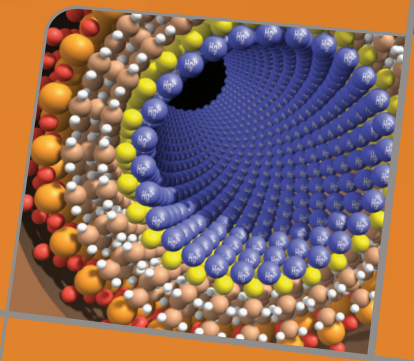
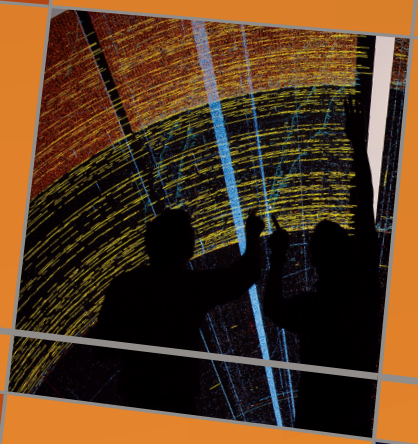
DISCOVERY *in Action*

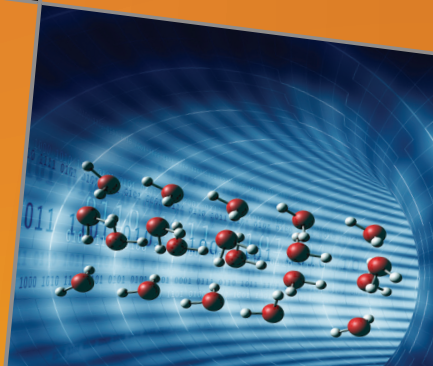
Through the years

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by **Battelle** *Since 1965*







PNNL IS DISCOVERY IN ACTION

For more than 50 years, Pacific Northwest National Laboratory has been improving lives. We investigated the requirements for successful artificial heart implants. When America landed on the moon for the very first time, our researchers studied the lunar material they collected from the Apollo program. We invented technology that led to compact discs . . . helped protect our U.S. ports of entry after the 9-11 attack on our homeland . . . and, our technologies have helped improve the fuel efficiencies of automobiles.

Here we highlight a few of the scientific innovations developed by our spirited discovers in their quest to solve complex problems in energy, the environment and national security. Today, more than 4,000 staff are employed at the Department of Energy's national laboratory. At PNNL, they dedicate their lifes' work to transform the world through courageous discovery and innovation. Our Richland, Wash., campus includes unique laboratories, specialized equipment and EMSL, the Environmental Molecular Sciences Laboratory, a DOE national scientific user facility. We also operate a marine research facility in Sequim, Wash. and satellite offices in Seattle, Wash.; Portland, Ore.; and Washington, D.C.

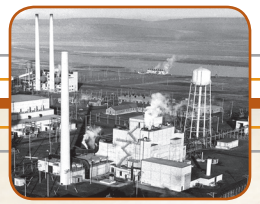
Early 1960s Researchers at PNL (now called PNNL) developed the standards and devices for setting and measuring radiation doses received by nuclear industry workers. Tens of thousands of people, including children, have been measured by whole-body counters since the 1960s to relate their physical content of radioactive materials to sources such as food and water.

1960s PNL formulated the first use of a digital computer for complete process control of a mass spectrometer.

Mid-1960s PNL devised a computer code, called COBRA for COolant Boiling in Rod Arrays, which allowed for three-dimensional, multiphase hydrothermal modeling of reactor and other complex systems.

1967 PNL researchers continued the fundamental scientific and technical work that provided the basis for the design, fabrication and reprocessing of weapons-grade nuclear fuels.

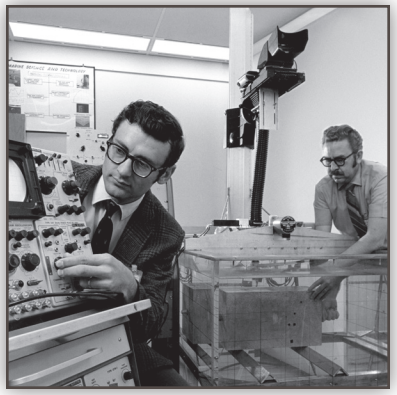
1960



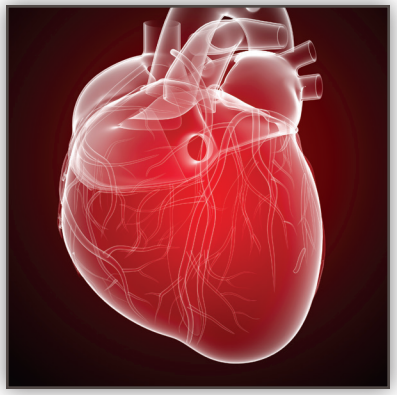
1940s The government created the $85-million Atomic Energy Commission laboratory complex operated by General Electric at Hanford for the Manhattan Project.

IT'S BATTELLE!
To Operate Laboratories At Hanford
Offer Described As Outstanding, Objectives Met
Chance Seen As Challenge
Tri-City Herald

1965 Battelle won the contract to operate the R&D lab, at that time called Pacific Northwest Laboratory.



1967 PNL researchers invented the basic technologies that form the foundation of holography.



1969 PNL scientists investigated the requirements for successful artificial heart implantations.

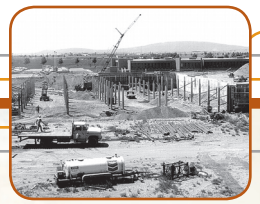
1969 The Acoustic Emission tester earned PNL its first IR 100 Award (now called R&D 100 Awards). The technique made it possible to monitor the structural integrity of metal components.

1970 For the first time, researchers saw live TV images of inside the human body. Using the PNL-designed acoustic holography technique, physicians focused the image at any depth within living tissue to detect fetal abnormalities and locate blood clots for surgical removal. It also allowed surgeons to view internal organs without operating.

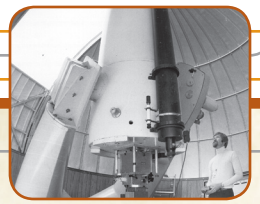
1971 The interior flaws of an aluminum test block were "read" as a three-dimensional image by a scanned acoustical holography, which contributed to the basic inventions that form the foundation of holography.

1971 Biologists and materials scientists created a porous substance called Void Metal Composite (VMC). Its ability to develop a "living union" between bone and prosthetic devices by bone ingrowth enabled VMC to anchor artificial teeth or femoral head prosthesis. It also could be surgically implanted and used as a splint for badly broken bones. The next year PNL received an IR 100 (now called R&D 100) Award for VMC.

1971 Researchers at PNL completed experiments on design and operation of high-temperature, gas-cooled reactors at the High Temperature Lattice Test Reactor.

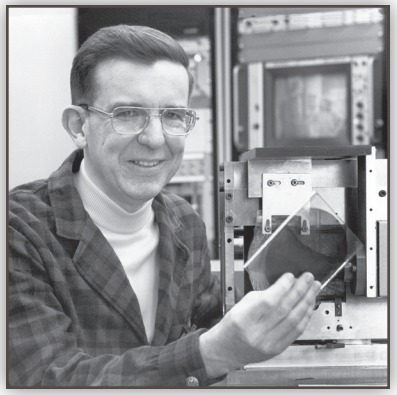


1965 Ground was broken on the first phase of a $19-million campus expansion in Richland.



1967 PNL began operation of the 120-square-mile Arid Lands Ecology reserve.

1969 America landed a man on the moon; PNL was the only Northwest organization chosen by the National Aeronautics and Space Administration (NASA) to analyze lunar material collected from the Apollo program. The research helped determine the origin and history of the moon by measuring the radioactivity of its surface materials.



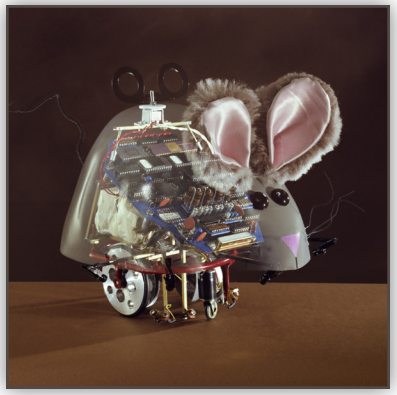
1974 PNL invented a technique called optical digital recording that stores information as a track of dots about one micron in diameter. This innovation served as the critical design element for compact discs and players now manufactured worldwide.

1974 Scientists developed the first all-sputtered photovoltaic cell.

1975 The high-speed inspection system, originally developed to inspect small-arms ammunition, was adapted for a variety of other manufacturing processes.

1975 PNL developed a sensitive, but relatively simple, method for measuring mineral loss from bones—a potential problem for astronauts in long space flights—by measuring the body's uptake of strontium-85.

1977 Scientists developed a technology for incorporating high-level radioactive waste in a stable glass form suitable for permanent geologic disposal. The technology was deployed at West Valley, Savannah River and Hanford.



1978 Micromouse, called "Moonlight Special," took 500 voluntary hours to assemble. It was a self-contained robot that used microprocessor technology to solve complicated mazes.

1970

1971 Then President Richard M. Nixon visited PNL.

1974 The Marine Research Laboratory, now called the Marine Sciences Laboratory, opened in Sequim, Washington.

1977 National "energy crisis" hits; the U.S. Department of Energy was formed.

1977 President Carter instituted a moratorium on nuclear fuel recycling.

1979 An accident, the most serious in U.S. commercial nuclear power plant operating history, occurred at the Three-Mile Island Nuclear Generating Unit.

1978 Materials, developed at PNL, prevented unwanted root growth and vegetation from invading septic tanks, roadways, sidewalks, and buried gas pipes—potentially saving millions of dollars in maintenance costs. The award-winning technology was commercialized and now is available in a variety of products.

1979 Using on-board equipment in PNL's DC-3 aircraft, sampling and analysis of pollutants from industrial centers was completed. The effort was part of a two-year study of pollutant concentrations and transformations in the atmosphere. Data resulting from the work would be used to develop regional air pollution models to help determine environmental impacts of burning fossil fuels.

1979 A jointly developed sputter-deposition, optical coating process was used to improve optical components for high-energy laser systems employed in fusion energy research.

1979 PNL invented a new type of exposure chamber. The device provided a means for more accurate, consistent aerosol exposure levels.

1980

1980 IBM released the PC, launching the modern computer age.

1980 Mount St. Helens erupted; PNL researchers collected and analyzed samples of ash to determine potential environmental and health hazards.

Mid 1980s PNL becomes a DOE laboratory; growth of basic research capability began. Change to read: Mid-1980s—PNL designated a "national" laboratory, though the name would not change to reflect it for another decade. Growth of basic research capability began.

1980 Scientists created a method to turn sewage sludge into synthetic asphalt. The method provided lower-cost paving material and an environmentally safe way of disposing sewage sludge. The accompanying synthetic oil product also could be used as fuel oil.

1979 PNL was named to manage the DOE's 5-year, $10-million Seasonal Thermal Energy Storage Program—an effort to demonstrate the storage and retrieval of energy on a seasonal basis using heat or cold from waste.

1980 PNL wrote a national wind energy atlas to aid wind turbine manufacturers, utilities, energy developers, and government agencies in assessing the economic feasibility of installing turbines.

1980 Studies were conducted to identify possible biological effects of an ultra-high voltage transmission system at the Bonneville Power Administration's full-scale 1,000-kilovolt prototype line. The research was the first to monitor the effects of UHV transmission on a natural ecosystem.

1980 PNL developed a new-generation, high-speed inspection system using video image inspection processes for products such as bearings, bottles and light bulbs.

1980 PNL scientists developed a solid-state light detector capable of counting individual protons, making it possible to use infrared in a new way. The detector—the first to offer efficient photon counting beyond one micron wavelength—showed promise for use in near-infrared astronomy as well as a wide range of other light measurements.

1980 PNL was named lead laboratory for a national program designed to determine the causes and effects of acid rain. The DOE study was part of a 10-year National Acid Precipitation Assessment program, the most comprehensive effort at that time on the acid rain problem.

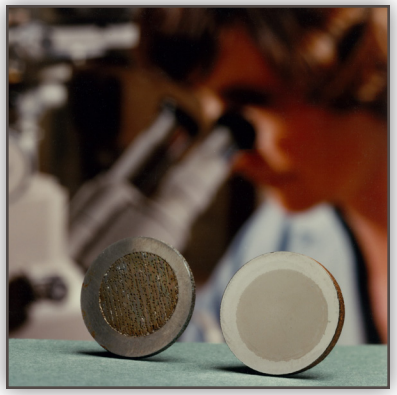
1981 Instruments were constructed at PNL for use on the International Space Station and other spacecraft to measure radioactive particles that could pass through a human body and potentially harm astronauts.

1986 The Chernobyl Nuclear Power Plant disaster occurred in Ukraine. PNL was assigned the lead role in collecting and maintaining information on the Chernobyl nuclear accident, including analyzing the levels of radiation after the plume arrives in the United States as well as collecting air samples of the fallout using research aircraft.

1984 PNL moves from being a DOE Nuclear Energy Laboratory to one within DOE's Office of Energy Research (later renamed Office of Science). Growth of basic research began.

1987 The Molecular Science Research Center established the basis for PNL's first user facility—later named EMSL, the Environmental Molecular Sciences Laboratory.

1982 A unique paint was developed for use in helping reduce theft by permanently marking small tools, office and heavy equipment, art objects and personal property. The paint is mixed with different combinations of chemical ions and can be applied to metal, wood, plastic or rubber items.



1982 PNL designed a glassy, stainless steel coating with corrosive-resistant properties comparable to titanium. The coating could be applied to nearly any metal surface by high-rate, sputter-deposition or electro-deposition. It also could be used in corrosive environments, such as seawater, geothermal wells, nuclear power plants and other chloride liquid environments.

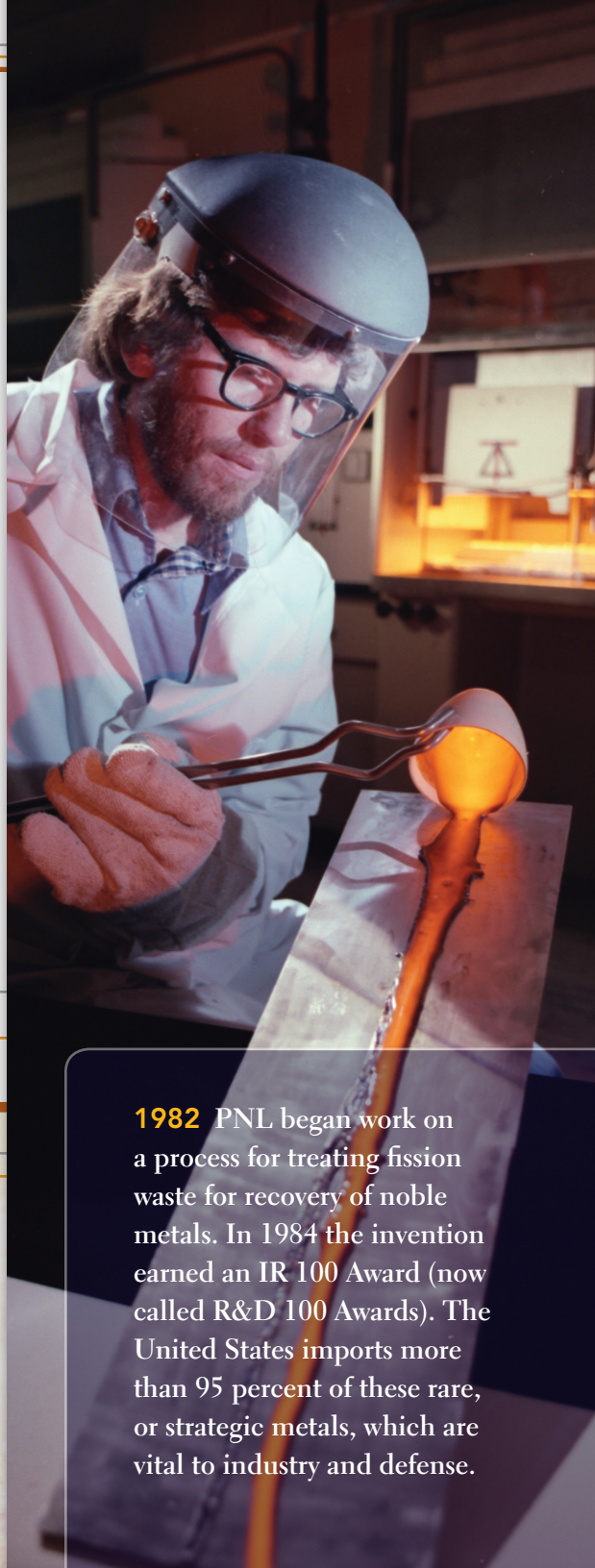
1983 The award-winning Portable Blood Irradiator developed at PNL is the first fully portable device for continuous irradiation of blood. The device showed promise in suppressing early rejection of organ and tissue transplants by continuously irradiating a patient's blood.

1988 Hanford's last remaining production reactor, N Reactor, ordered shut, bringing an end to 45 years of nuclear weapons material production and a start to environmental cleanup.

1989 The devastating Exxon Valdez oil spill occured in Alaska. PNL researchers based in Sequim conducted ecological assessment and other studies shortly after the accident and then later to gauge the success of cleanup activities.

1989 The Berlin Wall fell; the Soviet Union was dissolved.

1990 PNL helped create the U.S. Global Climate Change Research Program.



1982 PNL began work on a process for treating fission waste for recovery of noble metals. In 1984 the invention earned an IR 100 Award (now called R&D 100 Awards). The United States imports more than 95 percent of these rare, or strategic metals, which are vital to industry and defense.

1988 Engineers developed a $2.5 million robotic mannequin—so humanlike it sweats—for the U.S. Army to test protective clothing.

1987 Researchers designed the processes that convert sugar- and starch-laden agricultural wastes into a high-protein cattle feed supplement and food processing wastes into useful methane fuel.

1988 A process called Waste Acid Detoxification and Reclamation that recycled hazardous acids used in various metal finishing processes was invented at PNL. WADR later was commercialized.

1989 Engineers developed a holographic imaging system that rapidly identifies hidden weapons, explosives and other contraband—even plastic, ceramic, and other non-metallic weapons. Today the technology is in use at airports and has been adapted for other uses.

1990

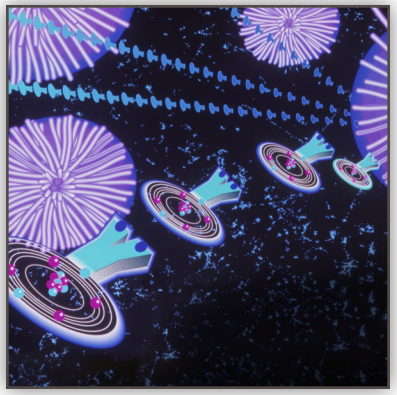
1991 PNL became technical program coordinator of DOE's Atmospheric Radiation Measurement Program.

1993 The Historic FreedomCAR agreement was signed between the "Big Three" automakers and the federal government.

1993 PNL developed superplastic- forming technology to meet new mileage emissions and recycling goals.

1993 The Global Change Assessment Model was the first model to use an integrated energy-economic framework to estimate future greenhouse gas emissions. GCAM is now widely used by scientists and policymakers around the world to understand global change.

1989 Advanced ceramic fabric materials developed at PNL helped in space exploration. Ceralite™ materials, made from continuous fibers of metallic oxides or other low-density materials, were used on space shuttle flights to significantly reduce the mass and weight of heat radiators, piping, and other spacecraft components.



1990 Radiochemists discovered a process for extracting highly pure yttrium-90 from nuclear waste that could be used in nuclear medicine for cancer treatment. When combined with drugs that specifically target cancer cells, the isotope delivers a highly localized and effective radiation treatment with minimal side-effects to the patient. The process was commercialized in 1999 and is now the active ingredient in several new cancer drug products used worldwide.

1991 Early stages of portable acoustic inspection devices were designed for the U.S. Department of Defense. Since then, the technology has been used by the U.S. Defense Threat Reduction Agency, United Nations Weapons Inspectors, the Internal Revenue Service, the State Department and others.

1995 PNNL developed an ultrasonic imaging system that enabled physicians to quickly and accurately diagnose torn ligaments, tumors, vein disorders, newborn hip malformations and other soft-tissue abnormalities. Unlike conventional ultrasound technology that uses reflected acoustic waves, the new imaging system transmitted acoustic waves through the body. This technology was commercialized.

1995 Researchers developed the Softdesk Energy software that could be used to design more energy-efficient buildings. The program integrated specialized software, computer-aided design drafting tools and commonly used manual techniques for estimating energy use. The result used a one-of-a-kind system that provided immediate feedback on a building's energy consumption during the design process.

1995 Though a national laboratory since its inception in 1965, PNL becomes Pacific Northwest National Laboratory (PNNL) when DOE added "national" to its name in a ceremony on the Richland campus.

1995 PNNL led DOE's International Nuclear Safety Program.

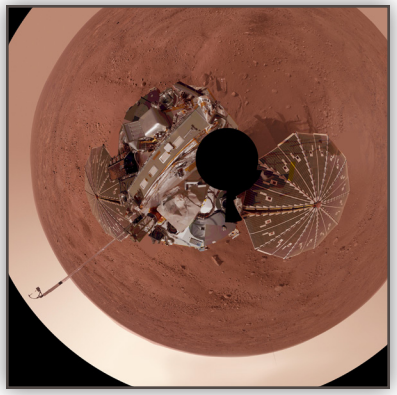
1995 A massive power outage hit the East Coast of the United States.

1997 The William R. Wiley Environmental Molecular Sciences Laboratory (EMSL) was completed.

1998 PNNL established the Center for Global Security located in Seattle. The Center teamed with the University of Washington to establish the Institute for Global and Regional Security Studies in the UW's Jackson School of International Studies.

Late 1990s The U.S. government created regulations on fuel consumption and emission and air-quality standards.

1995 The NWChem high-performance computational software model was created at EMSL and is used for chemical and biochemical reactions at the molecular scale. The software is one of the most used molecular science software for massively parallel computing in the world. It went open source in 2010.



1995 A subsurface lithoautotrophic microbial ecosystem, known as SliME, discovered by PNNL, thrives in an environment similar to the surface of Mars. Rather than using photosynthesis, the microbes live on chemical energy in basalt, a rock common to Earth and Mars.

1996 RubberCycle™ addressed the problem of what to do with stockpiled tires. Scientists invented a bioprocess using sulfur-loving microorganisms that change the surface chemistry of waste tire rubber, enabling it to bond with virgin rubber. This cost-effective method of producing vulcanized rubber products, such as tires, performed better than those made of new rubber alone.

1996 PNNL developed a portable, three-dimensional ultrasound medical imaging system for the U.S. Army. The system was tested at a U.S. Army MASH unit in Bosnia. It also was used by physicians in rural areas and by those treating medical emergencies in hard to access places.

1996 Researchers designed a technically based, integrated approach to evaluate economically efficient paths to mitigate carbon dioxide emissions.

1997 PNNL fabricated the first Tritium-Producing Burnable Absorber Rods inserted in a commercial reactor, removing the need for special production reactors.

2000

2000 PNNL led the core technology component of the Solid State Energy Conversion Alliance's low-cost solid oxide fuel cell (and related technologies) development. This work also supported DOE's Heavy Vehicle, FreedomCar, and Hydrogen programs.

2001 PNNL provided leadership in the development of advanced communication and control technologies to benefit a highly connected electricity grid.

2001 The human genome was decoded.

2001 Terrorists attacked the United States.

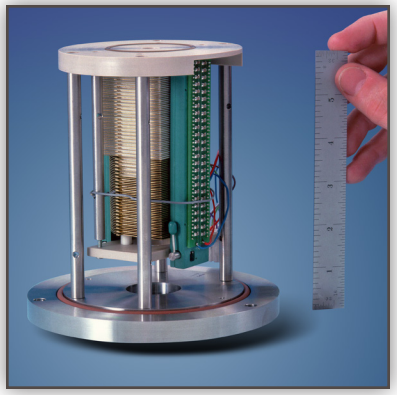
2001 The War in Afghanistan was launched.

1997 PNNL developed a highly sensitive sampler/analyzer that can be used to prevent proliferation of nuclear weapons by remotely detecting trace quantities of materials associated with such weapons. It was deployed around the world in support of the Comprehensive Nuclear Test-Ban Treaty.

1997 Researchers develop visualization software products that embody innovative visual representations. The software extracts useful information from massive amounts of data using algorithms that identify word similarities and themes in text. They have been used for law enforcement and national security purposes.

1998 PNNL improved radio-frequency identification tags that were used to track and monitor everything from clothing to pharmaceutical products to computer equipment. These tags currently are used by the U.S. military.

1999 PNNL developed one of the first climate models that analyzes global warming's potential impacts to a region's agriculture, recreation, water resources and salmon stocks.



1999 The award-winning Electrodynamic ion Funnel designed at PNNL significantly improved the sensitivity of certain mass spectrometry tools and other analytical instruments. Mass spectrometry is used in environmental, biotechnology and drug applications, as well as in medical, biological and other broad areas of research.

2001 The U.S. Department of Homeland Security was established.

2001 PNNL provided scientific and technical support to help interdict radiological and nuclear weapons.

2003 PNNL reported to DOE's Pacific Northwest Site Office.

2003 The East Coast electricity grid blackout occurred.

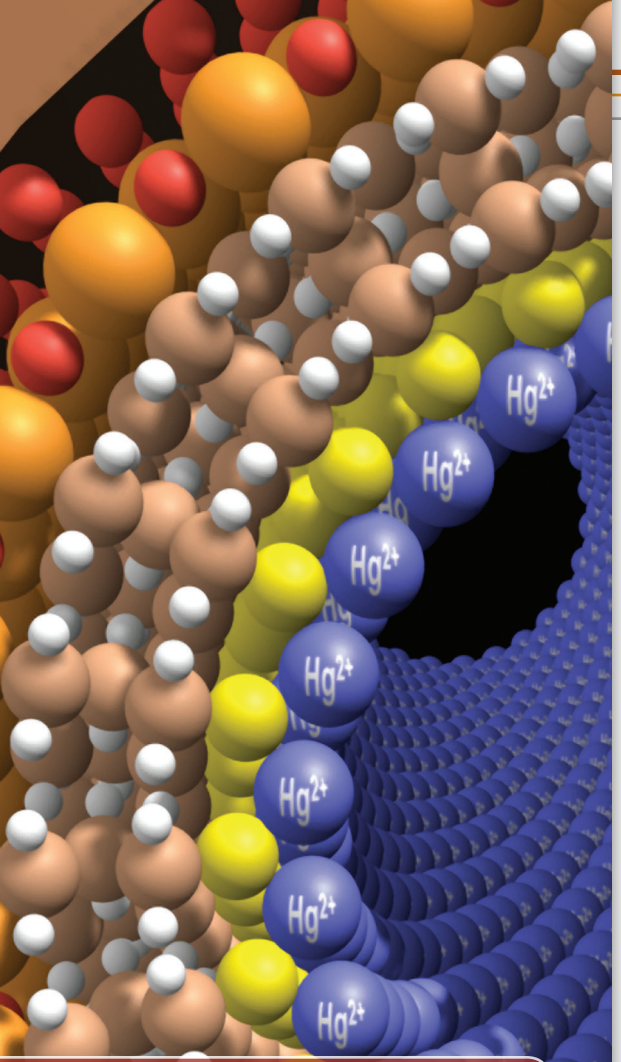
2003 PNNL formed the GridWise Alliance Board.

2003 The National Institutes of Health designated PNNL as a center for basic research in proteomics.

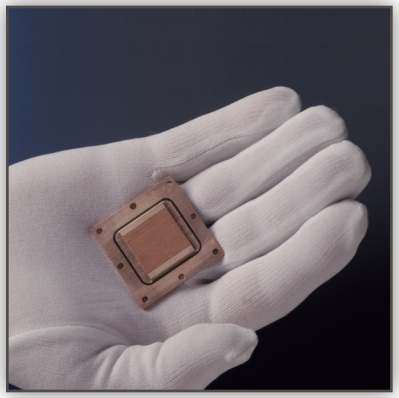
2003 The War in Iraq began.

2004 DHS created the National Visual Analytics Center™ and asked PNNL to lead the effort.

2005 PNNL partnered with Oregon State University and created the Microproducts Breakthroughs Institute.



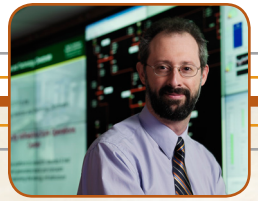
1998 Researchers engineered the ceramic called SAMMS, short for self-assembled monolayers on mesoporous supports, to remove hazardous mercury and other heavy metals from water and other liquids. The product was commercialized and is now being used to solve global environmental challenges.



1999 Researchers developed the award-winning MicroHeater, a palm-sized combustion unit that weighed less than .2kg (5 oz.). The technology could provide heat for portable personal heating and cooling devices, in-line water heaters, fuel cell systems, and indoor heating systems.

1999 Scientists developed a new way to make plastic virtually impermeable so it could be used to replace glass in new display technologies. Using plastics instead of glass would allow laptop computer monitors, cell phones and other flat-panel displays to be thinner, more rugged and lighter weight. The product is incorporated into many commercial products.

2000 PNNL engineered the Timed Neutron Detector, an award-winning technology, which quickly and easily detects metallic and non-metallic landmines.

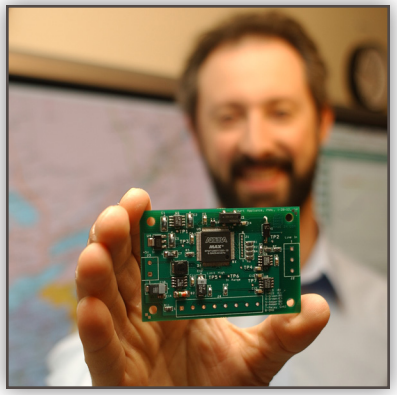


2005 PNNL joined DOE's Joint Genome Institute.

2006 PNNL launched the Pacific Northwest GridWise™ Demonstration projects.

2006 PNNL established the Electricity Information Operations Center for researching and developing technologies and concepts to better manage and control the electric grid.

2008 PNNL began the largest construction effort in its history to replace research facilities for biological sciences, computational sciences and nuclear research.



2000 PNNL produced a prototype Grid-Friendly™ Appliance Controller chip that can be incorporated into consumer appliances. Licensed in 2011, the chip allows appliances to respond to severe changes in the power grid by shutting down the load or temporarily scaling back energy use.

2000 PNNL combined an optical microscope with a nuclear magnetic resonance microscope to allow direct observation of a single living cell's physical and chemical composition—without invading or destroying the cell—in real time. This new technology is used to study the effects of environmental conditions on live cells.

2002 PNNL designed a faster, more thorough mass spectrometry method for identifying proteins. The system significantly advances the technology infrastructure required to understand the roles proteins play in cellular function and disease development.

2002 PNNL selected to lead a DHS program that integrated and began deploying radiation detection systems at ports of entry around the country that allow U.S. Customs and Border Protection Officers to scan for and detect the presence of illicit nuclear and radiological materials.

2002 Researchers invented a means to deposit metal atoms on very thin oxide layers, making entire computer memories immediately available for use. The technique also may help fabricate less expensive catalysts for chemical reactions and lead to better nanotechnology devices and ceramic or metal seals.

2003 PNNL designed a saliva-testing system that can be used to monitor human exposure to harmful chemicals. Using sophisticated mass spectrometry equipment, researchers developed a portable microanalytical sensor to quickly diagnose organophosphate pesticide exposure in humans. The sensor provided immediate results without the need for blood.

2008 PNNL and Washington State University dedicated the jointly developed Bioproducts, Sciences, and Engineering Laboratory located on the WSU Tri-Cities campus.

2008 PNNL launched the Institute for Interfacial Catalysis (now the Institute for Integrated Catalysis) to encourage collaboration among catalysis researchers across the country and bridge the gap from fundamental catalysis research to process application.

2009 A joint carbon capture and storage science and technology program was created with the Chinese Academy of Sciences and the National Energy Technology Laboratory.

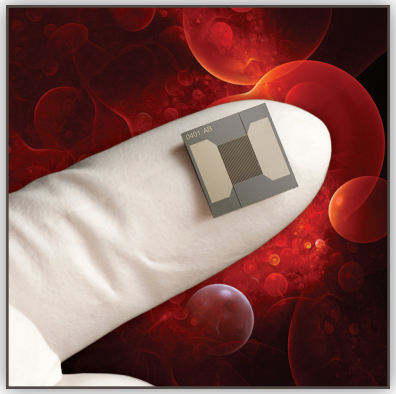
2009 PNNL was awarded stewardship of the Defense Department's Center for Adaptive Supercomputing Software—Multi-Threaded Architectures.

2007 Work began on pilot-scale pretreatment processes for the Hanford Waste Treatment Plant, which is designed to treat waste stored in underground tanks. PNNL's role to test the processes was completed in 2009.

2007 A technology that reduces NOx—a mixture of nitric oxide and nitrogen dioxide—in the diesel engine was invented at PNNL. Called Lean-NOx Trap, the technology works by combining an electrically charged gas with a specialized catalyst. First used in the 2007 Dodge Ram pickup, it is also being used in the Volkswagen Jetta TDI.

2008 Engineers initiated work on the Smart Charger Controller to mitigate peak demand on the grid when many electric vehicles charge at the same time. It also controls the battery charging to even out the fluctuations in the electricity production from wind and solar resources. In 2011, the controller was tested in commercially available electric cars.

2009 An on-board, health-monitoring device from PNNL helped military personnel ensure the Army's Hellfire II missiles performed without failure. It marked the Army's first-ever deployment of missiles in the Middle East that feature a device to constantly monitor the weapon's battlefield readiness.



2010 Molecular traces can be telltale signs of explosives in a briefcase or progressing human disease. Revolutionary ion mobility separations in a microchip, developed at Owlstone Nanotech and PNNL, dramatically improve the ability to rapidly detect specific molecules in complex samples.

2010

2009 PNNL dedicated two new laboratories—the Biological Sciences Facility and the Computational Sciences Facility.

2009 PNNL established the Center for Molecular Electrocatalysis to pursue advanced research in energy.

2011 PNNL dedicated facilities to replace research capabilities in materials science and nuclear research.

2011 Archer Daniels Midland Company began operating a full-scale production facility built to employ the Propylene Glycol from Renewable Sources process developed at PNNL. The new facility, which has 100,000 metric tons annual production capacity, is now being used to manufacture renewables-based industrial and pharmaceutical grade propylene glycol—a commodity chemical used in everyday industrial and consumer products traditionally made via petroleum.

2010 Through the Pacific Northwest Smart Grid Demonstration Project, researchers begin a unique, five-year regional effort to test new smart grid technology, including PNNL's transactive control signal, and quantify smart grid costs and benefits. The project, led by Battelle, will help make the region's and nation's electric grid more reliable and efficient.

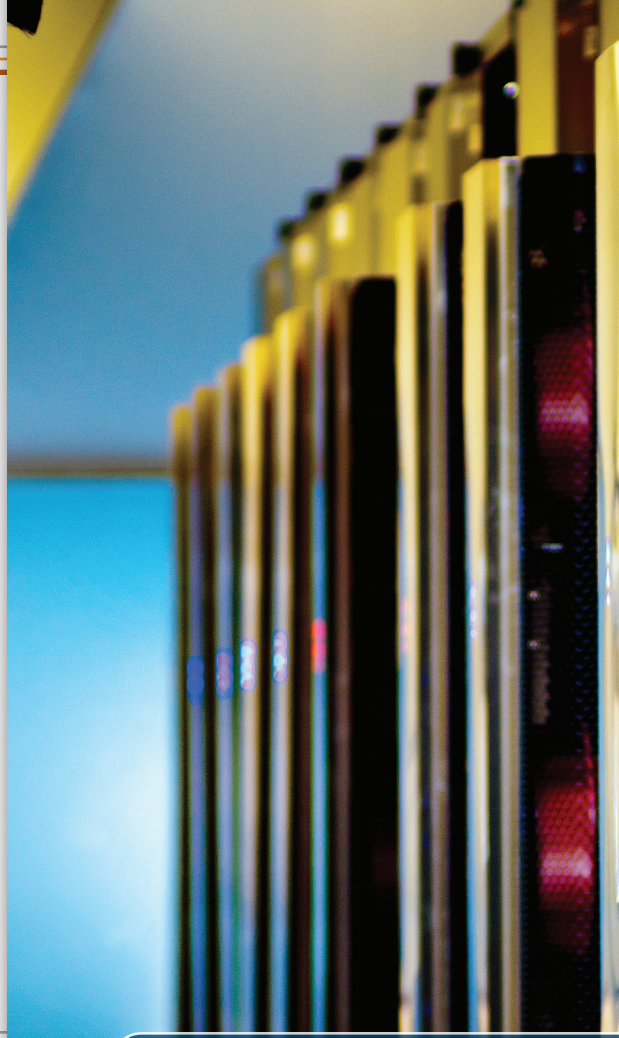
2010 PNNL developed the hermetic environmental protection package for an ultra-small self-charging power source. The lithium ion-based battery with a thin photovoltaic collector is only five millimeters in diameter and approximately 50 microns thick (a human hair is approximately 70 microns thick) with an energy density greater than 300 watt-hours per liter.

2010 PNNL's scalable cyber visualization tools offer insight into massive datasets to help analysts discover early indictors of potentially malicious activity. This provides analysts a significantly improved situational awareness of network activity, providing more efficient investigation to support prevention, response, and mitigation of harmful attacks.

2012 New battery material developed by scientists at PNNL, Vorbeck Materials and Princeton University enables electric vehicles and consumer electronic products to recharge in a fraction of the time currently required.

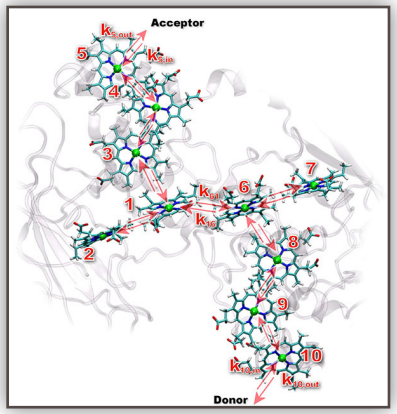
2011 Following the earthquake and tsunami that hit Fukushima, Japan, in March 2011, ultra-trace nuclear detection technology developed at PNNL, employed for international treaty verification purposes in Japan, immediately is used to provide technical readings for Japanese decision makers. Days later, the same equipment at PNNL detects the first signals of nuclear fallout that has made its way to the atmosphere over the United States.

2011 PNNL staff members were recognized by DOE Secretary Chu for helping to keep the nation and the world safe. First, when the Deepwater Horizon exploded and spilled oil into the Gulf of Mexico, and secondly when tons of used nuclear fuel in the former Soviet Union was at risk of falling into the wrong hands.



2012 EMSL's Olympus supercomputer advances science and saves energy. It can compute as fast as 20,000 typical PCs combined, and is the first large-scale computer exclusively available to PNNL researchers and their collaborators.

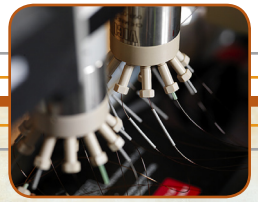
2012 Purification systems are critical to thousands of sailors isolated deep underwater in submarines. PNNL's Advanced Carbon-Dioxide Removal Unit, developed with support from the Naval Sea Systems Command, captures carbon dioxide directly from the atmosphere within a submarine; it's an environmentally friendly removal process that creates a healthier underwater environment. It is scheduled for installation in a Navy submarine in 2014.



2013 Proteins on the surface of bacteria produce an electric current by simply touching a mineral surface, allowing them to breathe iron in the environment. The discovery made by PNNL researchers is important for understanding how carbon works its way through the atmosphere, land and oceans, and will aid with cleaning up soil contaminants, for trapping carbon dioxide and for making batteries out of bacteria.

2013 A demonstration on how gas trapped under a frozen water layer escapes could answer questions about how astrophysical ices and water form on planets. The discovery made by PNNL scientists also could be used as a model to study the properties of glasses used for materials science, nuclear waste storage, drug delivery and pharmaceuticals.

2012



2012 PNNL researchers develop PRISM, a new technique using mass spectrometers that could speed drug discovery and basic biology research. The technique matches the sensitivity and accuracy of antibody-based clinical tests to identify protein biomarkers associated with cancer and other diseases.

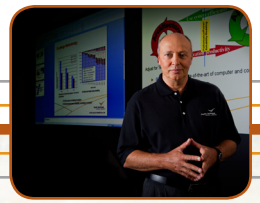
2012 PNNL is awarded funding to contribute expertise to a 5-year, $120 million new batteries and energy storage research hub called the Joint Center for Energy Storage Research.

2013

2013 Cascade, a new supercomputer expected to rank among the world's fastest machines, was added to EMSL. The advanced computer is used to run computationally intense climate and biological simulations, along with other scientific programs.

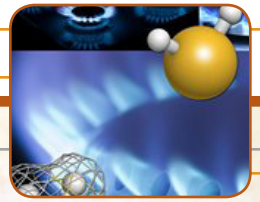
2013 A continuous chemical process developed by PNNL engineers produces useful crude oil minutes after they pour in harvested algae. With additional conventional refining, the crude algae oil is converted into aviation fuel, gasoline or diesel fuel.

2013 A component of plastic bottles and canned food linings that have helped make the world's food supply safer has the potential to mimic the sex hormone estrogen if blood and tissue levels are high enough. PNNL researchers' studies show that in the general population, people's exposure to bisphenol A, or BPA, may be many times too low to effectively mimic estrogen in the human body.

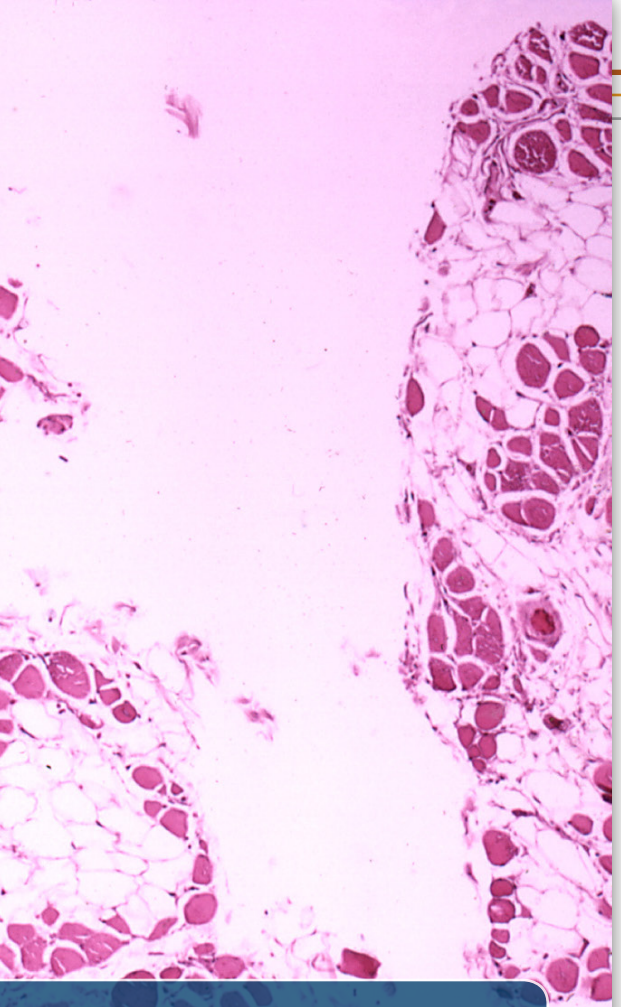


2013 The Northwest Institute for Advanced Computing is formed by the University of Washington and PNNL. Through the institute, researchers will work to ensure the next generation of computers and the methods used to run them can address challenges ranging from climate change to energy management.

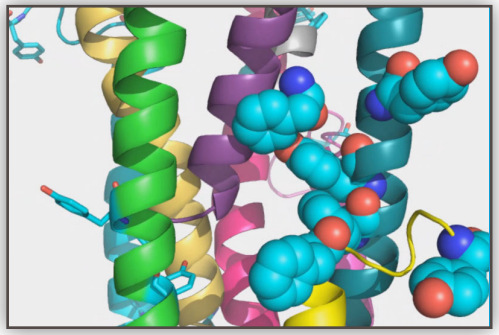
2013 PNNL is selected to shape research priorities for the Reference Facility for Offshore Renewable Energy. The DOE facility will be used to test technologies, such as remote sensing designed to determine the power-generating potential of offshore winds and waters.



2013 Natural gas, an affordable energy source, also harbors hydrogen sulfide—a toxin that must be removed. PNNL discovered a method to remove hydrogen sulfide that is more effective and efficient than current techniques.



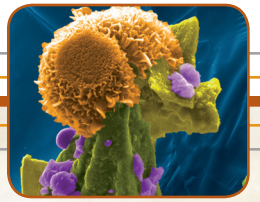
2014 People with muscular dystrophy could one day assess the effectiveness of their medication with the help of a smartphone-linked device, a new study in mice suggests. The PNNL study used a new method to process ultrasound imaging information that could lead to hand-held instruments that provide fast, convenient medical information.



2013 Tiny electrical wires protrude from some bacteria and contribute to rock and dirt formation. Researchers studying the protein that makes up one such wire have determined the protein's structure. The finding is important to such diverse fields as producing energy, recycling Earth's carbon and miniaturizing computers.

2014 PNNL scientists more accurately estimated the effect of atmospheric aerosols on clouds. As a result, the Intergovernmental Panel on Climate Change reduced the minimum it expects the earth's temperature to change in response to carbon dioxide emissions.

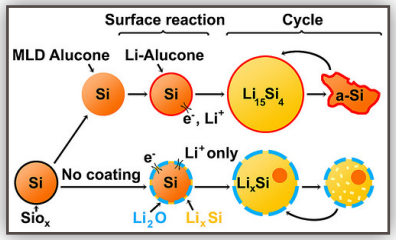
2014



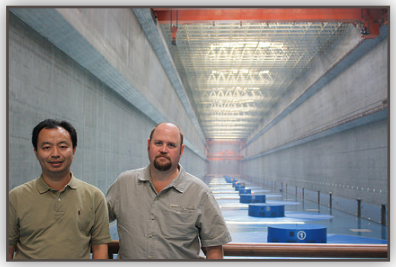
2013 PNNL scientists discovered the first iron-based catalyst that converts hydrogen directly to electricity. The result moves chemists and engineers one step closer to widely affordable fuel cells.

2014 Five PNNL researchers are named to a comprehensive list of the world's most highly referenced scientists in the areas of engineering and materials science, geosciences, engineering as well as chemistry.

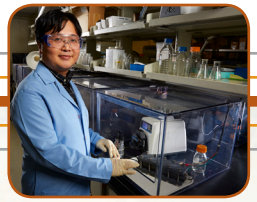
2014 The Glyph™ is a three-dimensional headset display that contains PNNL-developed virtual retinal technology that's easier to read. The technology was commercialized for military applications to improve the sight of soldiers in dark battlefields and aid with piloting armored or unmanned vehicles. It also shows promise for applications such as surgery and virtual training.



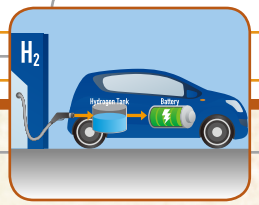
2014 A silicon nanomaterial with 10 times the energy storage capacity of graphite was developed by PNNL researchers. The discovery could lead to better batteries with longer life than today's lithium-ion batteries.



2014 PNNL researchers discovered that modifying turbines to minimize dramatic shifts in pressure offers an important way to keep fish safe when passing through dams. The research is part of a promising body of work that aims to reduce injuries by improving turbine designs in dams around the world.



2014 Washington Governor Jay Inslee and the state Department of Commerce awarded $14.3 million in matching grants to three state utilities to lead energy storage projects with ties PNNL. Some of the utilities will install the all-vanadium redox flow battery developed at PNNL and licensed in 2012.



2014 PNNL joined a consortium of automakers, energy companies, government laboratories, and others that aims to accelerate the rollout of an infrastructure for hydrogen-powered vehicles and related technologies.

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