of cyber security events.

**Why Use SCOT?**

Developed by cyber security incident responders for cyber security incident responders, SCOT provides many advantages to an IR team:

- Designed to be easy to use, learn, and maintain
- Instant updating keeps IR team in sync and their efforts coordinated
- Automated detection and correlation of common cyber security indicators such as IP addresses, domain names, file hashes, and e-mail addresses
- Alert collection and centralization from a wide range of security systems
- Extensible plugin infrastructure to allow additional automated processing
- Full Text searchable knowledge base that allows the entire IR team to easily learn from past cyber security events

For additional information about SCOT, please see <http://getscot.sandia.gov>

SCOT is now available as open-source software and can be downloaded at: <https://github.com/sandialabs/scot>





**Thin Film Electrode Synthesis** represents a fast and inexpensive integrated power source for MEMS technology

The development of small, light-weight power sources is driven by the need for smaller electronic devices and emerging technologies, such as microelectromechanical systems (MEMS). Due to the size constraints of such a technology, there is a need to create an integrated power source that will not substantially increase the weight or size of the device. To address this problem, Sandia developed a method of synthesizing a thin film battery using alkoxide compounds. A precursor layer is formed and deposited as a thin film, then heated to 650°C to crystallize it into ceramic. Multiple layers are deposited, with each layer being approximately 500-1000 angstroms in thickness, and possess electrochemical properties. Sandia's method of synthesis represents a fast and inexpensive approach that can be conformally coated onto a variety of surfaces as a thin layer device.

*Applications and Industries*

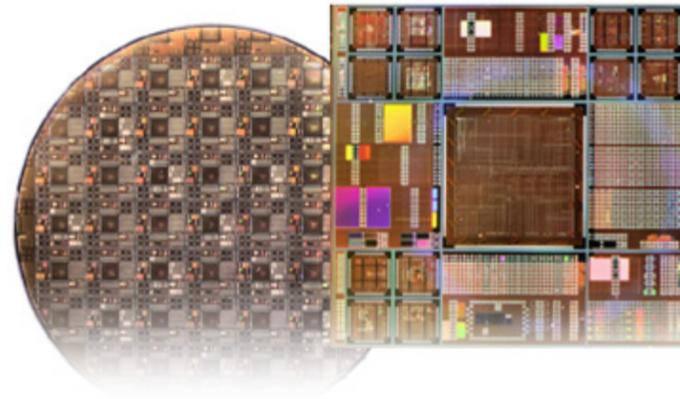
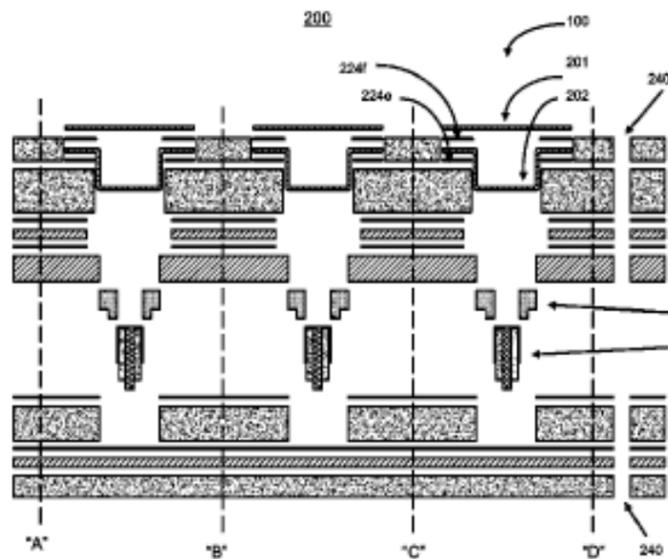
- Electronics
- Solar cell storage
- Wireless sensors
- Medical devices

**Cold Cathode Vacuum Switch Tubes** reduces the hand assembly of multiple parts, thereby decreasing the overall cost of production

Vacuum switch tubes play a vital role in applications that require stand-off of high voltages and fast switching of large currents. Such applications include triggering of air-bags, the initiation of explosives, control of high energy physics equipment, power supplies and capacitive discharge units. However, the assembly of vacuum tube switches typically requires piece-by-piece hand assembly by a highly skilled craft worker, making the process expensive and laborious. In addition, hand assembly can also result in variations that can affect the uniformity of the overall apparatus. As a way to combat this problem, Sandia developed a method of batch fabrication which involves stacking an assembly of layers comprising multiple tube sub-assemblies. The layers are then heated in a vacuum oven to affect the bonding of the individual layers. Sandia's method of fabricating multiple switch tubes through batch fabrication reduces hand assembly and piece part counts, thereby reducing the overall cost of producing a vacuum switch tube.

*Applications and Industries*

- Aircraft
- Aerospace
- Electronics



**Apparatus for Integrated Circuit Defect Testing** provides users with a novel way to test conventional integrated circuits

Failure analysis methods are essential for the development, manufacture, and qualification of integrated circuits (ICs). Current methods revolve around testing the quiescent power supply current, however, the disadvantage of this method stems from its need for the analog measurement circuitry to be provided in line with power supply connection to the IC. Sandia's defect testing apparatus allows for increased measurement sensitivity for multiple ICs. In addition, measured sensitivity is unaffected and no measurement circuitry must be placed in-line with the electrical connection between the power supply source and the IC to be tested.

*Applications and Industries*

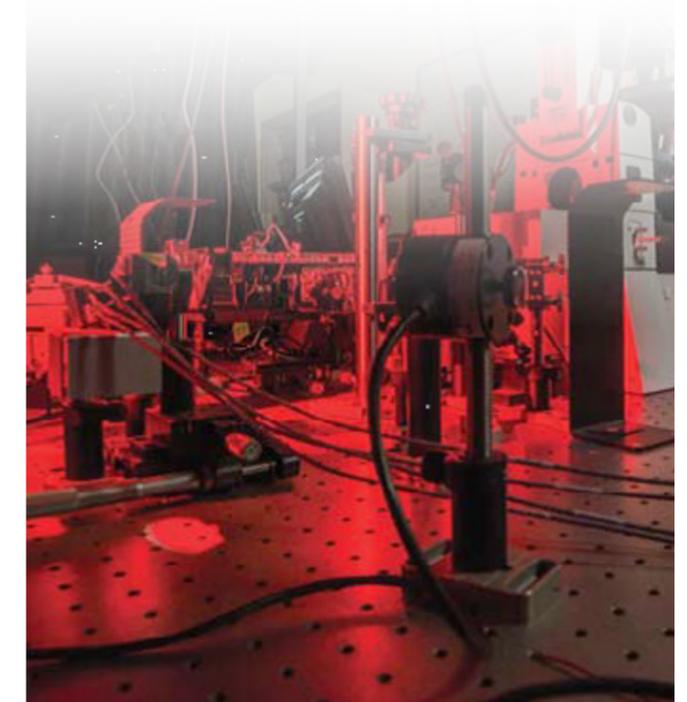
- Electronics
- Semiconductors
- Medical implants
- Sensors

**Scanning Fluorescent Microthermal Imaging** creates high resolution thermal maps

Fluorescent microthermal imaging (FMI) is a thermal imaging technique based on the concept of using film with a temperature-dependent fluorescence quantum yield. The film is applied to a surface of a substrate (such as an integrated circuit) to create a high resolution thermal map of the substrate. Sandia's apparatus allows users to perform FMI on microelectronic devices (such as integrated circuits) when positioned in thermal contact with a thin film. A laser scanning source focuses a beam of light energy onto the thin film, causing it to fluoresce with an intensity that is responsive to temperature variations. A scanning microscope collects the fluorescence data one pixel at a time while a computer imager translates the data into a thermal image of temperature variations of the integrated circuit. Advantages of Sandia's invention include increased speed of thermal imaging, improved signal-to-noise ratio, and reduced implementation cost.

*Applications and Industries*

- Microelectronics
- Electro-optical devices
- Medical devices

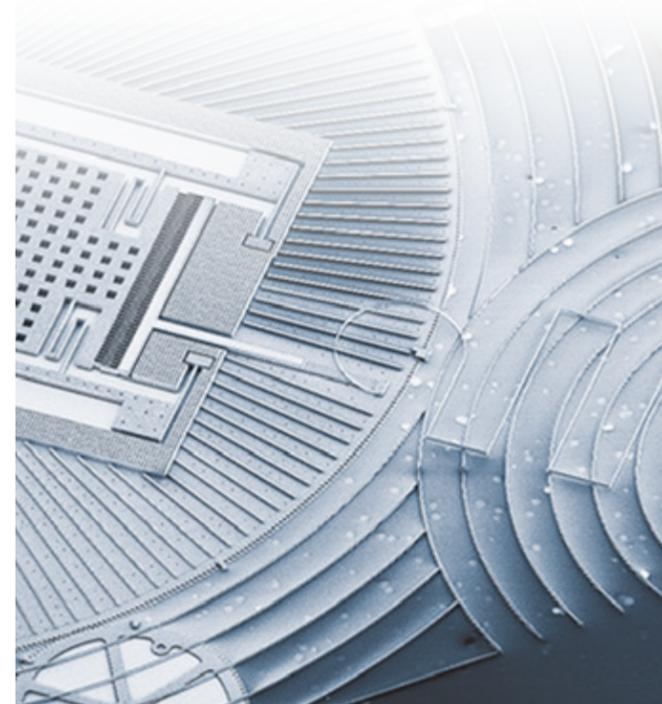


## Chemical Mechanical Polishing

Chemical Mechanical Polishing (CMP) is the process of polishing the top surface of a wafer with an abrasive slurry, suspended with chemical agents. The process represents a hybrid between chemical etching and free abrasive polishing. Sandia developed multiple patents revolving around CMP, specifically for micromachining elements in addition to the fabrication of photonic bandgap structures. Continue reading to find out more about Sandia's CMP technologies:

CMP can eliminate the topography problems inherent in multi-level micromachining processes. A sacrificial oxide layer is placed on top of a level comprised of functional elements with etched valleys. The deposited sacrificial layer has sufficient thickness to both fill the etched valleys while covering the functional elements. The sacrificial oxide layer is then polished down through CMP, allowing for another layer of functional elements to be placed on top.

In addition, CMP can be used for recessed layers of a microelectromechanical system (MEMS) device formed in a cavity etched into a semiconductor substrate. This method utilizes a resilient polishing pad to planarize the recessed layers. Advantages of this method include improved patterning of subsequently deposited layers, which eliminates mechanical interferences between functional elements of

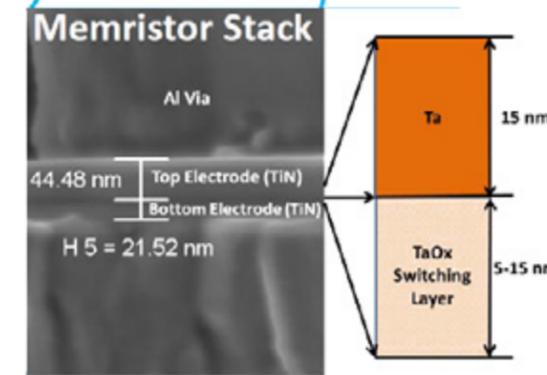
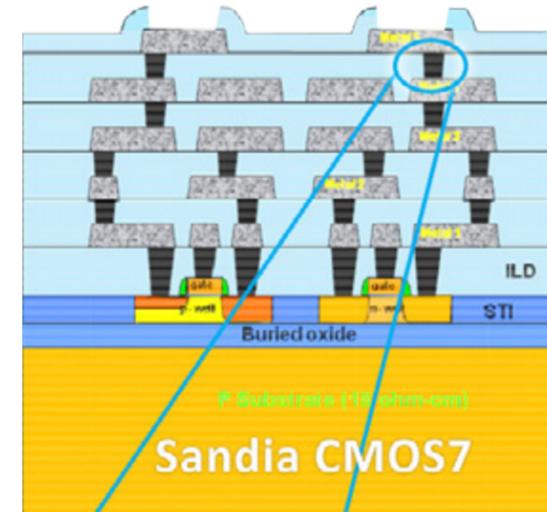


the MEMS device. As an added step, CMP can also polish the semiconductor substrate, forming a MEMS device that can be integrated with various electronic circuitries (CMOS, BiCMOS, etc.).

Another function of CMP is to fabricate three-dimensional photonic bandgap structures. This method uses microelectronic integrated circuit processes to form the photonic bandgap structure on a silicon substrate. Layers are then deposited and patterned, with subsequent CMP used to planarize each layer into uniform lattices. The steps for forming each layer of the photonic bandgap structure can be repeated a number of times to form a three-dimensional bandgap structure. Advantages of this method include elimination of adverse topography effects, a precise vertical tolerancing of layers, and provides the backbone to fabricate many different types of two-dimensional photonic bandgap structures.

### Applications and Industries

- Microelectronics
- Semiconductor fabrication
- Data storage



## Resistive Switching Device provides greater reliability and reproducibility for memristors

Sandia has found a new approach to memristor design and fabrication, providing greater control over the tuning of the resistance state of the device. Furthermore, the current invention improves upon device-to-device reliability and reproducibility. The goal is to use a resistive switching layer comprised to two sub-layers of switchable insulative material (i.e. titanium oxide) that possess contrasting ionic mobility in between two opposing electrodes. The insulating layer will suppress field amplification while optimizing filament growth.

### Applications and Industries

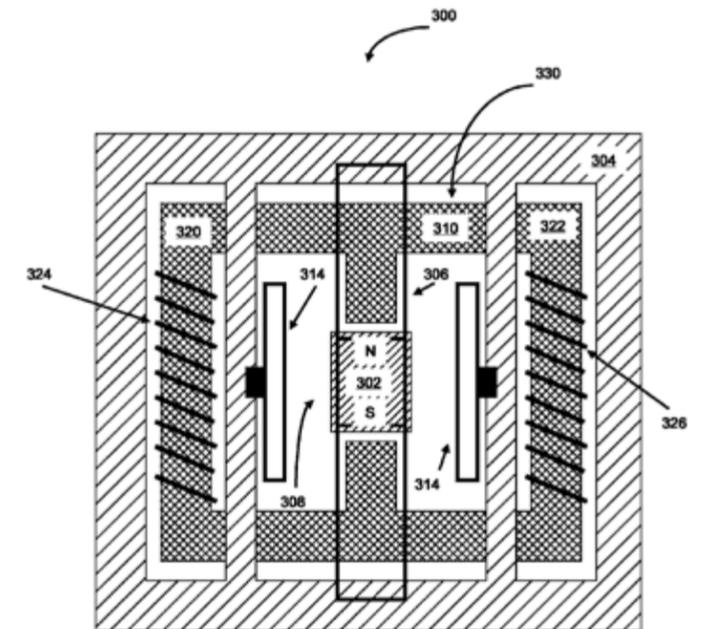
- Electronics
- Microelectronics
- Semiconductor manufacturing

## Vibrational Energy Harvester measures and collects vibrations from the environment to generate electrical power

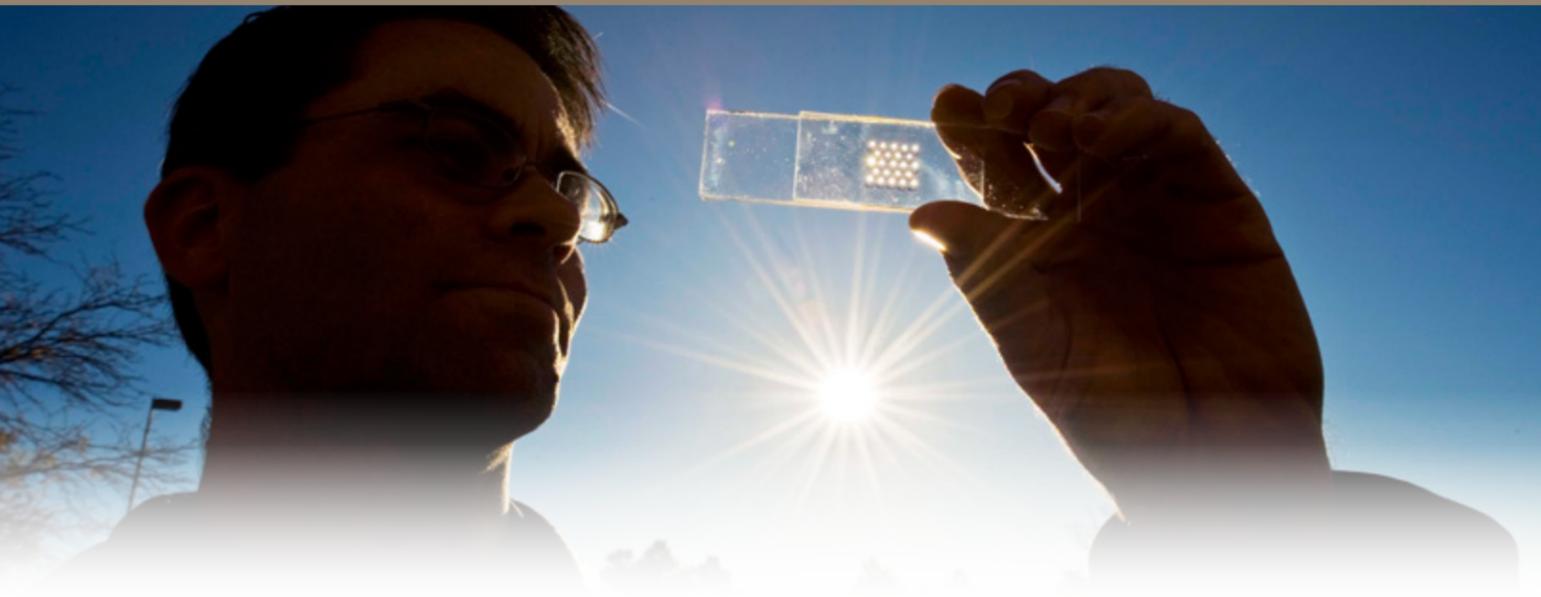
Conventional batteries possess a finite amount of energy and contain chemicals that are often harmful to the environment. As an alternative source of energy, Sandia developed a vibrational energy harvesting device that can supply power to small remote systems. The technology acts as a sensor that can detect vibrations in its environment while generating an electrical signal in response. The present invention utilizes a velocity-damped resonant generator (VDRG) that uses magnetic induction in order to convert mechanical vibrations into an electrical signal for sensing and power generation. In addition, Sandia's vibrational energy harvester can be created through microelectromechanical (MEM) fabrication techniques, which facilitates batch fabrication of multiple devices that are fully assembled.

### Applications and Industries

- Automotives
- Heavy machinery
- Large architectural structures



A schematic plan view illustration of an embodiment of a mechanical vibration to electrical energy converter.



**Microsystems Enabled Photovoltaics (MEPV): Solar Glitter™ Photovoltaic Technology revolutionizes solar energy collection**

2012 R&D 100 Winner

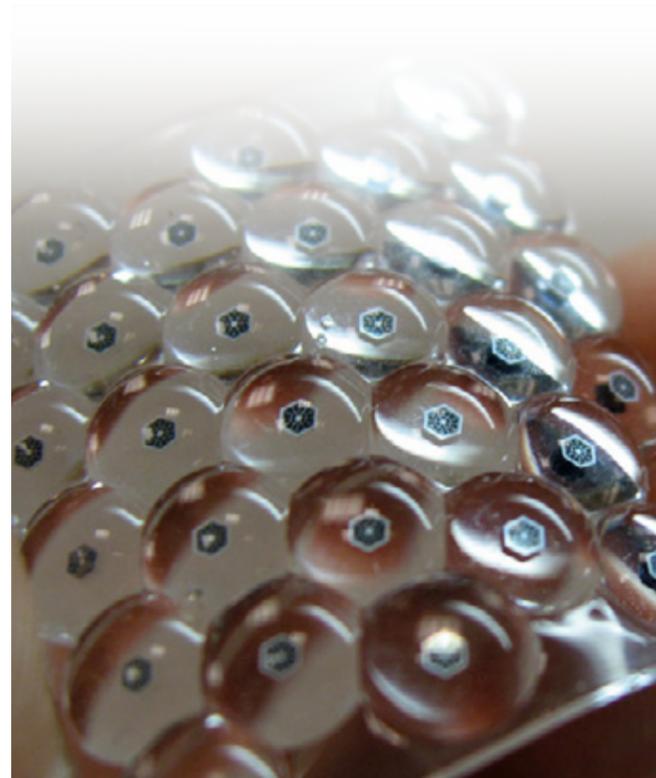
These tiny glitter-sized photovoltaic (PV) cells could revolutionize solar energy collection. Made from robust semiconductor materials, miniaturized PV generated clean electricity that can work as safely, reliably, and durably as present day grid power, and can be cheaper than all other forms of energy.

Sandia's microsystems-enabled photovoltaics (MEPV) uses microdesign and microfabrication techniques to produce solar cells as small as 3-20 microns thick and 100-1000 wide. These PV cells are then placed or 'printed' onto a low-cost substrate with embedded contacts and microlenses for focusing sunlight onto the cells. Moving to micro-scale PV cell sizes results in distinct benefits at cell, module, and system levels, including reducing the amount of expensive semiconductors by 30 times while still achieving high efficiencies.

MEPV solar power systems can have impact on both mobile and stationary power applications. At the system level, the individual micro-PV cells can be interconnected to tailor voltage and current output to meet system requirements. The flat panel profile with micro-optical focusing further simplifies sun tracking, reducing both the cost and complexity of the solar concentrating design.

MEPV units can be placed into flexible sheets that could wrap around unusual shapes for solar power integrated into buildings, tents, and maybe even clothing. Rooftop micro-PV modules could have intelligent controls, inverters, and even storage built into the chip—simplifying the grid-integration process.

Put together, glitter-sized photovoltaic cells become the building blocks for generation electricity in a new, efficient, versatile, and inexpensive way—the powering of anything could become as simple as exposing it to light.



**Small, robust Wireless Passive Radiation Sensor gives immediate real-time warning of radiation doses using a portable, inexpensive transceiver**

Existing small radiation detectors do not produce an immediate real-time warning of radiation doses because the detectors need to be sent to a lab for readout, which can require days or weeks to complete. Other detectors are fragile, need human interpretation of colors, cost hundreds of dollars each or are not easily mass produced. Therefore, a need remains for a wireless passive radiation sensor that can remotely detect radiation using a portable, inexpensive transceiver.

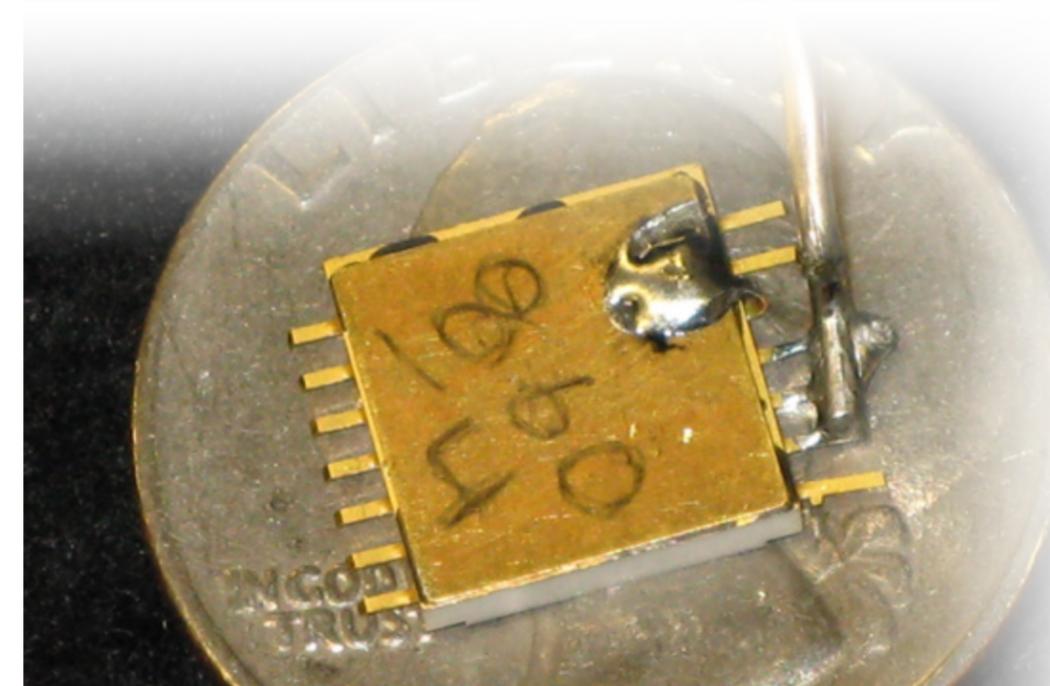
A novel measurement technique is employed using surface acoustic wave (SAW) devices, passive RF, and radiation sensitive-films to provide a wireless passive radiation sensor that requires no batteries, outside wiring, or regular maintenance. The sensor is small (<1 cm<sup>2</sup>), physically robust, and will operate unattended for decades. In addition, the sensor can be insensitive to measurement position and read distance due to a novel self-referencing technique eliminating the need to measure absolute responses that are dependent on RF transmitter location and power.

The radiation sensor is triggered by ionizing radiation e.g., gamma or neutron radiation. On exposure to a given level of radiation, the radiation-sensitive film can switch from high

resistance (e.g., >105 Ω) to low resistance (e.g., <102 Ω). The radiation-sensitive film forms catalytic sites when electrons are ionized from the molecules due to a radiation event and the resulting cascade reaction converts the initially dielectric film to a conductive metallic film. This response covers several orders-of-magnitude change in resistance after a minimum radiation threshold is reached. The sensor is analogous to a 'smoke detector' in that it detects either the presence or absence of radiation but also retains the exposure information after the radiation is gone like a radiation dosimeter. The sensor is comprised of non-moving parts, RF monitor, sensor film, and sensor chemistry, enclosed in a robust package. The advantage of this radiation sensor is its size, simplicity, and immediate response. The sensors do not require batteries that add unacceptable mass and maintenance to the structure or wires to retrieve the data, enabling remote sensing.

*Applications and Industries*

- Healthcare
- Medical Devices
- Agriculture
- Aircraft and aerospace
- Electric utility
- Industrial machinery
- Nuclear power



**Embedded Fiber Optic Sensors enable measurement of apparent velocity time histories in low to high shock regimes and for non-shocks**

Current laser interferometry pressure pulse detection techniques use the shock induced change in index of refraction to track detonation and/or shock fronts in a single fiber optic by reflecting laser light off of the boundary created between the unshocked material and the shocked material. However, this technique cannot be used in regimes where there is not a strong enough shock front to reflect the laser light above the noise floor. Other embedded fiber techniques use a chirped fiber Bragg grating to track a shock position versus time by correlating a known spectrum of light to a calibrated position. The two systems described above use a single fiber and measure only time-of-arrival for a strong shock. Sandia has developed a novel Embedded Fiber Optic Sensor (EFOS) system able to measure apparent particle velocity time histories in low to high shock regimes and for nonshocks. The apparent particle velocity traces provide both time-of-arrival data and can be transformed into pressure time histories, a capability unique to the Sandia EFOS system.

Many explosives and/or combustion event shave short run-up distances requiring sub-millimeter measuring techniques. Sandia's EFOS system utilizes Corning SMF-28 9/123- $\mu\text{m}$  diameter fibers (but not limited to glass fibers) placed at known distances from a target surface and connected to infrared



*PDV coupled with the EFOS diagnostics could be used in both military and civilian weapons systems during the concept, design and fielding phases in measuring exerted chamber and barrel pressures (derived from particle velocities), timing etc.*

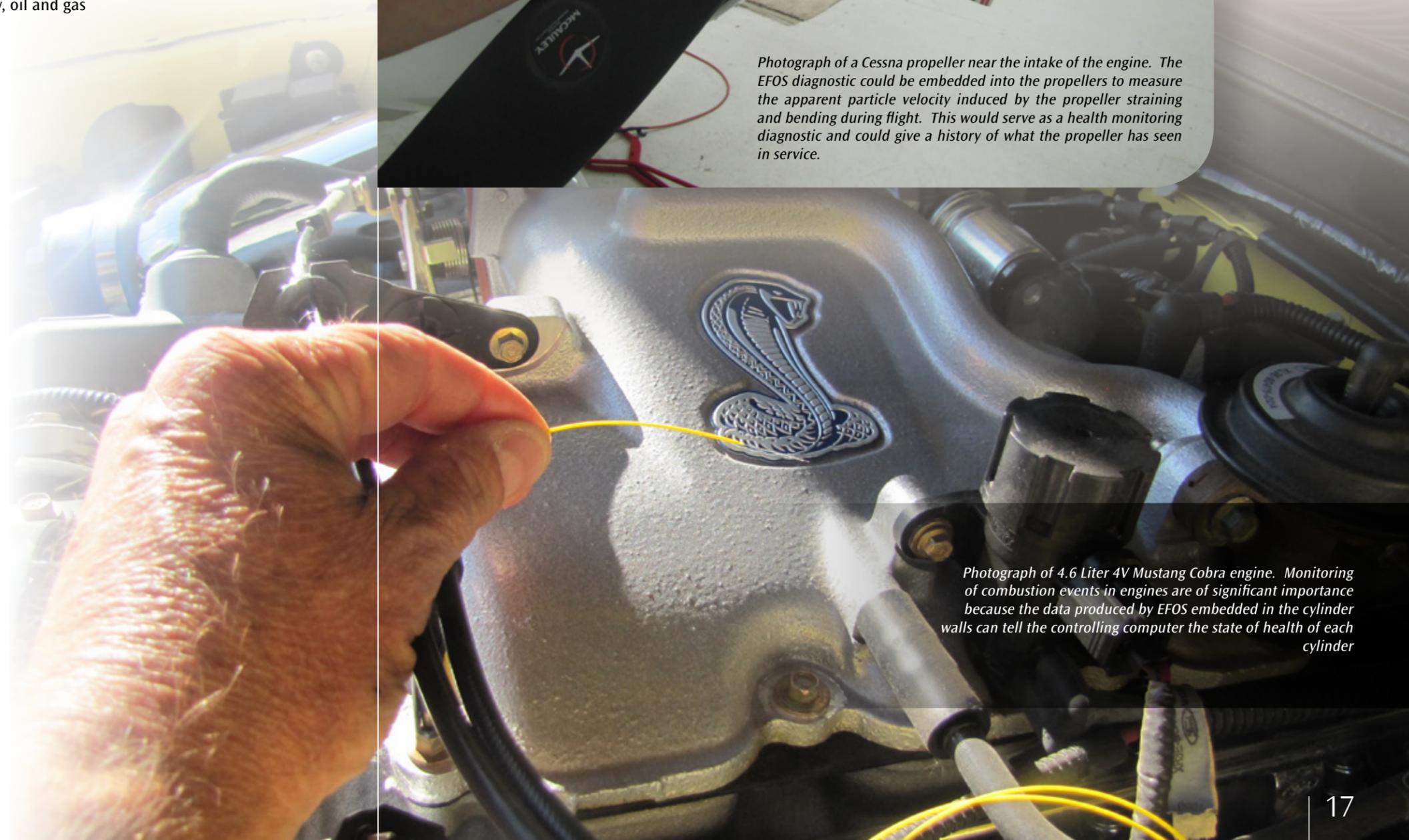
detectors coupled with Photonic Doppler Velocimetry (PDV). The PDV system uses the Doppler shifted beat frequency of reflected infrared laser light as compared to a reference leg of the laser source with a heterodyned signal. The probes detect apparent particle velocity traces similar to that seen in traditional laser interferometer particle velocity measurements that help interrogate the transient phenomena of explosives or shock waves, but at the microscale and potentially smaller.

**Application and Industries:**

- Aerospace – propulsion systems, “smart” materials
- Automotive – engine design and health monitoring
- Defense – design and/or evaluation of systems using energetic materials
- Medical – transducers for medical procedures involving pressure pulses
- Seismology, oil and gas



*Photograph of a Cessna propeller near the intake of the engine. The EFOS diagnostic could be embedded into the propellers to measure the apparent particle velocity induced by the propeller straining and bending during flight. This would serve as a health monitoring diagnostic and could give a history of what the propeller has seen in service.*



*Photograph of 4.6 Liter 4V Mustang Cobra engine. Monitoring of combustion events in engines are of significant importance because the data produced by EFOS embedded in the cylinder walls can tell the controlling computer the state of health of each cylinder*



*Did you know that a Sandian invented the modern-day cleanroom?*

When Willis Whitfield first conceived the idea of his cleanroom, it was during an era where nuclear weapon components were becoming smaller and there was a need to prevent dust particles from accumulating on the machinery. Whitfield proposed a solution of constantly flushing out the cleanroom with highly filtered air that would circulate the workspace at a rate of 4,000 cubic feet or about 10 changes of air per minute.



*Standing in an early version of his cleanroom design, Willis Whitfield checks air quality monitoring equipment. Because they could remove dust and bacteria from the air, clean rooms had many applications in the medical and microelectronics industries.*



*Cleanroom inventor Willis Whitfield, who passed away Nov. 12 at age 92, lived long enough to see his creation mark its 50th anniversary. After thirty years with Sandia Labs, Willis retired in 1984.*

When Whitfield debuted his model clean room in 1962, people originally thought it was a fluke- the particle detectors within Whitfield's clean rooms were measuring numbers that were almost a thousand times lower than conventional methods at the time. When the first cleanroom was tested, "the dust counters went to nearly zero. We thought they were broken," Whitfield said in a 1993 interview with Sandia. Whitfield's cleanroom measured an average of 750 dust particles one third of a micron in size per cubic foot of air, compared to the average 1 million particles per cubic foot of air in current cleanrooms of the time. Question after question, Whitfield was

drilled about the true efficacy of his product- so much so that he began reporting lower figures to prevent shocking people. Recalling his father's story about his talk at the American Society for Contamination Control conference, manufacturers called the cleanroom a hoax. However, they were rebuked by one of Whitfield's colleagues from Bell Labs who thought that Whitfield was wrong and said, "His numbers are 10 times too conservative," recalls Jim Whitefield.

Within a couple of years, more than \$50 billion worth of cleanrooms had been built worldwide. RCA and General Motors Co. were among the first to adopt the cleanroom. Bataan Memorial Methodist Hospital, now known as Lovelace Medical

Center, became the first hospital to employ the cleanroom in operating rooms to prevent infections. The cleanroom revolutionized the pharmaceutical and microelectronics industry, and to this day, cleanrooms are being used in hospitals, laboratories, and manufacturing plants all over the world.





Exceptional service in  
the national interest

## Intellectual Property Creation & Licensing Practices at Sandia



### Intellectual Property Creation

Sandia's intellectual property results primarily from R&D conducted for the government in the national security sector. We collaborate with industry, leveraging each other's strengths to develop innovative technology. We perform internal R & D directed at the most challenging issues in national security, for which breakthroughs would provide exceptional value to government and industry. All totaled, Sandia has more than 1200 patents and 500 commercial copyrights, the bulk of which are available for licensing. Licensing Sandia's Intellectual Property

Sandia's intellectual property may be licensed for commercial use (internal or commercial sale), test and evaluation, or execution of a government contract. One may also secure an option on a future license. Example licenses include:

- Commercial Patent License
- Commercial Copyright License (software or design plans)
- Commercial Hybrid License (copyright and patent)
- Test and Evaluation License
- License Option
- Government Use Notice

Sandia is mandated by the Department of Energy to move its technology to the marketplace for the benefit of the U.S. economy. Given our national security focus, government is the primary customer for many Sandia licensees, but our technologies also find use in the industrial and consumer markets. Sandia issues licenses to companies ranging in size from start-ups to multinationals. Our qualification procedure considers a company's ability to bring a product to market as conveyed by their business plan, among other factors. The possibility to create a new company that can leverage our technology and achieve substantial growth is also important, given our interest in entrepreneurship.

### Licensing Practices

- License term usually runs the length of the patent or copyright. Terms for Test and Evaluation licenses and License Options are limited in time.
- Financial consideration may include an upfront license fee, annual license fee, milestone fee, or running royalty, as appropriate. We seek an equitable return to the laboratory without impeding the licensee's ability to successfully commercialize the technology.
- Performance requirements may be established to insure the licensee is diligent in their commercialization plan.
- Licenses may be limited by field of use, region, or period of restraint. Non-exclusive licenses are preferred, but we consider exclusive licenses when the business case is justified. Exclusive licensing requires a competitive assessment of potential licensees to select the one having the highest probability of success. Performance requirements are also more stringent.
- Commercial licensees must substantially manufacture their product in the U.S., given the Department of Energy's intent to provide benefit to the U.S. economy.
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