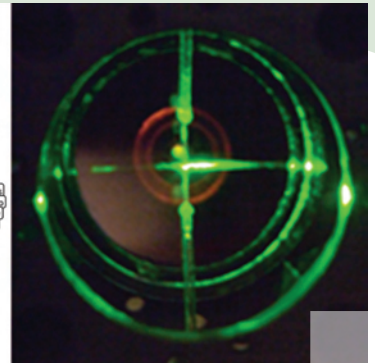
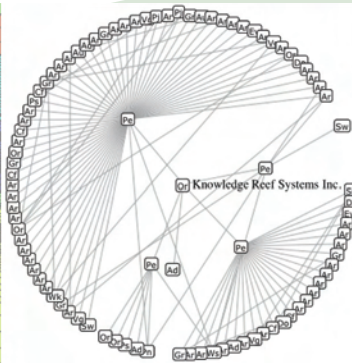
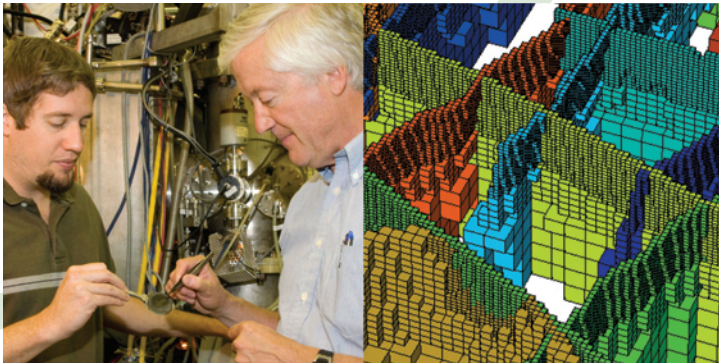


# Outstanding Innovation

2008 Technology Transfer Awards



*Carrying on the tradition of world-changing innovation*



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*Outstanding  
Innovation*  
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Tuesday, May 26, 2009  
Los Alamos National Laboratory  
Los Alamos, New Mexico







**W**elcome to the 11th annual Technology Transfer Awards reception. This evening we celebrate Los Alamos National Laboratory innovators and recognize their vital role in transferring state-of-the-art technologies from the Laboratory to the private sector.

Our national security depends on science and technology, and the United States relies on Los Alamos National Laboratory for the best of both. The accomplishments of tonight's honorees, in the form of copyrighted, patented, and licensed technologies, bring recognition to the Laboratory for our world-class science. Moreover, their commercialization helps to strengthen the nation's economic security by enhancing U.S. industrial competitiveness.

The exceptional work produced by tonight's honorees also helps the Laboratory attract new employees, program sponsors, and collaborators by expanding our interactions with industry. Our Laboratory innovators use science and technology to meet national security challenges while at the same time fueling startup companies, creating job opportunities, and attracting business and capital to Northern New Mexico. That outcome benefits the region, the national economy, and all of society.

On behalf of the senior management team and the Laboratory community, I extend congratulations and appreciation to this evening's honorees for their achievements. Continued participation by Laboratory innovators in technology transfer activities will allow Los Alamos National Laboratory to continue its vital role in regional and national economic competitiveness for decades to come.

Michael R. Anastasio  
Laboratory Director



## **Keynote Speaker: William C. Enloe Chairman and Chief Executive Officer Los Alamos National Bank**

William C. (Bill) Enloe is Chairman and Chief Executive Officer of Los Alamos National Bank (LANB), a position he has held since 1994. Having joined the bank in 1971, his career has spanned over 38 of its 46-year history. He has served as President and Chief Executive Officer of Trinity Capital Corporation, the holding company for LANSB, since 1979. He is also CEO of Title Guaranty and Insurance Company, a subsidiary of Trinity Capital Corporation, and was appointed to the Federal Reserve Bank of Kansas City's Denver Branch Board of Directors in December 2008.

Enloe plays a key role in developing the bank's strategic and operational focus and maximizing its performance. Under his leadership, LANSB has received prestigious honors including the New Mexico Ethics in Business Award and a 2000 Malcolm Baldrige National Quality Award.

He is committed to numerous New Mexico charities and involved in supporting economic development efforts. He serves as a member and/or director of multiple organizations including the LANSB Venture Acceleration Fund Review Panel, the Santa Fe Institute, the Delle Foundation, Los Alamos Economic Development Corporation, Los Alamos Economic Development Land Use Council, and Los Alamos Technical Associates, Inc. Enloe is also president of the Los Alamos Community Development Committee.

He received the Leadership New Mexico Distinguished Leader Award in 2007, and has been named the state, regional, and national recipient of the SBA Financial Advocate of the Year; received the New Mexico Distinguished Public Service Award; and been named Citizen of the Year by the Los Alamos Chamber of Commerce.

Enloe holds a bachelor's degree from Eastern New Mexico University and is a graduate of the University of Colorado School of Banking.

## Abstracts of Issued Patents

Listings are in accordance with issue dates from beginning to end of fiscal year 2008

### Conductive Layer for Biaxially Oriented Semiconductor Film Growth

Alp T. Findikoglu (MPA-STC)  
Vladimir Matias (MPA-STC)  
U. S. Patent 7,288,332

A conductive layer for biaxially oriented semiconductor film growth and a thin film semiconductor structure such as, for example, a photodetector, a photovoltaic cell, or a light emitting diode (LED) that includes a crystallographically oriented semiconducting film disposed on the conductive layer. The thin film semiconductor structure includes: a substrate; a first electrode deposited on the substrate; and a semiconducting layer epitaxially deposited on the first electrode. The first electrode includes a template layer deposited on the substrate and a buffer layer epitaxially deposited on the template layer. The template layer includes a first metal nitride that is electrically conductive and has a rock salt crystal structure, and the buffer layer includes a second metal nitride that is electrically conductive. The semiconducting layer is epitaxially deposited on the buffer layer. A method of making such a thin film semiconductor structure is also described.

### Integrated Optical Biosensor System (IOBS)

Karen M. Grace (ISR-4)  
Martin R. Sweet (ISR-4)  
Roy M. Goeller (ISR-4)  
Leland Jean Morrison (ISR-4)  
Wynne Kevin Grace (C-PCS)  
Jerome D. Kolar (ISR-4)  
U.S. Patent 7,289,207

An optical biosensor has a first enclosure with a pathogen recognition surface, including a planar optical waveguide and grating located in the first enclosure. An aperture is in the first enclosure for insertion of sample to be investigated to a position in close proximity to the pathogen recognition surface. A laser in the first enclosure includes means for aligning and means for modulating the laser, the laser having its light output directed toward said grating. Detection means are located in the first enclosure and in optical communication with the pathogen recognition surface for detecting pathogens after interrogation by the laser light and outputting the detection. Electronic means is located in the first enclosure and receives the detection for processing the detection and outputting information on the detection, and an electrical power supply is located in the first enclosure for supplying power to the laser, the detection means, and the electronic means.

## Detection of Phenols Using Engineered Bacteria

Cheryl R. Kuske (B-6)  
Thomas C. Terwilliger (B-9)  
Arlene A. Wise (B-7)  
U.S. Patent 7,303,894

Detection of phenols using engineered bacteria. A biosensor can be created by placing a reporter gene under control of an inducible promoter. The reporter gene produces a signal when a cognate transcriptional activator senses the inducing chemical. Creation of bacterial biosensors is currently restricted by limited knowledge of the genetic systems of bacteria that catabolize xenobiotics. By using mutagenic PCR to change the chemical specificity of the *Pseudomonas* species CF600 DmpR protein, the potential for engineering novel biosensors for detection of phenols has been demonstrated. DmpR, a well-characterized transcriptional activator of the P. CF600's dmp operon mediates growth on simple phenols. Transcription from Po, the promoter heading the dmp operon, is activated when the sensor domain of DmpR interacts with phenol and mono-substituted phenols. By altering the sensor domain of the DmpR, a group of DmpR derivatives that activate transcription of a Po-lacZ fusion in response to eight of the EPA's eleven priority pollutant phenols has been created. The assays and the sensor domain mutations that alter the chemical specificity of DmpR is described.

## 3-D Readout-Electronics Packaging for High-Bandwidth Massively Paralleled Imager

Kris K. Kwiatkowski (P-23)  
James Lyke  
U.S. Patent 7,309,878 (DOE)

Dense, massively parallel signal processing electronics are co-packaged behind associated sensor pixels. Microchips containing a linear or bilinear arrangement of photo-sensors, together with associated complex electronics, are integrated into a simple 3-D structure (a "mirror cube"). An array of photo-sensitive cells are disposed on a stacked CMOS chip's surface at a 45-degree angle from light reflecting mirror surfaces formed on a neighboring CMOS chip surface. Image processing electronics are held within the stacked CMOS chip layers. Electrical connections couple each of said stacked CMOS chip layers and a distribution grid, the connections for distributing power and signals to components associated with each stacked CMOS chip layer.

## Reversible Electro-Optic Device Employing Aprotic Molten Salts and Method

Anthony K. Burrell (MPA-MC)  
Simon B. Hall (MPA-MC)  
T. Mark McCleskey (MPA-MC)  
Benjamin P. Warner (MPA-MC)  
U.S. Patent 7,317,106

A single-compartment reversible mirror device having a solution of aprotic molten salt, at least one

soluble metal-containing species comprising metal capable of being electrodeposited, and at least one anodic compound capable of being oxidized was prepared. The aprotic molten salt is liquid at room temperature and includes lithium and/or quaternary ammonium cations, and anions selected from trifluoromethylsulfonate ( $\text{CF}_3\text{SO}_3^-$ ), bis(trifluoromethylsulfonyl) imide ( $((\text{CF}_3\text{SO}_2)_2\text{N}^-)$ ), bis(perfluoroethylsulfonyl) imide ( $((\text{CF}_3\text{CF}_2\text{SO}_2)_2\text{N}^-)$ ) and tris(trifluoromethylsulfonyl)methide ( $((\text{CF}_3\text{SO}_2)_3\text{C}^-)$ ). A method for preparing substantially pure molten salts is also described.

## Catalytic Synthesis of Metal Crystals Using Conductive Polymers

Wenguang Li (C-PCS)  
Hsing-Lin Wang (C-PCS)  
U.S. Patent 7,318,904

A method of forming metal nanoparticles using a polymer colloid that includes at least one conductive polymer and at least one polyelectrolyte. Metal ions are reduced in water by the conductive polymer to produce the nanoparticles, which may be then incorporated in the colloidal structure to form a colloid composite. The method can also be used to separate selected metal ions from aqueous solutions.



## Network Topology Mapper

Michael E. Fisk (ACS-PO)  
Eugene M. Gavrilov (CTN-5)  
Daniel A. Quist (IAT-2)  
U.S. Patent 7,319,677

A method enables the topology of an acyclic fully propagated network to be discovered. A list of switches that comprise the network is formed and the MAC address cache for each one of the switches is determined. For each pair of switches, from the MAC address caches the remaining switches that see the pair of switches are located. For each pair of switches the remaining switches are determined that see one of the pair of switches on a first port and the second one of the pair of switches on a second port. A list of insiders is formed for every pair of switches. It is determined whether the insider for each pair of switches is a graph edge and adjacent ones of the graph edges are determined. A symmetric adjacency matrix is formed from the graph edges to represent the topology of the data link network.

## Synthesis of $^{13}\text{C}$ and $^2\text{H}$ Substituted Methacrylic Acid, $^{13}\text{C}$ and $^2\text{H}$ Substituted Methyl Methacrylate and/or Related Compounds

Marc A. Alvarez (B-8)  
Rodolfo A. Martinez (B-8)  
Clifford J. Unkefer (B-8)  
U.S. Patent 7,321,049

The present invention is directed to labeled compounds of the formulae ##STR00001## wherein Q is selected

from the group consisting of --S--, --S(.dbd.O)--, and --S(.dbd.O)<sub>2</sub>--, Z is selected from the group consisting of 1-naphthyl, substituted 1-naphthyl, 2-naphthyl, substituted 2-naphthyl, and phenyl groups with the structure ##STR00002## wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub> and R<sub>5</sub> are each independently selected from the group consisting of hydrogen, a C<sub>1</sub>-C<sub>4</sub> lower alkyl, a halogen, and an amino group selected from the group consisting of NH<sub>2</sub>, NHR and NRR' where R and R' are each independently selected from the group consisting of a C<sub>1</sub>-C<sub>4</sub> lower alkyl, an aryl, and an alkoxy group, and X is selected from the group consisting of hydrogen, a C<sub>1</sub>-C<sub>4</sub> lower alkyl group, and a fully-deuterated C<sub>1</sub>-C<sub>4</sub> lower alkyl group. The present invention is also directed to a process of preparing labeled compounds, e.g., process of preparing  $^{13}\text{C}$  methacrylic acid by reacting a (CH<sub>3</sub>CH<sub>2</sub>O $^{13}\text{C}$ (O) $^{13}\text{C}$ H<sub>2</sub>) aryl sulfone precursor with  $^{13}\text{CHI}$  to form a (CH<sub>3</sub>CH<sub>2</sub>O $^{13}\text{C}$ (O) $^{13}\text{C}$ ( $^{13}\text{CH}_3$ )<sub>2</sub>) aryl sulfone intermediate, and, reacting the (CH<sub>3</sub>CH<sub>2</sub>O $^{13}\text{C}$ (O) $^{13}\text{C}$ ( $^{13}\text{CH}_3$ )<sub>2</sub>) aryl sulfone intermediate with sodium hydroxide, followed by acid to form  $^{13}\text{C}$  methacrylic acid. The present invention is further directed to a process of preparing  $^2\text{H}_8$  methyl methacrylate by reacting a (HOOC--C(C $^2\text{H}_3$ )<sub>2</sub>) aryl sulfinyl intermediate with CD<sub>3</sub>I to form a ( $^2\text{H}_3\text{COOC--C(C}^2\text{H}_3$ )<sub>2</sub>) aryl sulfinyl intermediate, and heating the (2H<sub>3</sub>COOC--C(C $^2\text{H}_3$ )<sub>2</sub>) aryl sulfinyl intermediate at temperatures and for time sufficient to form  $^2\text{H}_8$  methyl methacrylate.

## Synthesis of Isotopically Labeled R-OR S- $^{13}\text{C}$ , $^2\text{H}$ Glycerols

Marc A. Alvarez (B-8)  
Rodolfo A. Martinez (B-8)  
Clifford J. Unkefer (B-8)  
U.S. Patent 7,321,070

The present invention is directed to asymmetric chiral labeled glycerols including at least one chiral atom, from one to two  $^{13}\text{C}$  atoms and from zero to four deuterium atoms bonded directly to a carbon atom, e.g., (2S) [1,2- $^{13}\text{C}_2$ ]glycerol and (2R) [1,2- $^{13}\text{C}_2$ ]glycerol, and to the use of such chiral glycerols in the preparation of labeled amino acids.

## Ultrasonic Analyte Concentration and Application in flow Cytometry

Greg R. Goddard (B-9)  
Steven W. Graves (B-9)  
Gregory Kaduchak (B-9)  
Christopher S. Kwiatkowski (IAT-2)  
John C. Martin (B-9)  
Gary C. Salzman (ISR-4)  
Dipen N. Sinha (MPA-11)  
U.S. Patent 7,340,957

The present invention includes an apparatus and corresponding method for concentrating analytes within a fluid flowing through a tube using acoustic radiation pressure. The apparatus includes a function generator that outputs a radio frequency electrical signal to a transducer that transforms the radio frequency electric signal to an acoustic signal and couples the acoustic

signal to the tube. The acoustic signal is converted within the tube to acoustic pressure that concentrates the analytes within the fluid.

### Method for Producing Metal Oxide Nanoparticles

Chun Ku Chen  
Daniel Mendoza (W-2)  
Jonathan Phillips (MST-7)  
U.S. Patent 7,357,910

Method for producing metal oxide nanoparticles. The method includes generating an aerosol of solid metallic microparticles, generating plasma with a plasma hot zone at a temperature sufficiently high to vaporize the microparticles into metal vapor, and directing the aerosol into the hot zone of the plasma. The microparticles vaporize in the hot zone into metal vapor. The metal vapor is directed away from the hot zone and into the cooler plasma afterglow where it oxidizes, cools and condenses to form solid metal oxide nanoparticles.

### Microporous Crystals and Synthesis Schemes

Eva R. Birnbaum (C-IIAC)  
T. Mark McCleskey (MPA-MC)  
Kevin C. Ott (MPA-MC)  
William Tumas (SPO-AE)  
Matthew Z. Yates (C-SIC)  
U.S. Patent 7,361,327

Novel zeolites are produced by combining a polar solute, a silicon or phosphorous source, and a structure directing agent. Surfactants and a hydrophobic solvent are added to

the previously mixed three species and shaken to disperse the surfactants. The reverse microemulsion is stirred overnight, at about room temperature and then iced for five to ten minutes. A metal source is added vigorously shaken for about two minutes. The mixture is then aged for about two hours at about room temperature. A mineralizer is added and the resultant mixture aged for about two hours at about room temperature. The mixture is heated to about 180°C, for a suitable time period. The final novel product is then isolated.

### Polymer-Assisted Deposition of Films

Anthony K. Burrell (MPA-MC)  
Quanxi Jia (MPA-STC)  
Yuan Lin (MST-STC)  
T. Mark McCleskey (MPA-MC)  
U.S. Patent 7,365,118

A polymer-assisted deposition process for deposition of metal oxide films is presented. The process includes solutions of one or more metal precursor and soluble polymers having binding properties for the one or more metal precursor. After a coating operation, the resultant coating is heated at high temperatures to yield metal oxide films. Such films can be epitaxial in structure and can be of optical quality. The process can be organic solvent-free.

### Ice Method for Production of Hydrogen Clathrate Hydrate

Konstantin A. Lokshin (LANSCE-LC)  
Yusheng Zhao (LANSCE-LC)  
U.S. Patent 7,371,907

The present invention includes a method for hydrogen clathrate hydrate synthesis. First, ice and hydrogen gas are supplied to a containment volume at a first temperature and a first pressure. Next, the containment volume is pressurized with hydrogen gas to a second higher pressure, where hydrogen clathrate hydrates are formed in the process.

### Catalyst and Method for Reduction of Nitrogen Oxides

Kevin C. Ott (MPA-MC)  
U.S. Patent 7,378,069

A Selective Catalytic Reduction (SCR) catalyst was prepared by slurry coating ZSM-5 zeolite onto a cordierite monolith, then subliming an iron salt onto the zeolite, calcining the monolith, and then dipping the monolith either into an aqueous solution of manganese nitrate and cerium nitrate and then calcining, or by similar treatment with separate solutions of manganese nitrate and cerium nitrate. The supported catalyst containing iron, manganese, and cerium showed 80 percent conversion at 113°C of a feed gas containing nitrogen oxides having 4 parts NO to one part NO<sub>2</sub>, about one equivalent ammonia, and excess oxygen; conversion improved to 94 percent at

147°C. N<sub>2</sub>O was not detected (detection limit: 0.6 percent N<sub>2</sub>O).

### **Composition and Method for Removing Photoresist Materials from Electronic Components**

Leisa B. Davenhall (C-CDE)  
James B. Rubin (PMT-2)  
Craig M. Taylor (SPO-SC)  
U.S. Patent 7,381,694

Composition and method for removing photoresist materials from electronic components. The composition is a mixture of at least one dense phase fluid and at least one dense phase fluid modifier. The method includes exposing a substrate to at least one pulse of the composition in a supercritical state to remove photoresist materials from the substrate.

### **Linear Electric Field Time-of-Flight Ion Mass Spectrometer**

William C. Feldman (ISR-1)  
Herbert O. Funsten (ISR-DO)  
U.S. Patent 7,385,188

A linear electric field ion mass spectrometer having an evacuated enclosure with means for generating a linear electric field located in the evacuated enclosure and means for injecting a sample material into the linear electric field. A source of pulsed ionizing radiation injects ionizing radiation into the linear electric field to ionize atoms or molecules of the sample material, and timing means determine the time elapsed between ionization

of atoms or molecules and arrival of an ion out of the ionized atoms or molecules at a predetermined position.

### **Circular Permutant GFP Insertion Folding Reporters**

Geoffrey S. Waldo (B-9)  
Stephanie Cabantous (B-9)  
U.S. Patent 7,390,640

Provided are methods of assaying and improving protein folding using circular permutants of fluorescent proteins, including circular permutants of GFP variants and combinations thereof. The invention further provides various nucleic acid molecules and vectors incorporating such nucleic acid molecules, comprising polynucleotides encoding fluorescent protein circular permutants derived from superfolder GFP, which polynucleotides include an internal cloning site into which a heterologous polynucleotide may be inserted in-frame with the circular permutant coding sequence, and which when expressed are capable of reporting on the degree to which a polypeptide encoded by such an inserted heterologous polynucleotide is correctly folded by correlation with the degree of fluorescence exhibited.

### **Charge-Free Low Temperature Method of Forming Thin Film-Based Nanoscale Materials and Structures on a Substrate**

Mark A. Hoffbauer (C-CDE)  
Alexander H. Mueller (C-CDE)  
U.S. Patent 7,393,762

A method of forming a nanostructure at low temperatures. A substrate that is reactive with one of atomic oxygen and nitrogen is provided. A flux of neutral atoms of at least one of nitrogen and oxygen is generated within a laser-sustained-discharge plasma source and a collimated beam of energetic neutral atoms and molecules is directed from the plasma source onto a surface of the substrate to form the nanostructure. The energetic neutral atoms and molecules in the plasma have an average kinetic energy in a range from about 1 eV to about 5 eV.

### **Multiple Pole Railgun Barrel with Separated Ballistic Guidance and Electrical Current Contact Surfaces**

James R. Sims (AET-1)  
U.S. Patent 7,398,722

An electromagnetic propulsion system is disclosed having separate rails for ballistic guidance and for carrying current. In this system, one or more pairs of ballistic guidance rails are provided, with each ballistic guidance rail having a pair of current carrying rails joined to it to form a combined rail. Each

combined rail is separated electrically from adjacent combined rails by electrically insulating blocks. Each of the current carrying rails in a given combined rail pair have the same electrical polarity, and the polarities alternate between adjacent combined rails. Armatures contact current carrying rails to complete the circuit to generate the accelerating Lorentz force on the armatures. Bore riders on the sabot and/or projectile are in contact with the ballistic guide rails. Separation of the current carrying and ballistic guidance functions increases resistance of the system to rail movement and bending, as well as reduced wear/damage to the rails. In further embodiments, a circumferential over wrap providing compressive force on the rails further increases resistance of the system to rail movement and bending.

### **Continuous Air Monitor Filter Changeout Apparatus**

John C. Rodgers (HSR-4)  
U.S. Patent 7,399,337

An apparatus and corresponding method for automatically changing out a filter cartridge in a continuous air monitor. The apparatus includes: a first container sized to hold filter cartridge replacements; a second container sized to hold used filter cartridges; a transport insert connectively attached to the first and second containers; a shuttle block, sized to hold the filter cartridges that is located within the transport insert; a transport driver

mechanism means used to supply a motive force to move the shuttle block within the transport insert; and, a control means for operating the transport driver mechanism.

### **Quantum Coherent Switch Utilizing Commensurate Nanoelectrode and Charge Density Periodicities**

Neil Harrison (MPA-NHMFL)  
Albert Migliori (MPA-NHMFL)  
John Singleton (MPA-NHMFL)  
U.S. Patent 7,408,235

A quantum coherent switch having a substrate formed from a density wave (DW) material capable of having a periodic electron density modulation or spin density modulation, a dielectric layer formed onto a surface of the substrate that is orthogonal to an intrinsic wave vector of the DW material; and structure for applying an external spatially periodic electrostatic potential over the dielectric layer.

### **Catalyst and Method for Reduction of Nitrogen Oxides**

Kevin C. Ott (MPA-MC)  
U.S. Patent 7,413,720

A Selective Catalytic Reduction (SCR) catalyst was prepared by slurry coating ZSM-5 zeolite onto a cordierite monolith, then subliming an iron salt onto the zeolite, calcining the monolith, and then dipping the monolith either into an aqueous solution of manganese

nitrate and cerium nitrate and then calcining, or by similar treatment with separate solutions of manganese nitrate and cerium nitrate. The supported catalyst containing iron, manganese, and cerium showed 80 percent conversion at 113°C of a feed gas containing nitrogen oxides having 4 parts NO to one part NO<sub>2</sub>, about one equivalent ammonia, and excess oxygen; conversion improved to 94 percent at 147°C. N<sub>2</sub>O was not detected (detection limit: 0.6 percent N<sub>2</sub>O).

### **Apparatus and Method for Monitoring Breath Acetone and Diabetic Diagnostics**

Wenqing Cao (MPA-STC)  
Yixiang Duan (C-CDE)  
U.S. Patent 7,417,730

An apparatus and method for monitoring diabetes through breath acetone detection and quantitation employs a microplasma source in combination with a spectrometer. The microplasma source provides sufficient energy to produce excited acetone fragments from the breath gas that emit light. The emitted light is sent to the spectrometer, which generates an emission spectrum that is used to detect and quantify acetone in the breath gas.

## Coherent Hybrid Electromagnetic Field Imaging

Bradly J. Cooke (ISR-2)  
David C. Guenther (ISR-4)  
U.S. Patent 7,417,744

An apparatus and corresponding method for coherent hybrid electromagnetic field imaging of a target, where an energy source is used to generate a propagating electromagnetic beam, an electromagnetic beam splitting means to split the beam into two or more coherently matched beams of about equal amplitude, and where the spatial and temporal self-coherence between each two or more coherently matched beams is preserved. Two or more differential modulation means are employed to modulate each two or more coherently matched beams with a time-varying polarization, frequency, phase, and amplitude signal. An electromagnetic beam combining means is used to coherently combine said two or more coherently matched beams into a coherent electromagnetic beam. One or more electromagnetic beam controlling means are used for collimating, guiding, or focusing the coherent electromagnetic beam. One or more apertures are used for transmitting and receiving the coherent electromagnetic beam to and from the target. A receiver is used that is capable of square-law detection of the coherent electromagnetic beam. A waveform generator is used that is capable of generation and control of time-

varying polarization, frequency, phase, or amplitude modulation waveforms and sequences. A means of synchronizing time varying waveform is used between the energy source and the receiver. Finally, a means of displaying the images created by the interaction of the coherent electromagnetic beam with target is employed.

## Interception and Modification of Network Authentication Packets with the Purpose of Allowing Alternative Authentication Modes

Alexander D. Kent (ACS-PO)  
U.S. Patent 7,421,576

Methods and systems in a data/computer network for authenticating identifying data transmitted from a client to a server through use of a gateway interface system that are communicatively coupled to each other are disclosed. An authentication packet transmitted from a client to a server of the data network is intercepted by the interface, wherein the authentication packet is encrypted with a one-time password for transmission from the client to the server. The one-time password associated with the authentication packet can be verified utilizing a one-time password token system. The authentication packet can then be modified for acceptance by the server, wherein the response packet generated by the server is thereafter intercepted,

verified and modified for transmission back to the client in a similar but reverse process.

## Spin Microscope Based on Optically Detected Magnetic Resonance

Gennady P. Berman (T-4)  
Boris M. Chernobrod (T-4)  
U.S. Patent 7,305,869 (DOE)

The invention relates to scanning magnetic microscope which has a photoluminescent nanoprobe implanted in the tip apex of an atomic force microscope (AFM), a scanning tunneling microscope (STM) or a near-field scanning optical microscope (NSOM) and exhibits optically detected magnetic resonance (ODMR) in the vicinity of unpaired electron spins or nuclear magnetic moments in the sample material. The described spin microscope has demonstrated nanoscale lateral resolution and single spin sensitivity for the AFM and STM embodiments.

## Spinning Cold Plasma Apparatus and Methods Relating Thereto

Jaeyoung Park (P-24)  
Choongseock Chang  
Jemo Kang  
U.S. Patent 7,367,196 (Princeton BioMeditech Corporation)

Disclosed herein is an apparatus for generating a spinning cold plasma. A preferred embodiment of the spinning cold plasma apparatus is portable and includes a vortex

tube having an inner wall to form a vortex reaction chamber. The vortex tube preferably has a cold gas outlet formed at a first end of the vortex tube and a hot gas outlet formed at a second end of the vortex tube. The vortex tube preferably has a plurality of gas inlet openings formed therein for directing pressurized gas tangentially to the inner wall into the vortex reaction chamber. A preferred embodiment of the portable spinning cold plasma apparatus also includes a valve positioned at least partially within the cold gas outlet and a valve positioned at least partially within the hot gas outlet. The portable device preferably also includes an ionizing device, such as an RF source or microwave source, for transmitting electromagnetic energy into the vortex reaction chamber to ionize pressurized gas therein. Additional apparatus and methods are also disclosed herein.

## **Devices, Systems, and Methods for Imaging**

Scott Watson (HX-4)

David Appleby

Iain Fraser

U.S. Patent 7,358,502

Certain exemplary embodiments comprise a system, which can comprise an imaging plate. The imaging plate can be exposable by an x-ray source. The imaging plate can be configured to be used in digital radiographic imaging. The imaging plate can comprise a phosphor-based image storage device configured to convert an image stored therein into light.

## Copyrights Asserted in Fiscal Year 2008

### VINE, Version 1.0 (Addons 1 and 2)

Andrew F. Nelson (HPC-5)

VINE is an implementation of a particle-based hydrodynamic scheme using the "Smoothed Particle Hydrodynamics" (SPH) algorithm. It may be used both as a hydrodynamic code, as a particle code (i.e., as an N-body code) without hydrodynamic effects or as both in combination. We expect that it will be most readily used in simulations of astrophysical systems. VINE is quite featureful and includes modules to compute not only hydrodynamic forces but also self-gravity, cosmological effects and periodic boundaries.

### PixelVizion, Version 1.0

Andrew J. Dubois (HPC-5)  
Carolyn M. Connor (HPC-5)  
David H. Dubois (HPC-5)

LANL's PixelVizion is the first know application of Network Processor Unit (NPU) technology to computer visualization. This NPU-based image composition software enables line-rate (i.e., high-speed) graphics composition for large-scale data-visualization clusters via Intel's IXP2850 NPU technology.

### Watcher-Tracker, Version 0.1

Andrew M. Fraser (ISR-2)

The package provides a self-contained platform for demonstrating and experimenting with algorithms for multi-target tracking. The

software runs on any system that provides a python interpreter and the following additional python packages: wx-python, scipy and matplotlib. The code also requires the packages numpy and scipy.linalg, which are part of any complete scipy distribution.

### SIMD Abstraction Layer (SAL), Version 0.1

Benjamin K. Bergen (CCS-2)  
Timothy M. Kelley (CCS-2)

The SIMD Abstraction Layer (SAL) provides generic types and intrinsics for implementing numerical algorithms that use the short-vector execution pipelines that are available on many modern computing architectures. Such pipelines are often referred to as being single-instruction-multiple-data (SIMD), because they allow a single operation, such as addition or multiplication, to be applied to multiple data elements with a single instruction. This library is implemented as a set of C header files that may be included in a larger project. The goal of SAL is to provide a generic interface to the different instruction set of architectures (ISAs) used to implement short-vector execution pipelines by the different chip vendors that achieves close to the same performance as hand coded intrinsics.

## Gaussian Process Modeling and Simulation Analysis (GPMSA), Version 1.0

Brian J. Williams (CCS-6)  
David M. Higdon (CCS-6)  
James R. Gattiker (CCS-6)

GPM/SA is a set of MatLab functions for performing statistical analyses that combine experimental/observational data with detailed physical simulation output. This code carries out:

- Sensitivity analysis of the simulation code, which explores how code outputs vary as input settings change;
- Calibration/inversion determining which input settings lead to simulations that are consistent with the experimental or observational data; and
- Predicting system behavior and determining appropriate uncertainties for these predictions.

## PAGOSA, Version 15.9

Wayne Weseloh (X-4-SS)

PAGOSA is a 3-D Eulerian Hydro Code developed at the Los Alamos National Laboratory for massively parallel super computer systems using Fortran-90 array syntax. The code was first implemented on the CM-2, CM-200 and CM-5 systems created by Thinking Machines, then the T3D system built by CRAY, the SGI ORIGIN systems and, most recently, the Compaq ALPHA systems recently installed. The code was derived from the MESA family of

serial codes originally developed for use on the CRAY vector computers and written in serial Fortran-77.

This code is designed to use hundreds and even thousands of processors in tightly coupled systems with a high speed interconnect. Lately, it has focused on using MPI for the inter-processor communications but has used others in the past and is easily adaptable to the new ones in the future. It is programmed in a "Single Instruction, Multiple Data" (SIMD) paradigm, also known as "Data Parallel," using Fortran-90 arrays and array operations.

## Ciao HTTP Server Library, Version 0.5

Sean M. Brennan (ISR-3)

Provides flexible HTTP 1.1 stream handling (web server), for use with the Ciao Prolog system.

## Bayesian Inference Dipole Analysis (BIDA), Version 1.0

Sung Chan Jun (P-21)

BIDA is a software to nominally localize MEG neuronal electric multipole under the Bayesian probabilistic framework. Particularly, through Bayes's rule all prior information (related to sources) as well as likelihood distribution (related to physical modeling on neuronal electric sources in MEG, where spherical head model is used) are incorporated and the marginal posterior distribution is formulated. If this marginal posterior distribution is given, Markov Chain Monte Carlo (MCMC)

sampling technique is used to sample all likely source information from the given marginal posterior. BIDA contains MCMC sampling procedure for the given MEG posterior distribution. Particularly, this includes active time range for each dipole force. Through BIDA, one can get all possible MEG source information (number of sources, location, orientation, time course, active time range, and so on) for the given MEG measurement. Even this software was developed for averaged MEG measurement, a minor modification enables BIDA to be applicable for EEG measurement and MEG/EEG single trial data under certain assumptions.

## HHMR Operating System

David C. Jones (N-1)

This code runs on a 8051 micro controller and interfaces with a 20 key keypad, an LC Display, and the FPGA so that information and setup parameters can be exchanged for proper usage. It also interfaces with N-1's INCC software for remote runs and data collection.

## Bayesian Model Averaging (BMA), Version 1.0

Jasper A. Vrugt (EES-16)

Bayesian Model Averaging (BMA) has recently been proposed as a statistical method to calibrate forecast ensembles from numerical weather models. Successful implementation of BMA however, requires accurate estimates of the weights and vari-



ances of the individual competing models in the ensemble. This MATLAB code computes the weights and variances of the individual model forecasts using either the Expectation Maximization algorithm (option 1) or Markov Chain Monte Carlo sampling (option 2).

### **A Multi-Algorithm Genetically Adaptive Multiobjective Algorithm (AMALGAM), Version 1.0**

Jasper A. Vrugt (EES-16)

Most real-world search and optimization problems involve multiple conflicting objectives. Such problems are common in engineering, science, and commerce. This MATLAB code implements an innovative concept of genetically adaptive multi-algorithm optimization. The method builds on two new concepts, multi-method search, and adaptive offspring creation, to ensure a fast, reliable and computationally efficient solution to multiobjective nonlinear global optimization problems. We call this approach A Multi-Algorithm, Genetically Adaptive Multiobjective or AMALGAM. It is significantly more efficient than current state-of-the-art evolutionary algorithms, approaching a factor of ten improvement for the more complex, higher dimensional problems.

### **Differential Evolution Adaptive Metropolis (DREAM), Version 1.0**

Jasper A. Vrugt (EES-16)

The Differential Evolution Adaptive Metropolis (DREAM) algorithm is a general purpose Markov Chain Monte Carlo (MCMC) sampler for computationally efficient estimation of the high probability density (HPD) region of the parameter space. The scheme runs multiple different chains simultaneously for global exploration, and automatically tunes the scale and orientation of the proposal distribution during the search. The algorithm maintains detailed balance and ergodicity and various examples involving nonlinearity, highdimensionality, and multimodality show that DREAM is generally superior to other adaptive MCMC sampling approaches. The DREAM scheme significantly enhances the applicability of MCMC simulation to complex, multimodal search problems.

### **LANL Hybrid K-Edge Densitometer (HKED), Version 2007**

Michael L. Collins (N-4)

This code performs analysis of data obtained on Hybrid K-Edge/X-Ray Fluorescence Densitometer (HKED) instruments, and controls hardware components of these systems. A HKED instrument running this software can measure the concentrations of uranium, plutonium, neptunium, americium, thorium, and curium in a liquid sample.

### **Hand-Held Multiplicity Register (HHMR) FPGA VHDL Program**

Matthew R. Newell (N-1)

The HHMR FPGA VHDL code is firmware used to calculate correlations between neutron events fed into the Hand-Held Multiplicity Register (HHMR). It is a VHDL code that runs on a XILINX Spartan III, XC3S15001-4fg320, FPGA. The VHDL code is used to measure incoming pulse streams and measure the correlation between these input pulses. It determines the Reals rate, the Accidentals rate and the Multiplicity distribution. The code contains multiple shift registers, counters, histogramming memory, input derandomizers, control and input/output, IO, modules.

### **AMALGAM-SO, Version 1.0**

Jasper A. Vrugt (EES-16)

In the last few decades many different algorithms have been developed for solving complex search and optimization problems. The focus has been on the development of a single universal operator for population evolution that is always efficient for a diverse set of optimization problems. However, existing theory and numerical experiments have demonstrated that it is highly unlikely that such a universal operator exists. In a recent paper we have shown that significant advances in the field of evolutionary computation can be made if we embrace a concept of self-adaptive, multimethod

optimization, the goal of which is to develop a combination of search methods that have all the desirable properties to efficiently handle a wide variety of response surfaces. Our MATLAB code implements this new concept of multimethod search, called a MultiAlgorithm Genetically Adaptive Method for Single Objective optimization (AMALGAM-SO). This new algorithm simultaneously uses the strengths of the Covariance Matrix Adaptation (CMA) evolution strategy, Genetic Algorithm (GA) and Particle Swarm Optimizer (PSO) for population evolution, and implements a restart strategy with successively increasing population size. Benchmark results in 10, 30 and 50 dimensions using synthetic functions from the special session on real-parameter optimization of CEC 2005 show that AMALGAM-SO is generally superior in efficiency, robustness and reliability to currently available search algorithms. The new search method is relatively easy to implement, and is designed to take full advantage of the power of distributed computer networks.

### Fast Chi-Squared Reference Implementation

David Palmer (ISR-1)

This is an implementation of the Fast Chi-Squared Technique for finding periodic signals in irregularly sampled data, as described in Palmer, 2007. It uses an FFT-based technique to produce the best-fit periodic model for the data, search-

ing over all possible periods and harmonic compositions.

### Cell Messaging Layer, Version 1.0

Scott D. Pakin (CCS-1)

The Cell Messaging Layer is a communication library for use by applications running on clusters of Cell Broadband Engine processors (e.g., Roadrunner). Specifically, the Cell Messaging Layer enables any SPU (Synergistic Processing Unit - the Cell BE's vector processor) in the entire cluster to communicate directly with any other SPU. The Cell Messaging Layer provides a subset of the familiar MPI interface to facilitate the porting of message-passing applications to the Cell BE.

### VTK/ParaView with LANL Modules (PVLANL), Version 1.0

James P. Ahrens (CCS-1)

Lee A. Ankeny (HPC-1)

Patricia K. Fasel (CCS-3)

PVLANL, Version 1.0 is an extension to the VTK (Visual Tool Kit) and ParaView (Parallel Visualizer) graphics libraries. The PVLANL modules consist of data readers, data filters which to analysis processing and manipulation of the data read, and 2D and 3D output routines for visualizing the data. The modules are in VTK standard pipeline format such that they can be used with other existing VTK modules. The primary science application for this release is

cosmology as described in the paper "The Cosmic Code Comparison Project," Katrin Heitmann, et al., (LA-UR-071953).

### FAST-ER (Features from Accelerated Segment Test-Enhanced Repeatability)

Edward J. Rosten (ISR-2)

This software uses machine learning to produce an improved kind of a particular type of low-level image processing operator. The program then uses machine learning to further optimize the operator for speed. The final output is the source code for a program that can apply the operator to an image.

### JumboMem, Version 1.0

Scott D. Pakin (CCS-1)

JumboMem is a piece of middleware that enables an unmodified sequential application to directly access all of the memory in a cluster.

### Special Form Capsule Drawings

Cristy L. Abeyta (N-3)

Danny A. Martinez (AET-1)

The Off-Site Source Recovery (OSR) Project at Los Alamos National Laboratory manages excess and unwanted radioactive sealed sources and other radioactive materials that present a risk to public health, safety and national security; and for which no disposal options currently exist. Due to their age, a lack of available manufacturer data

and unknown origin, or the potential for leakage, some of the radioactive sealed sources targeted for recovery by the OSR Project, do not meet US Department of Transportation (US DOT) Type A requirements. Sealed sources that are special form can be shipped using US DOT Type A, 7A packages, which provide increased flexibility in shipping. In 2000, the OSR Project developed a sealed source overpack called the LANL Special Form Capsule (SFC) to provide method to ensure US DOT special form containment of radioactive sealed sources during transport. A key feature of the SFC was that it could be easily assembled in the field and allowed sealed sources which did not have current special form certification or documentation for domestic transport to be made special form by field encapsulation in a LANL SFC. After successful testing of the SFC, it was decided to fabricate a capsule to accommodate the many source sizes. The LANL SFC Model I, II, and III have been tested and certified to meet all requirements specified in Title 49 Part 173 of the Code of Federal Regulations, Section 469 (49CFR173.469). Its development expands the capabilities of the OSR Project and Department of Energy to efficiently transport and store sealed sources.

## **SENSIX, Version 0.4**

Sean M. Brennan (ISR-3)

SENSIX is an embedded operating system specifically for wireless sensor networks. It does not provide an OS kernel, but can interact with several commodity kernels (e.g., Linux, Windows). SENSIX also includes scc, the Sensor-C Compiler. The Sensor-C language is a refinement of C, also specifically for wireless sensor networks. SENSIX provides system services optimized for power savings, while Sensor-C allows an application developer to take full advantage of such optimization.

## Fiscal Year 2008 License Income Recipients

### **Ambrosiano, John (D-4)**

*Knowledge-based Matchmaking and  
Social Networks*

### **Arendt, Paul (MPA-STC)**

*Carbon Nanotube Portfolio for Structural  
Applications  
Superconductivity Technology*

### **Audia, Jeffrey (N-1)**

*MiniGRAND Family of Instruments*

### **Backhaus, Scott**

*Traveling Wave Device with Mass Flux  
Suppression*

### **Bai, Ying (ISR-5)**

*Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments*

### **Barbe, Michael (MST-6)**

*Laser Production of Articles from  
Powders (Directed Light Fabrication)*

### **Billen, James (LANSCE-ABS)**

*PARMELA, Version 3*

### **Black, Marcie (IAT-2)**

*Increased Energy Conversion via Incorporation  
of an Intermediate Bandgap*

### **Bollen, Johan (STBPO-RL)**

*Blackbox Version 1.0*

### **Borozdin, Konstantin (P-25)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

### **Bott, Terrence (D-6)**

*LED Tree, Version 1.0*

### **Bourret, Steven (N-1)**

*Advanced Multiplicity Shift Register  
(AMSR)  
Cosmic-Ray Neutron Background Reduction  
Using Localized Coincidence  
Veto Neutron Counting for Use with  
SuperHENC  
MiniGRAND Family of Instruments*

### **Bowles, Jeffrey (ISR-6)**

*Combined Thermal/ Epithermal Neutron  
(CTEN-FIT EXE), Version 1.0*

### **Bradbury, Andrew (B-9)**

*Anti-Sulfotyrosine Antibodies  
LANL GFP Portfolio  
Self Assembling Split Fluorescent Protein  
System (Los Alamos Green Fluorescent  
Protein Portfolio)*

### **Bronisz, Lawrence (IAT-2)**

*Superconductivity Technology*

### **Brown, Donald (EES-17)**

*Down Hole Sealing Method (Cerami-  
crete) – RSA  
Geothermal Energy Production with  
Supercritical Fluids*

### **Brumby, Steven (ISR-2)**

*Genie Pro, Version 2.0*

### **Brunson, Glenn (N-2)**

*Combined Thermal/ Epithermal Neutron  
(CTEN-FIT EXE), Version 1.0*

### **Burrell, Anthony (MPA-MC)**

*Electrochromic Technology  
Method for Detecting Binding Constants  
Using Micro X-Ray Fluorescence  
(MXRF)*

*Polymer-Assisted Deposition of Metal  
Oxides and Nitrides (PAD)*

*Polymer-Assisted Deposition of Metal  
Oxides and Nitrides*

### **Busick, Deanna (MST-11)**

*Composite Bipolar Plates for Electro-  
chemical Cells*

### **Cabantous, Stephanie (B-9)**

*LANL GFP Portfolio  
Protein Folding and Solubility Screening  
using a Green Fluorescent Protein  
Research Tool  
Self Assembling Split Fluorescent Protein  
System (Los Alamos Green Fluorescent  
Protein Portfolio)*

### **Cai, Hong (B-7)**

*Flow Cytometry  
Particle Size Analysis in a Turbid Media  
with a Single-fiber Optical Probe  
while Using a Visible Spectrometer*

**Canpolat, Murat (B-3)**

*Particle Size Analysis in a Turbid Media  
with a Single-Fiber Optical Probe  
While Using a Visible Spectrometer*

**Chavez, David (DE-1)**

*Pyrotechnic Compositions*

**Clancy, Sean (X-3-EC)**

*MESA, Version 8.0*

**Cole, Dean (B-DO)**

*Method of Using 5,10,15, 20- Tetrakis  
(4-Carboxyphenyl) Porphine for  
Detecting Cancers of the Lung*

**Coulter, James (MPA-STC)**

*Superconductivity Technology*

**Cremers, David (C-ADI)**

*Laser Production of Articles from  
Powders (Directed Light Fabrication)*

**Davey, John (MPA-11)**

*Direct Methanol Fuel Cell Technology*

**Depaula, Raymond (MPA\_STC)**

*Carbon Nanotube Portfolio for Structural  
Applications  
Superconductivity Technology*

**Dixon, Raymond (MPA)**

*Laser Production of Articles from  
Powders (Directed Light Fabrication)*

**Driscoll, Judith (MPA-STC)**

*Superconductivity Technology*

**Duan, Yixiang (C-CDE)**

*Low-power Microwave Atmospheric  
Plasma*

**Dziewinski, Jacek (WCM-4)**

*Nitrate Reduction*

**Eads, Damian (ISR-2)**

*Genie Pro, Version 2.0*

**Edlund, Kimberley (HPC-5)**

*Genie Pro, Version 2.0*

**Ehler, Deborah (MPA-MC)**

*Water Soluble Polymers and Their Use in  
Removal of Metals*

**Eisenhawer, Stephen (D-6)**

*LED Tree, Version 1.0*

**Esch-Mosher, Diana (ISR-3)**

*Genie Pro, Version 2.0*

**Espinoza, Brent (MST-7)**

*Cross-Linked Polybenzimidazole Mem-  
brane for Gas Separation*

**Espy, Michelle (P-21)**

*Ultra-Low Frequency NMR*

**Estep, Robert (N-2)**

*Combined Thermal/ Epithermal Neutron  
(CTEN-FIT EXE), Version 1.0  
MAKE-MAT*

**Feng, Wu-Chun (N-2)**

*EnergyFit*

**Foltyn, Stephen (MPA-STC)**

*Superconductivity Technology*

**Fraser, Andrew (ISR-2)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Galassi, Mark (ISR-1)**

*Genie Pro, Version 2.0*

**Gardner, David (MPA-10)**

*Pulse Tube Refrigerator with Variable  
Phase Shift and Traveling Wave  
Device with Mass Flux Suppression*

**Goddard, Greg (B-9)**

*Low-Cost Portable Flow Cytometry*

**Gohdes, Joel (C-SIC)**

*Water Soluble Polymers and Their Use in  
Removal of Metals*

**Gottesfeld, Shimshon (MPA-11)**

*Direct Methanol Fuel Cell Technology  
Preventing CO Poisoning in Fuel Cells*

**Graves, Steven (B-9)**

*Low-Cost Portable Flow Cytometry*

**Green, Jesse (P-25)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Groves, James (MPA-STC)**

*Carbon Nanotube Portfolio for Structural  
Applications  
Superconductivity Technology*

**Habbersett, Robert (B-9)**

*Low-Cost Portable Flow Cytometry*

**Halbig, James (N-1)**

*Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments*

**Hall, Simon (MPA-MC)**

*Electrochromic Technology*

**Hansen, Walter (N-1)**

*Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments*

**Harker, William (N-1)**

*Advanced Multiplicity Shift Register  
(AMSR)  
SuperHENC Neutron Coincidence Code,  
Version 1.0*

**Harvey, Neal (ISR-2)**

*Genie Pro, Version 2.0*

**Havrilla, George (C-CDE)**

*Method for Detecting Binding Constants  
Using Micro X-Ray Fluorescence  
(MXRF)*

**Hengartner, Nicolas (CCS-3)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Henins, Ivars (P-24)**

*Atmospheric Pressure Plasma Jet Port-  
folio*

**Herrmann, Hans (P-24)**

*Atmospheric Pressure Plasma Jet Port-  
folio*

**Hiskey, Michael (DE-1)**

*Lead-Free (Green) Primaries  
Pyrotechnic Compositions*

**Hoffbauer, Mark (C-CDE)**

*Film Growth by Energetic Neutral Atom  
Lithography / Epitaxy*

**Hogan, Gary (P-25)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Holesinger, Terry (MPA-STC)***Superconductivity Technology***Hollas, Charles (N-2)***Combined Thermal/ Epithermal Neutron  
(CTEN-FIT EXE), Version 1.0***Hollingsworth, Jennifer (C-PCS)***Optical Amplifiers and Lasers***Horley, Earl (ISR-4)***SuperHENC Neutron Coincidence Code,  
Version 1.0***Howat, Andrew (X-6)***SABRINA***Hsu, Chung-Hsing (CCS-1)***EnergyFit  
Wide-Area Neutron Detection Instru-  
ment (WENDI)***Hsu, Hsiao-Hua (P-24)***Wide-Area Neutron Detection Instru-  
ment (WENDI)***Huynh, My Hang (DE-1)***Lead-Free (Green) Primaries***Ianakiev, Kiril (N-1)***Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments***Jia, Quanxi (MPA-STC)***Polymer-Assisted Deposition of Metal  
Oxides and Nitrides (PAD)  
Superconductivity Technology***Jin, Zhe (C-ACS)***Low-power Microwave Atmospheric  
Plasma***Johnson, Jeffrey (HPC-3)***SABRINA***Jones, David (N-1)***Hand Held Multiplicity Register***Jorgensen, Betty (DE-6)***Cross-Linked Polybenzimidazole Mem-  
brane for Gas Separation  
Low-Cost Portable Flow Cytometry***Kaduchak, Gregory (B-9)***Low-Cost Portable Flow Cytometry***Kelley, Thomas***PC/FRAM, Version 2.3  
PC/FRAM, Version 3.4***Klimenko, Alexei (ISR-1)***Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same***Klimov, Victor (C-PCS)***Optical Amplifiers and Lasers***Klosterbuer, Shirley (N-1)***Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments***Kraus, Robert (LDRD-PO)***Ultra-Low Frequency NMR***Kreiskott, Sascha (MST-STC)***Superconductivity Technology***Krick, Merlyn (N-1)***Advanced Multiplicity Shift Register  
(AMSR)  
Cosmic-Ray Neutron Background Reduc-  
tion Using Localized Coincidence  
Veto Neutron Counting for Use with  
SuperHENC***Kwiatkowski, Christopher (IAT-2)***Low-Cost Portable Flow Cytometry***Lamartine, Bruce (TT-DO)***Ultrahigh Vacuum Focused Ion Beam  
Micromill Technique***Less, Richard (MST-6)***Laser Production of Articles from  
Powders (Directed Light Fabrication)***Lewis, Cris (C-CDE)***Method for Detecting Binding Constants  
Using Micro X-Ray Fluorescence  
(MXRF)**Laser Production of Articles from  
Powders (Directed Light Fabrication)***Lewis, Gary (MPA)***Laser Production of Articles from  
Powders (Directed Light Fabrication)***Li, Alexander (MST-STC)***Polymer-Assisted Deposition of Metal  
Oxides and Nitrides (PAD)***Li, Quingwen (MPA)***Carbon Nanotube Portfolio for Structural  
Applications***Lin, Yuan (MPA-STC)***Polymer-Assisted Deposition of Metal  
Oxides and Nitrides (PAD)***Long, Gregory (DE-1)***Cross-Linked Polybenzimidazole Mem-  
brane for Gas Separation***Mahan, Cynthia (C-DO)***Method for Detecting Binding Constants  
Using Micro X-Ray Fluorescence  
(MXRF)***Makela, Mark (P-25)***Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same***Marczak, Stanislaw (WES-EDA)***Nitrate Reduction***Martin, Joe (C-ADI)***Lead-free Percussion Primer Mixes Based  
on Metastable Interstitial Composite  
(MIC) Technology***Martin, John (B-9)***Low-Cost Portable Flow Cytometry***Martinez, Rodolfo (B-8)***Use of Prolines for Improving Growth  
and Other Properties of Plants and  
Algae***Matias, Vladimir (MPA-STC)***Superconductivity Technology***Matlashov, Andrei (P-21)***Ultra-Low Frequency NMR***McCleskey, Thomas (MPA-MC)***Electrochromic Technology  
Method for Detecting Binding Constants  
Using Micro X-Ray Fluorescence  
(MXRF)**Polymer-Assisted Deposition of Metal  
Oxides and Nitrides (PAD)***McGhee, John (CCS-4)***Attila, Version 2.0*

**Melton, Sheila (N-2)**

*Combined Thermal/ Epithermal Neutron  
(CTEN-FIT EXE), Version 1.0  
MAKE-MAT*

**Menlove, Howard (N-1)**

*Cosmic-Ray Neutron Background Reduc-  
tion Using Localized Coincidence  
Veto Neutron Counting for Use with  
SuperHENC  
SuperHENC Neutron Coincidence Code,  
Version 1.0*

**Meyne, Julianne (IAT-1)**

*DOE Patent*

**Michalczyk, Ryszard (B-8)**

*Piperazine-based Nucleic Analogs*

**Mikhailovski, Alexandre (C-PCS)**

*Optical Amplifiers and Lasers*

**Milewski, John (MST-6)**

*Laser Production of Articles from  
Powders (Directed Light Fabrication)*

**Miller, Thomasin (C-ACS)**

*Method for Detecting Binding Constants  
Using Micro X-Ray Fluorescence  
(MXRF)*

**Mitchell, Terence (MST-8)**

*Photonic Crystal - LiNi and LiTi*

**Moody, David (RP-1)**

*Method of Using 5,10,15, 20- Tetrakis  
(4-Carboxyphenyl) Porphine for  
Detecting Cancers of the Lung*

**Morris, Christopher (P-25)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Mosher, John (P-21)**

*Ultra-Low Frequency NMR*

**Mourant, Judith (B-9)**

*Particle Size Analysis in a Turbid Media  
with a Single-fiber Optical Probe  
while Using a Visible Spectrometer*

**Moyzis, Robert (STB-CHGS)**

*DOE Patent*

**Mueller, Alexander (C-CDE)**

*Film Growth by Energetic Neutral Atom  
Lithography / Epitaxy*

**Naud, Darren (DE-1)**

*Pyrotechnic Compositions*

**Newell, Matthew (N-1)**

*Hand Held Multiplicity Register*

**Nolan, John (B-9)**

*Flow Cytometry*

**O'Connell, Michael (C-ACS)**

*Carbon Nanotube Portfolio for Structural  
Applications*

**Olsher, Richard (RP-2)**

*Proton Recoil Scintillator Neutron Rem  
Meter*

*Wide-Area Neutron Detection Instru-  
ment (WENDI)*

**Orum, John (CCS-3)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Ott, Kevin (MPA-MC)**

*Hybrid Catalyst for Selective Reduction  
of NOx (also known as ENDURE  
SCR Catalyst)*

**Pagliari, Stephen (WT-11)**

*High Concentration Tritium Sensor*

**Park, Jaeyoung (P-24)**

*Atmospheric Pressure Plasma Jet Port-  
folio*

**Parker, Robert (N-1)**

*Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments*

**Pautz, Shawn (SNL-ASCI)**

*Attila, Version 2.0*

**Pelowitz, David (N-1)**

*Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments*

**Perkins, Simon (ISR-2)**

*Genie Pro, Version 2.0*

**Perry, William (DE-3)**

*Plasma Torch Production of Metal Par-  
ticles of Controlled Sizes*

**Peterson, Otis (D-5)**

*Self-Regulating Nuclear Power Module*

**Phillips, Jonathan (MST-7)**

*Plasma Torch Production of Metal Par-  
ticles of Controlled Sizes*

**Porter, Reid (ISR-2)**

*Genie Pro, Version 2.0*

**Priedhorsky, William (LDRD-PO)**

*Systems, Methods and Apparatuses for  
Particle Detection and Analysis and  
Field Deployment of the Same*

**Prime, Michael (W-13)**

*System and Method for Measuring  
Residual Stress*

**Qian, Jiang (LANSCE-LC)**

*Diamond Silicon Carbide Composites  
and their Method for Preparation*

**Reagor, David (MPA-STC)**

*Through-the-Earth Radio*

**Reass, Pamela (ISR-4)**

*Advanced Multiplicity Shift Register  
(AMSR)  
MiniGRAND Family of Instruments*

**Ren, Xiaoming (MST-11)**

*Direct Methanol Fuel Cell Technology*

**Richmond, Scott (MST-16)**

*High Concentration Tritium Sensor*

**Robison, Thomas (C-CDE)**

*Water Soluble Polymers and Their Use in  
Removal of Metals*

**Rodgers, John (HSR-4)**

*Continuous Air Monitor (CAM) Tech-  
nology  
Alpha ECAM with Cyclo-Shroud Inlet*

**Rodriguez, Marko (T-5)**

*Knowledge-Based Matchmaking and  
Social Networks*

**Romero, Amos (AOT-IC)**

*Advanced Multiplicity Shift Register  
(AMSR)*

**Ryan, Robert (CS-OCS-4)**

*Work Package Generator (WPG) Software*

**Salazar, Steven (ISR-4)**

*Advanced Multiplicity Shift Register (AMSR)*

**Salzman, Gary (ISR-4)**

*Low-Cost Portable Flow Cytometry*

**Sampson, Thomas (N-1)**

*PC/FRAM, Version 2.3  
PC/FRAM, Version 3.4*

**Sauer, Nancy (INST-OFF)**

*Water Soluble Polymers and Their Use in Removal of Metals*

**Schmidt, Jurgen (B-9)**

*Piperazine-based Nucleic Analogs*

**Schultz, Larry (P-21)**

*Systems, Methods and Apparatuses for Particle Detection and Analysis and Field Deployment of the Same*

**Seagraves, David (RP-2)**

*Proton Recoil Scintillator Neutron Rem Meter*

**Selwyn, Gary (P-24)**

*Atmospheric Pressure Plasma Jet Portfolio*

**Shera, Brooks (C-CDE)**

*Single Molecular Detection Instrument Diagnostic Test*

**Silks, Louis (B-8)**

*Piperazine-based Nucleic Analogs*

**Sims, Benjamin (CCS-6)**

*Knowledge-Based Matchmaking and Social Networks*

**Sinha, Dipen (MPA-11)**

*Low-Cost Portable Flow Cytometry*

**Smith, Barbara (C-CDE)**

*Water Soluble Polymers and Their Use in Removal of Metals*

**Sossong, Michael (P-25)**

*Systems, Methods and Apparatuses for Particle Detection and Analysis and Field Deployment of the Same*

**Stan, Liliana (MPA-STC)**

*Superconductivity Technology*

**Stutz, Rodger (IAT-DO)**

*Ultrahigh Vacuum Focused Ion Beam Micromill Technique*

**Su, Yongxuan (C-ACS)**

*Low-power Microwave Atmospheric Plasma*

**Sweet, Martin (ISR-4)**

*Advanced Multiplicity Shift Register (AMSR)  
SuperHENC Neutron Coincidence Code, Version 1.0*

**Swift, Gregory**

*Pulse Tube Refrigerator with Variable Phase Shift and Traveling Wave Device with Mass Flux Suppression*

**Terwilliger, Thomas (B-9)**

*SOLVE/RESOLVE, Version 2.0*

**Theiler, James (ISR-2)**

*Genie Pro, Version 2.0*

**Thomas, Sharon (MST-11)**

*Direct Methanol Fuel Cell Technology*

**Thompson, Donald (T-CNLS)**

*Lead-free Percussion Primer Mixes Based on Metastable Interstitial Composite (MIC) Technology*

**Unkefer, Pat (B-DO)**

*Use of Prolines for Improving Growth and Other Properties of Plants and Algae*

**Usov, Igor (MST-8)**

*Carbon Nanotube Portfolio for Structural Applications*

**Van de Sompel, Herbert (STBPO-RL)**

*Blackbox Version 1.0*

**Van Riper, Kenneth (X-1)**

*SABRINA*

**Vasilik, Dennis (HSR-4)**

*Wide-Area Neutron Detection Instrument (WENDI)*

**Vasquez-Dominquez, Jose (MPA)**

*Through-the-Earth Radio*

**Verspoor, Cornelia (CCS-3)**

*Knowledge-based Matchmaking and Social Networks*

**Vo, Duc (N-1)**

*PC/FRAM, Version 2.3*

**Volegov, Petr (P-21)**

*Ultra-Low Frequency NMR*

**Waldo, Geoffrey (B-9)**

*LANL GFP Portfolio  
Protein Folding and Solubility Screening using a Green Fluorescent Protein Research Tool  
Self-Assembling Split Fluorescent Protein System (Los Alamos Green Fluorescent Protein Portfolio)*

**Wang, Haiyan (MPA-STC)**

*Superconductivity Technology*

**Ward, Michael (B-9)**

*Low-Cost Portable Flow Cytometry*

**Wareing, Todd (CCS-4)**

*Attila, Version 2.0*

**Warner, Benjamin (MPA-MC)**

*Electrochromic Technology  
Method for Detecting Binding Constants Using Micro X-Ray Fluorescence (MXRF)*

**Watkins, Jennifer (IAT-1)**

*Knowledge-based Matchmaking and Social Networks*

**Wayne, Weseloh**

*MESA, Version 8.0*

**Weisbrod, Kirk (AET-5)**

*Corrosion Test Cell*

**Wells, Cyndi (IAT-1)**

*Method for Detecting Binding Constants Using Micro X-Ray Fluorescence (MXRF)*

**Weseloh, Wayne (X-4-SS)**

*MESA v.8.0*

**West, James (X-6)**

*SABRINA*



**White, Paul (B-7)**

*Flow Cytometry*

**Williamson, Todd (C-CDE)**

*Film Growth by Energetic Neutral Atom  
Lithography / Epitaxy*

**Wilson, Mahlon (MPA-11)**

*Adiabatic Fuel Cell Stack  
Composite Bipolar Plates for Electro-  
chemical Cells  
Direct Methanol Fuel Cell Technology*

**Young, Jennifer (X-2-n2)**

*Cross-Linked Polybenzimidazole Mem-  
brane for Gas Separation  
PARMELA, Version 3.1*

**Zawodzinski, Christine (MST-11)**

*Direct Methanol Fuel Cell Technology*

**Zelenay, Piotr (MPA-11)**

*Direct Methanol Fuel Cell Technology*

**Zeytun, Ahmet (B-7)**

*LANL GFP Portfolio  
Self-Assembling Split Fluorescent Pro-  
tein System (Los Alamos Green Flo-  
rescent Protein Portfolio)*

**Zhang, Xiefei (MPA-STC)**

*Carbon Nanotube Portfolio for Structural  
Applications*

**Zhao, Yusheng (LANSCE-LC)**

*Diamond Silicon Carbide Composites  
and Their Method for Preparation*

**Zheng, Lianxi (MPA-STC)**

*Carbon Nanotube Portfolio for Structural  
Applications*

**Zhu, Yuntian (MPA-STC)**

*Carbon Nanotube Portfolio for Structural  
Applications*

## **Fiscal Year 2008 Executed Cooperative Research and Development Agreements (CRADAs)**

### **Stand-off Explosives Detection**

Samuel M. Clegg (C-PCS)

Modification and system development and proof of concept demonstration of LANL's one-of-a-kind high power ultraviolet (UV) Raman light detection and ranging (LIDAR) system to perform stand-off detection of explosive residues left behind by terrorist bomb makers.

### **Development of Superconducting Fault Current Limiter (SFCL) Components**

Stephen P. Ashworth (MPA-STC)

Assist the Participant in developing High Temperature Superconducting Fault Current Limiter (SFCL) components by providing support in a number of critical areas.

### **Analyze Surface Stain on Copper-Beryllium Alloy Strip**

David E. Dombrowski (MST-6)

Analyze surface stain on Copper-Beryllium alloy strip (nominally 1.8 wt% Be content) for chemical composition and chemical valence information using state of art surface analysis equipment.

### **Development of Novel Countermeasures Against Pathogens and Toxins**

Goutam Gupta (B-7)

Emergence of pathogens and toxins with resistance against conventional drugs, vaccines, and host defense peptides and proteins warrants novel countermeasures that are able to efficiently capture and rapidly clear them. In this CRADA, the technical expertise and resources at LANL and the CRADA Participant will be combined to design and test the efficacy of a novel class of protein therapeutics that can target both intact pathogens and toxins. The anti-pathogen or anti-toxin protein is a chimera with capture and clearance domains. The capture and clearance domains are chosen from the large repertoire of host defense peptides and proteins. Although, the individual capture and clearance domains are rendered ineffective by pathogenic resistance mechanisms, the chimeric scaffolds can be designed in such a way that they retain their anti-microbial activity even in the face of pathogenic resistance. Here, encouraged by initial studies, a CRADA is prepared for the design of chimeric proteins targeted against (i) intact bacteria such as *Xylella fastidiosa* (a plant pathogen that poses a threat to grape and wine industries in the USA and citrus industry in Brazil) and *Staphylococcus aurea* (blood-borne pathogens) and (ii) deadly toxins from *Staphylococcus aurea* and *Bacillus anthracis* (a high priority bio-threat agent). In addition, a structure-based

method will be developed that will aid the accelerated design of vaccines. The method is a paradigm shift from conventional approaches in that the vaccine candidate is not a real protein from the pathogen but an engineered protein scaffold that displays multiple immunogenic and relatively conserved epitopes in their native conformation.

### **Fission Meter Multiplicity Upgrade**

Matthew R. Newell (N-1)

Jointly develop and commercialize LANL's multiplicity shift register technology into the Participants existing Fission Meter instrument. The Participant's Fission Meter is an advanced portable neutron source identification system for the interdiction of fissionable material. The Participant's Fission Meter consists of a high-efficiency neutron detection system and easy-to-use software implemented on a rugged hand-held PC.

### **Multiple Exciton Generation (MEG) Photovoltaics**

Milan Sykora (C-PCS)

Investigating the use of the Multiple Exciton Generation (MEG) technology toward the development of a new generation of photovoltaic (PV) devices.

### **Advanced Acoustic Sensor Technology for Fluid Flow Analysis in Pipelines**

Dipen N. Sinha (MPA-11)

Investigating the use of LANL's advanced acoustic sensor technology in a whole range of applications related to fluid flow through pipelines and wellbore tubulars. The applications will range from determining various factors involved in fluid quality (flow rate, density, viscosity, chemical composition, oil/water/gas volume fractions, etc.), the interaction of the fluid with the pipeline (e.g., depositions such as scale, asphaltenes or hydrates), and the condition (e.g., erosion/corrosion) of the pipeline itself. This project will enable optimization of drilling efficiency, optimization of oil production, and reservoir management. This is important from the perspective of improving hydrocarbon recovery, well yields and hence to national energy security.

### **Thermal Management of Submersible Electric Motors**

Coyne Prenger (AET-1)

Investigating the use of LANL's advanced thermal analysis capability and extensive knowledge of heat pipes for cooling downhole oil industry motors. Improved cooling of the motors is expected to

result in increased reliability and greatly lower motor maintenance costs in producing wells. This is a key enabling technology for further development of many domestic U.S. oil reserves such as the steam injection fields of California or deep-water Gulf of Mexico.

### **A Mobile Benthic-Paleoic Observatory to Support Fisheries and Ecosystem Management**

Lakshman Prasad (ISR-2)

The objective of this work is to collaborate with the CRADA Partner in habitat characterization, mapping, and census of benthic organisms by providing rapid and automated means of processing and assimilating information from the vast amounts of seafloor image data gathered. Such a capability is critical to the viability of the proposed mobile observatory in providing timely, actionable information to aid fisheries management.

### **Hydrocarbon Impurity**

Greg R. Goddard (B-9)

Collaboration to determine acoustic or other field-based methods for separation/flocculation/fractionation of oil components from aqueous suspensions.

## Particle Separation

Greg R. Goddard (B-9)

Collaboration to determine acoustic or other field-based methods for separation/flocculation/fractionation of particulates from aqueous suspensions.

## Carbon Nanotube Composite Conductors

Fred M. Mueller (MPA-STC)

Collaboration to develop an ultra-high conductivity composite based on carbon nanotubes. The project seeks to fabricate test specimens of a composite that has significantly higher electrical conductivity than pure copper.

## Sensor Development and Advanced Concepts for Oil Shale Recovery

Jonathan L. Mace (DE-6)

Develop new methods that are based on combinations of thermal, chemical, and physical manipulation of subsurface systems. In addition the need to develop improved sensor technology to query subsurface properties will assist in the grading of new *in-situ* methods and enhance the delivery of new technologies to the field.

## GaN and InGaN Films for Photovoltaic Applications

Mark A. Hoffbauer (C-CDE)

In the course of research and development, Los Alamos National Laboratory developed capabilities in depositing and growing high quality thin films composed of Indium Gallium Nitride (InGaN) using techniques involving Energetic Neutral Atom Beam Lithography/Epitaxy (ENABLE) technology. These films confer certain advantages in converting light energy (photons) to electrical current when deposited in specific conformations, e.g. photovoltaic devices. The Participant wishes to incorporate this technology within its products.

## Growth Characterization and Management of Salt Tolerant Algae

Pat J. Unkefer (B-DO)

Collaborate to advance the development of the algal biodiesel. The collaboration will increase algal yields and extensive technical capabilities to examine and assess a set of potential operating parameters for the algal production ponds.

## Anodization of Aluminum Beryllium Alloys

Scott Lillard (MST-6)

This work seeks to develop an anodization procedure for Al-Be alloys, especially AlBeMet 162, in near

neutral pH solutions using a combination of organic and non-organic based acids.

## Stationary Anti-Scatter Grids for Digital Breast Imaging

Mark A. Hoffbauer (C-CDE)

The National Institutes of Health has funded this Small Business Innovation Research (SBIR) for the Participant to develop a method for fabricating focused x-ray anti-scatter grids for application to digital mammography. Such grids must have very small septa, high aspect ratio, and high accuracy, and the septa must match the pixels of the digital mammography detector over a large area. The etching process developed by Los Alamos National Laboratory using energetic neutral atom beam lithography/epitaxy (ENABLE) will be applied to the fabrication of such grids by making highly-precise cuts into polymer substrates. The Participant will use the resulting molds to fabricate metal grids by electroforming or casting.

## **Fiscal Year 2008 Work for Others – Non-Federal Agreements Executed**

### **Novel Immucapture Technology for Field Deployable Nucleic Acid- Based Detection of Plant Pathogens**

Robert B. Cary (B-7)

Pathogens-induced diseases pose a great threat to the U.S. citrus industry. Three such citrus diseases are citrus canker caused by *Xanthomonas axonopodis*, tristeza caused by citrus tristeza virus (CTV), and citrus greening (aka HLB) caused by *Candidatus Liberibacter*. Traditionally, diseases are monitored by the appearance of symptoms, or detection of causative pathogens by Polymerase Chain Reaction (PCR) and Enzyme-linked Immunosorbent Assay (ELISA). These methods are neither efficient nor cost-effective. We propose a next-generation and fieldable platform technology called lateral flow microarray (LFM) that allows detection of multiple citrus pathogens in a rapid, sensitive, and cost-effective manner. The technology relies on the genomic sequence of the pathogen and detects unique signatures identified on the genome. The LFM Platform has already been tested successfully in the laboratory set-up for the detection of *Xylella fastidiosa* (Xf) 9a5c (the CVC strain) and *Xanthomonas axonopodis* pv. *citri* (the Xac canker strain) using genomic DNA and synthetic RNA. In an attempt to extend the LFM platform for in-field use, we propose to develop appropriate sample preparation, nucleic acid isolation,

isothermal amplification, and multiplex detection protocols for identifying species and particular strains of *Xanthomonas axonopodis* and CTV. Once the genome sequence is available, suitable probes will be designed to detect *Candidatus Liberibacter* on the same LFM platform. These developments will make the LFM platform amenable to in-field detection of multiple citrus pathogens and, therefore, will provide an invaluable tool for citrus disease surveillance and management.

### **Free Electron Lasers**

Dinh Nguyen (ISR-6)

Proposal preparation for the Office of Naval Research (ONR).

### **Stand-Off Radiation Detection Systems (SORDS)**

Mark S. Wallace (ISR-1)

During this WFO project LANL will work on two task areas. The first task area will involve analytical modeling and simulation in support of system design, optimization, development, and effective use. In this area LANL will develop a comprehensive simulation and modeling system to represent the physical and instrumental characteristics relevant to the combined coded aperture / Compton imaging detector system. The second task area involves development, optimization, evaluation, and testing of algorithms to be used for analysis and interpretation of Stand-Off Radiation Detection Systems (SORDS) measurements. In this area LANL

will use data from the simulation and modeling system of Task Area 1, and eventually, experimental data from SORDS, to design, develop, and optimize algorithms to analyze SORDS data products.

### Downlink Development

Daniel I. Cooper (D-3)

Development of a downlink based upon the Terrabeam GigaLink terminal, tracked using a DPerception PTU-D300. The system currently has all mounts fabricated and basic software has been developed for pointing and analysis. The task is particularly difficult because tracking must be maintained within one (1) degree to establish a link between the units. Considerable tuning, and modification of the mounts is anticipated. LANL's experience with the use of these gimbal systems will be valuable in developing a system of value to all.

### Field Programmable Gate Array (FPGA) Computing Card

Matthew W. Stettler (ISR-3)

The work entails the design of an extremely fast, reprogrammable computational system for real-time data analysis. This entails both the design of processing engines and backplane systems.

### Field Studies to Quantify Natural and Man-Induced Events in NE China and Korea Using Seismic and Infrasound Observations

Rongmao Zhao (EES-17)

This proposal outlines a combined field and analysis program to quantify natural and man-induced sources in NE China and Korea. It builds upon three years of successful cooperation between the Institute of Geophysics, China Earthquake Administration (IGCEA), and Southern Methodist University (SMU). IGCEA and SMU have developed instruments, prepared sites and, with the support of IRIS/PASCCAL, installed fifteen broadband stations in NE China. These instruments are focused on two seismically active regions, Huailai Basin and Haicheng Area, with four to five close-in broadband instruments in each supplemented by five additional regional stations. Data recorded and delivered to the IRIS DMC have already been used for characterizing a number of sources in the region and provide constraints for propagation path models in the region. Based on this success, we propose to continue the operation of these regional stations, to build on the significant investment by adding telemetry and infrasound, to expand the dataset to include data from the Chinese telemetered digital network, to develop path models for routine moment tensor inversions, to develop ground-truth events for

regional observations and to supplement the data with stations on the Korean Peninsula, thereby extending the study into the Korean Peninsula. IGCEA has indicated that the data from some sites that are currently being recorded to disk can be real-time telemetered thus improving data access. Combining data for selected events adding data from the Chinese telemetered digital network will produce a data set for testing existing two- and three-dimensional propagation models for the region. Path models will be developed to provide a basis for routine moment tensor inversions of events recorded by the near, real-time network. The addition of three, small (~100 m aperture) infrasound arrays provides the opportunity to combine the seismic and infrasound data for source characterization. Seismic and infrasound data from this expanded broadband network, the in-country digital network data, and other Korean Peninsula stations will be used to assess seismic and infrasound sources in Korea extending our studies into the Korean Peninsula.

### Flux Pinning Additions to Increase $J_c$ Performance in BSCCO-2212 Round Wire for Very High Field Magnets

Terry G. Holesinger (MPA-STC)

Bi-2212 wires are of interest for use in high field magnets for nuclear magnetic resonance (NMR) or high energy physics applications. To investigate the potential benefits of dopants on improving the properties

of BSCCO-2212 / Ag composite wires, the proposed effort will determine which type of dopant(s), dopant amount(s) and dopant addition(s) techniques yield the greatest enhancement of engineering critical current density ( $J_c$ ) in BSCCO-2212 / Ag composite round wires.

## Phase II: Digital 2-D Neutron Detector for Protein Function Studies

Paul A. Langan (B-8)

This work will involve carrying out tests on a neutron detector on the Protein Crystallography Station on Flight Path 15.

## Small Event Yield and Source Characterization Using Local P and S Wave Code of Source Spectra

William S. Phillips (EES-17)

The highest valuable deliverable for this project will be a new local coda methodology that will outperform other methodologies using direct phases.

## Influenza Sequence Management Data and Analysis

Catherine A. Macken (T-6)

The Influenza Sequence Database (ISD) was fully developed by LANL and is a database-driven web site, with extensive and unique capabilities for storage and analysis of influenza genetic and protein sequences.

The ISD is a large, mature project, that has been partially supported by the CDC (USA) to extend ISD capabilities for supporting national and international public health and research interests connected with influenza. ISD staff will curate these data to the highest level applied to public data in the ISD. ISD staff will make available all analysis tools that have been designed for public use. ISD will develop custom features for data management and analysis to meet individual Sponsor's needs, as determined by analysis of required performance.

## Stage Sequencing Project

John C. Detter (B-6)

The Sponsor will send purified mycobacterium phage purified genomic DNA for draft sequencing and finishing to Joint Genome Institute (JGI)-LANL according to the following schedule of 12 phage genomes in FY09. Draft will need three 384-well plates sequenced in both the forward and reverse directions. The total number of 384-well plates draft sequenced for each phage will be six based on a 75 kb genome size. JGI-LANL will perform capillary sequencing on approximately 27.6K lines in FY09. Draft data, unannotated, will be provided to Science Education Alliance (SEA) participating institutions as the sequencing is completed. SEA participating institutions will release the draft and finished annotated sequences to GenBank.

## CCP2 Modeling for Well Integrity

James W. Carey (EES-14)

CO<sub>2</sub> migration through defects in the wellbore system has emerged as the potential leakage conduit of greatest concern in engineered CO<sub>2</sub> storage sites. The long-term permeability evolution of these defects depends upon complex chemical mass transfer processes because of the inherent reactivity of Portland cement with CO<sub>2</sub>-rich fluids. The primary objective of this proposal is improved understanding of CO<sub>2</sub>-dependent chemical and permeability evolution in the localized wellbore environment. In this study, experimental studies on simulated wellbore systems will be combined with field data of CO<sub>2</sub> wellbore interactions to develop a reactive transport model of wellbore performance. The experiments and modeling will be used to history-match the core observations and to develop a long-term forward modeling of coupled-process permeability evolution in the localized wellbore environment during active-injection and post-abandonment phases of CO<sub>2</sub> storage.

## Realistic Simulations and Empirical Data: MEG Reconstructions of Time

Douglas M. Ranken (HPC-1)

Magnetoencephalography (MEG) provides an excellent opportunity for capturing cognitive processes in both space and time; however, the analysis of MEG signals is complicated by the non-uniqueness of the electromag-

netic inverse problem. In addition, the MEG systems manufactured by three primary companies have different pickup coils, sensor arrays, noise cancellation methods, and different software packages for data analysis. Consequently, many MEG researchers either develop their own software for analyzing data or piece together shareware offered by others, partly due to the still unknown overall strengths and weaknesses of the different algorithms. One side effect of this situation is that many of the software implementations are specific to one particular data storage format or noise cancellation method. These factors make it extremely difficult to relate results across laboratories and pool data together, particularly clinical data. We will construct realistic simulated data sets and directly test these datasets using five algorithms that include multidipole, spatiotemporal modeling, current reconstruction and beamforming methods. The data sets and results will be made available to other investigators worldwide via the MIND Research Network site (download), and this site will also act as a repository for results of analyses performed by others for comparison (upload).

### Uranium-Isotope Content Determination

Christopher P. Leibman (C-CDE)

Develop a plan and cost estimate for anticipated future LANL analytical support.

### Stove for Cooking, Refrigeration and Electricity (SCORE)

Scott N. Backhaus (MPA-10)

The Stove for Cooking Refrigeration and Electricity (SCORE) aims to significantly improve health, quality of life, economic growth and social and educational opportunities, and thus reduce poverty in Africa and Asia by understanding the energy needs of their rural communities and working with them to develop the capability to manufacture an affordable versatile domestic appliance. This will combine the functionalities of a high-efficiency cooking stove, an electricity generator and a refrigerator (cool box), and may be fuelled by burning a range of biomass products. The project will ensure that the devices are acceptable at a technological, economic and social level and that there is sufficient scope for the communities to develop numerous businesses from the manufacture, repair and innovative applications of SCORE.

### Hydrogen Storage Materials

Thomas E. Proffen (LANSCE-LC)

The technique of periodic density functional quantum chemistry will be used to study the structure and properties of the metal alloy hydride phases. The computational approach will allow us to predict the most likely sites both on the surface and in the bulk material for hydride formation as well as the energetics

of the process. Using these results, plausible metal hydride models can be constructed that can be directly compared with measurements of the local structure from neutron spectroscopy.

### Converter Modulator Optimization

William A. Reass (AOT-RFE)

Provide electrical engineering services to upgrade the "as-built" converter-modulator design package. The converter-modulator design package was previously delivered to Dynapower Corporation as part of a "build-to-print" effort to produce high voltage converter-modulators for the Oak Ridge SNS accelerator project. Dynapower wishes to improve this design to better facilitate commercial resale of converter-modulators. Los Alamos developed the high-voltage converter-modulator technology for the SNS project. Dynapower won the "build-to-print" contract after the international bidding efforts of this design package. (The design package is public information.)

### Deployment of an SMZ/VPB/RO System for Removal of Organic Compounds from Produced Water

Enid J. Sullivan (C-CDE)

Deployment of a coupled Surfactant-Modified Zeolite (SMZ)-Vapor Phase Bioreactor (VPB)-Reverse Osmosis (RO) system for removal of organic compounds and salts from



oil and gas (O&G) produced waters is proposed. The ultimate goal is to produce a water treatment product that can be commercialized for use in the O&G industry, the electric power industry, and in other industries such as shipping (for de-oiling of bilge waters), or general water treatment systems (for organic-contaminated waters).

### **Training Course on MCNP/MCNPX**

John Hendricks (X-3-MCC)

Technical staff members at Los Alamos National Laboratory traveled to Lisbon, Portugal and conducted a training course/workshop, "MCNP MCNPX" on May 12–16, 2008. The workshop contained the following modules: Geometry, Sources, Tallies, Physics, Statistics, Variance Reduction and Criticality.

### **Introductory/Intermediate MCNP/MCNPX Training Course in Munich, Germany**

John Hendricks (X-3-MCC)

Technical staff members at Los Alamos National Laboratory traveled to Munich, Germany and conducted a training course/workshop, MCNP MCNPX (Monte Carlo N-Particle eXtended) on October 27–31, 2008. The workshop contained the following modules: Geometry, Sources, Tallies, Physics, Statistics, Variance Reduction and Criticality.

### **CTL and HIV Polymorphisms in Heterosexual Transmission**

Karina Yusim (T-6)

The main goal of this study is to understand the role that cytotoxic T lymphocyte (CTL) escape plays in HIV transmission and disease pathogenesis. This is split into several aims: 1.) Perform a cross-sectional analysis of HIV adaptation to HLA-class I restricted immune responses at a population and individual level to determine if HIV-1 polymorphisms associated with HLA alleles cluster within known HLA class I specific CD8+ CTL epitopes and if novel epitopes that are specific to African HLA alleles can be identified. 2.) Determine the relative contribution of HLA allele frequency and viral replicative fitness to fixation of escape mutation in the population consensus sequence. 3.) Determine the biological consequences of persistence, escape and reversion in epitope-specific gag and nef sequences by analysis of viral load and in vitro fitness. 4.) In HIV-1 high-risk non-transmitting couples determine if the long-term non-transmitting partners display a bias in escape signatures that may contribute to lack of transmission. These studies will further allow the application and development of models that address the impact of CTL escape mutations on viral load and viral fitness and their relevance to vaccine development.

### **Hydride Reactor Dynamics**

Duan Zhong Zhang (T-3)

This project will generate a model to simulate the dynamics of a novel hydride-fueled reactor that for the first time is completely self-regulating with no moving mechanical components. The task consists of integration of two components to predict the regions of stable operation for the reactor. The two components are a three-dimensional gas flow model and evaluation of nuclear criticality as a function of the hydrogen concentration and spatial distribution.

### **Hyperion Reactor Assessment and Technical Assistance**

Jeffrey Martin (D-5)

The Sponsor has been contracted to market the Hyperion Reactor, and fund and manage the technical assessment of the Hyperion Reactor concept. The Sponsor is contracting LANL to perform the technical assessment, and provide technical assistance because of its unique experience capabilities related to uranium hydride and nuclear reactor technology and industry.

### **Intelligent Personal Radiation Locator (IPRL)**

Scott E. Garner (N-2)

Development of an effective peak-based nuclide identification software tool which uses an algorithm based on Fuzzy-Logic. LANL has

also started development for a second peak based nuclide identification software tool that uses a second-derivative peak-finding algorithm. The Sponsor would like to determine the overall effectiveness of these two algorithms combined together for peak-based nuclide identification. The scope of this WFO is to complete the code for the second derivative peak-finding algorithm, merge it with the Fuzzy-Logic nuclide identification algorithm, and validate the code against the Sponsor's data.

### **Threat Agent Cloud Tactical Intercept and Countermeasure (TACTIC)**

Norman A. Doggett (B-7)

This work consists of development of the ability to detect the presence of specified biological agents using the detection technology of the Threat Agent Cloud Tactical Intercept and Countermeasure (TACTIC) Phase I proven dyes or others as optionally proposed by the Seller. This effort is in support of the TACTIC Phase II Program, which includes both a twelve (12) month Preliminary Design Review (PDR) Segment followed by a twelve (12) month Critical Design Review (CDR) Segment. The PDR Segment is a baseline effort, and the CDR Segment is a contract option.

### **Energy Water Systems, Carbon Management and Social Impact—The Web Portal and Outreach Component**

Gerald L. Geernaert (INST-OFF)

Development of a Web portal that will interest, inform, enlist, and retain input from the Sonoma Regional citizenry with the goal of mapping out a course towards energy sustainability and resilience, carbon neutrality, and economic vitality, given projections of future climate change. The solution options to be developed are to serve as examples for the state of California, the U.S., and international organizations. In large part, the project is to meet the goals of carbon footprint reduction outlined within AB32 and the Western Governors Initiative.

### **Antibody Selections**

Andrew M. Bradbury (B-9)

Antibodies will be selected against two recombinant prostate protein antigens that differ by a single amino acid.

### **Atmospheric Radiation Measurement**

Kim L. Nitschke (EES-14)

Provide support to Visidyne Incorporated by deploying two Sun Auriel Measurement (SAM) instruments within China. One instrument will be collocated and deployed in conjunction with the Atmospheric Radiation Measurement Program (ARM) Mobile Facility at the Shouxian

Observatory. The other instrument will be deployed and collocated with the ARM Ancillary facility in Linze and Xianghe.

### **Analysis of Bacillus Thuringiensis Strains**

Karen K. Hill (B-7)

Partner will provide 10 cultures representing 8 strains of *Bacillus thuringiensis* bacteria. This non-pathogenic, nonhazardous species of bacteria—a biosafety Level 1 organism—will be cultured within LANL by trained personnel. DNA will be isolated from the cultures using nonhazardous chemicals. The DNA preparations will be used in Amplified Fragment Length Polymorphism (AFLP) experiments. The AFLP data will be analyzed and an AFLP-based dendrogram will be generated that includes previously analyzed pathogenic and nonpathogenic *B. cereus* and *B. anthracis* and *B. thuringiensis* strains. This dendrogram in a final report will be provided to Valent Biosciences Corporation.

### **Heat Pipe Technology for Synthesis of Nylon Intermediates**

Robert S. Reid (AET-1)

Provide consulting services during the design, fabrication, and prove-out of high temperature heat pipes associated with a new process for bulk chemical synthesis. Design and fabrication will be performed by subcontractors as necessary. All testing shall be performed by the Sponsor. LANL

shall specifically provide consulting and oversight on the design requirements, engineering aspects, and fabrication techniques necessary to obtain maximum service life for the heat pipe under proposed operating conditions and environments.

### **Technical Support for Modeling and Characterizing the Performance of Spectral Sensors**

Roger R. Petrin (NN)

Investigate the system level performance and analyze the impact of key system parameters on overall performance for spectral sensors of interest to Lockheed Martin. LANL and Lockheed Martin will be using the LANL-developed Physics-based Integrated Modeling for Sensors (PIMS) software tool during this effort. LANL personnel have unique insight into the capabilities, operation, and limitations of PIMS. LANL will be providing this expertise, in addition to expertise acquired in previous sensor system modeling, development, characterization, and testing, as a partner with Lockheed Martin to assess system level performance of specified sensors.

### **Proposal for the Development of New HE Compounds**

David E. Chavez (DE-1)

The partner has expressed a need for high explosive (HE) materials with enhanced performance in high-temperature environments (475–500°F). Currently used HE materials,

such as HNS, RDX, and HMX, are not effective at such temperatures. Los Alamos National Laboratory has developed several HE compounds with properties that may provide significant performance improvements at high temperatures.

### **CO<sub>2</sub> Sequestration Potential in Taiwan**

Rajesh J. Pawar (EES-16)

This project will build upon the first year's work performed at LANL in FY08 for the WFO project funded by the Industrial Technology Research Institute (ITRI). The project involves assessment of a site as a potential long-term geologic CO<sub>2</sub> sequestration option for Taiwan. Previous year's activities focused on demonstrating the applicability of LANL's Finite Element Heat and Mass transfer code (FEHM) to perform numerical simulations of CO<sub>2</sub> sequestration in geologic reservoirs. We will develop a refined model in FEHM for the geologic site and couple the model to the CO<sub>2</sub>-PENS systems model.

### **Tritium Resistance of Polyimide Membranes**

Scott Willms (C-DO)

The Tritium Separation Centre (TSC) is an Nuclear Physics Institute project aimed at providing a facility for CANDU reactors to process tritiated heavy water on-site. (The CANDU reactor is a pressurized heavy water reactor developed initially in the late 1950s and 1960s by a partnership between Atomic Energy of Canada

Limited [AECL], the Hydro-Electric Power Commission of Ontario [now known as Ontario Power Generation], Canadian General Electric [now known as GE Canada], as well as several private industry participants.) The TSC comprises several processes, most of which are well established in the detritiation field. A major process in the TSC is the gaseous diffusion process (GD). Gaseous diffusion has been well established in heavy isotope separation. In the Sponsor's TSC, traditional GD is modified several ways including the use of polymer-based membranes.

### **Characterization of Crosslinked PBI Membranes for Use in Gas Separation Applications**

Kathryn Berchtold (MST-7)

Contribute invaluable test data and accumulation of expertise in the development of LANL PBI membrane technology, which will greatly assist in its eventual placement within the industrial setting for public benefit.

### **Breadth and Functional Assessment of Toggle-Peptide-Specific T Cell Responses**

Bette T. M. Korber (T-6)

The extraordinary scale of HIV variation poses a major obstacle for AIDS vaccine development. The effectiveness of HIV vaccine will depend on highly immunogenic antigenic sequences providing maximal cover-

age of circulating variants. Thus, vaccines need to include HIV regions that are targets of the protective immune responses, and that would allow cross-recognition between vaccine strains and circulating strains of the virus. Immune responses tend to be detected most often in the more conserved regions of HIV, which could be explained by the sequence differences between reagent strains and circulating viruses. We developed a method to increase sequence coverage by the peptide reagents by including several amino acid options in the peptide positions on the synthesis step so that peptide mixtures are developed instead of a single peptide. These mixtures (we call them "toggled peptides") have significantly increased coverage of circulating variants, and at the same time do not increase the workload/sample size of current assays.

Preliminary testing on 35 patients demonstrated significantly more CD8+ and CD4+ responses to the toggled mixtures than to the traditional consensus overlapping peptides. On average, in the Gag p24 and Pol HIV regions, 5 more CD8+ epitopes per person could be detected, and the responses to the toggled peptide mixtures were significantly higher in magnitude, indicating that the traditional approaches underestimate both the breadth and the magnitude of the T cell immune response. A portion of responses were lost in the toggled mixtures relative to consensus peptides, even though the toggled peptides always included the consensus. This suggests possible peptide

antagonism, a factor that could be important for polyvalent vaccine design, and which emphasizes the importance of the complete understanding of all the issues related to using toggled peptides. This proposal is devoted to a thorough analysis of the ability of these mixtures to increase the rate of detection of T cell responses, together with the analysis of the related issues such as possible peptide antagonism, synthesis issues, functional diversity of T cells elicited by these mixtures in impact on proliferate capacity, etc. Our role at LANL will be to provide computer and statistical analysis of the sequence and immunological data obtained experimentally, and of overall data stored in HIV databases.

### **Lateral Flow Microarrays: A Platform for Multiplexed Point-of-Care Diagnostics**

Robert B. Cary (B-7)

Nucleic acid-based assays for pathogen detection and identification offer sensitivity, specificity and resolution. Unfortunately, the manipulations for these assays have traditionally relied on nucleic acid isolation and amplification methods poorly suited for use outside of an appropriately equipped laboratory. Nonetheless, a significant need exists for more comprehensive, specific and facile diagnostics for use at the point-of-care. The recent emergence of several isothermal nucleic acid amplification strategies promise to alleviate the need for thermocycling hardware to achieve

sensitive nucleic acid detection. Liberated from demanding hardware requirements, nucleic acid amplification becomes suitable for use under circumstances where access to a laboratory infrastructure is limited or unavailable. To enable sensitive, multiplexed detection of isothermally amplified nucleic acids without costly or complex instrumentation, we developed a rapid lateral flow chromatographic approach to DNA microarray fabrication and hybridization.

In highly miniaturized embodiments, we refer to it as lateral flow microarrays (LFM). The technology enables the detection of 250 amol of nucleic acid analyte in 2 minutes. Coupled with isothermal amplification, the method addresses many of the hurdles to translation of nucleic acid assays from the laboratory to the field. However, a significant remaining challenge is presented by the need to render a complex biological sample, containing enzyme inhibitors and nucleases, suitable for isothermal amplification. Further, the integration of sample preparation, amplification and detection into a low-cost yet easily used system is required to realize a facile and robust point-of-care diagnostic tool. The over-arching hypothesis of this proposal is that a highly simplified and integrated nucleic acid analysis device can be realized using low cost lateral flow chromatography technologies. Making use of easily fabricated lateral flow devices offers an approach to sample preparation that is facile and familiar to the

end user and provides a solid-phase support to capture and concentrate diagnostic targets from confounding sample matrix constituents.

### **Hypergolic Safety Modeling and Simulation**

Duan Zhong Zhang (T-3)

This project will include the use of CartaBlanca, a LANL code, to simulate and to study hypergol reaction and related multiphase flows and fluid-structure interactions.

### **Racial Differences in IFN Transcriptional Response – Data Analysis/Modeling**

Alan Perelson (T-6)

The sponsor will be conducting experiments in order to understand the racial differences in the response to interferon based therapy for hepatitis C virus infection. LANL will analyze experimental data on the kinetics of the viral response to interferon to see if racial differences affect the viral response.

### **Computational Biology of Vascular Cell Behavior**

Yi Jiang (T-5)

Work proposed under this agreement includes the development of a cell-based mathematical and computational model for simulating vasculogenesis in embryos. The proposed work will help decipher the cell and tissue behavior required to form healthy vessels, and to help explain the mechanisms underlying

the failure of diseased vessels and the root causes of vascular malformations in fetuses and infants.

### **GEM: Combining Remote and In Situ Observations in the Plasma Sheet**

Sorin G. Zaharia (ISR-1)

The main topic of this project is inferring physical quantities in the Earth's magnetosphere (plasma sheet ion density, temperature, and pressure) remotely from ionospheric observations from the low-altitude DMSP satellites. The work to be done at LANL will involve numerical simulations of three-dimensional magnetosphere structure to compute the magnetic field self-consistent with the observed plasma data. The magnetic field will thus be used as a way of improving the mapping between the ionosphere and magnetosphere. Furthermore, the induced electric fields will be computed from time sequences of magnetospheric magnetic field structures.

### **Analysis of Geologic CO<sub>2</sub> Sequestration Potential in the Rock Springs Uplift, Wyoming**

Philip H. Stauffer (EES-16)

The Wyoming State Geological Survey has contacted LANL for assistance in building a numerical mesh of the Rock Springs Uplift (RSU), creating simulations of CO<sub>2</sub> flow and transport in the RSU, and starting to build a Performance Assessment model that can be used to show the

long-term safety of CO<sub>2</sub> sequestration in the RSU. The purpose of this proposal is to determine the feasibility of using the deeper sections of the Rock Springs Uplift (RSU) as a CO<sub>2</sub> sequestration reservoir.

### **Influenza Sequence Management Data and Analysis**

Catherine A. Macken (T-6)

The Influenza Sequence Database (ISD) was fully developed by LANL and is a database-driven web site, with extensive and unique capabilities for storage and analysis of influenza genetic and protein sequences. The ISD is a large, mature project, that has been partially supported by the CDC (USA) to extend ISD capabilities for supporting national and international public health and research interests connected with influenza. ISD staff will curate these data to the highest level applied to public data in the ISD. ISD staff will make available all analysis tools that have been designed for public use. ISD will develop custom features for data management and analysis to meet individual Sponsor's needs, as determined by analysis of required performance.

### **ITER Toriodal Field Coil Nuclear Heating Calculation Validation**

Scott Willms (C-DO)

The estimates of the nuclear heating in the toroidal field coils of Sponsor are critical for the design and

successful operation of Sponsor's magnetic fusion device. However, the blanket modules and vacuum vessel are designed to shield the coils from nuclear radiation so that for 500 MW of fusion power, the heating in the coils is reduced to less than 800 W per coil. This large attenuation in the neutron flux implies that the radiation transport calculations are difficult. Add to this the complexity of the Sponsor's device, and one concludes that this analysis is one of the most demanding for a magnetic fusion device. However, because of the great importance of the estimate of the heating, it is essential that the reliable calculations are carried out.

### **Project Management Support for ITER-Cadarache**

John P. Tapia (SPO-SC)

The Sponsor is a major international research project with the goal of demonstrating the scientific and technological feasibility of fusion energy. The fusion power will be up to 10 times greater than the external power delivered to heat the plasma. They are designed to be the premier scientific tool for exploring and testing plasma behavior in the fusion burning plasma regime, where the fusion process itself provides the dominant heat source to sustain the plasma temperature. It will provide the scientific basis and plasma control tools needed to move toward the fusion energy goal.

### **Thermoacoustic Space Power Generation**

Scott N. Backhaus (MPA-10)

Satellites in low-Earth orbit require electrical power to perform their missions. Typically, this power is generated from sunlight using panels of photovoltaic cells that recharge batteries while the satellite is not in the Earth's shadow. However, certain mission types may utilize orbits that make using solar panels difficult. Dynamical power conversion devices, such as a thermoacoustic electric generator, may have significant advantages. These devices require a heat input instead of a solar input making them adaptable to many different energy sources such as radioisotope.

### **Provide Controller/Evaluator Support of DOE/NNSA RAPTER Training**

Sarah C. Hoover (IAT-3)

LANL personnel will provide Controller/Evaluator support as well as training support for RAPTER training in support of DOE's Radiological Assistance Program (RAP).

### **Novel Fiber Optic Methods**

Charles R. Farrar (INST-OFF)

Perform preliminary finite element analyses of a sonar array for the Sponsor.

### **DUSEL R&D for a Tonne Scale Ge Neutrinoless Double-Beta Decay Experiment**

Steven R. Elliott (P-23)

Assess a solid-state Germanium detector for the Sponsor. In particular, LANL will examine its performance to determine its suitability for use in a large-mass double beta decay experiment.

## User Facility Agreements Executed in Fiscal Year 2008

User Facility Agreements permit outside users, including scientists and engineers from industry, universities, and other government agencies to conduct research using the Laboratory's unique experimental research equipment and facilities. The Laboratory has approximately 40 facilities available for use. Users access the equipment in order to fabricate, calibrate, test, and evaluate products and processes. The partner directs the activity described within the agreement for use of the designated facility and pays the full cost for use of the facility. During FY 2008, the Laboratory's Weapons Neutron Research Facility was the only active user facility with partners performing the projects listed below.

### **Weapons Neutron Research Facility**

#### **Stephen Wender (LANSCE-NS), Facility Coordinator**

Neutron Soft Error Time-to-Fail and Data Corruption Rate Measurements  
Atmosphere Neutron Effects in 65 nm and 45 nm CMOS SRAM and Logic

Neutron Soft Error Sensitivity of Advanced FPGAs

Accelerated Characterization of the Rate of Neutron-Induced Soft Errors in 45 and 65 nm SPARC Devices

Soft Error and Latch-Up Studies in Technology Nodes Below 110 nm

Neutron Single-Event Effects Testing of Various Commercial Integrated Circuits

Soft Error Rate Testing of Advanced Semiconductor Memory and Logic Devices

Investigation of Effects of NSEU on Avionics Equipment, Commercial Systems 2007

Investigation of Neutron Induced SRAM and Logic SER in 130 nm Microcontrollers

Power Device Evaluation

Evaluation of the Effects of Atmospheric Radiation on Avionic Components

JEDEC89 Terrestrial Cosmic Radiation Testing on Reconfigurable SRAM Switch

Accelerated Soft Error Rate Testing of AMD's Quad-Core Microprocessor

Neutron FIT Rate Characterization on SRAM, Register File Arrays, and System-on-Chip (SoC) in Advanced CMOS Processes

SER Evaluation of Semiconductor Storage Cells

## Distinguished Awards for 2008

### Distinguished Patent Award

The Distinguished Patent Award honors inventors whose patented invention exhibits outstanding innovation. The award is selected by the Laboratory Patent Advisory Council and recognizes a premier patent exemplifying significant technical advance, adaptability to public use, and noteworthy value to the mission of Los Alamos National Laboratory. The patent and the inventors recognized for this award reflect the Laboratory's stalwart tradition of superior technical innovation and creativity.

#### *2008 Award Winner*

The 2008 Distinguished Patent Award goes to the patent titled "Ultrasonic Analyte Concentration and Application in Flow Cytometry," submitted by a team comprising the following researchers: Greg Kaduchak, Greg Goddard, Gary Salzman, Dipen Sinha, John Martin, Christopher Kwiatkowski, and Steven Graves of Biosciences, International and Applied Technology, and Materials Physics and Applications divisions. This patent is at the core of a portfolio of intellectual property that has been exclusively licensed to Life Technologies (formerly Invitrogen) for broad commercial deployment.

The patent invention uses acoustic forces to position, concentrate, or fractionate particles suspended in a fluid. Acoustic concentration of bio-

logical cells could be incorporated into a fully automated analysis tool that provides contamination-free, high-speed, real-time measurements without the use of fluid suspension.

In one design of the system, a long cylindrical (or axially symmetrical geometry) fluid-filled glass tube is coupled with a piezo-ceramic transducer to create a resonant pressure field within the fluid-filled tube. As the resonant pressure field is dipole in character, the particles within the fluid are driven towards minima in the radiation force potential created by the field. The use of the cylindrical geometry eliminates the need for accurate alignment of the transducer system enabling a more robust tool and the use of a lower cost optical analysis system. This is in contrast to systems employing planar, confocal or traveling wave fields. Use of a cylindrical geometry provides the further benefit of a lower energy density within a tube thereby reducing cavitation, convection and thermal gradients within the fluid.

### Distinguished Licensing Award

The Distinguished Licensing Award recognizes innovators who proactively engage in commercialization activities at Los Alamos National Laboratory and who have had a positive impact on the Laboratory's Licensing Program. These individuals, by example, demonstrate



outstanding success in transferring Laboratory-developed technologies to the public and private sectors. In addition, the Laboratory's reputation is enhanced by the commercialization track record of current and former recipients of this distinguished honor.

The recipients of this distinguished award are champions for the Laboratory's licensing program and are recognized for their role in confirming the benefits of proactive technology commercialization activities.

#### *2008 Award Winner*

The 2008 recipient of this award is Mark Hoffbauer of the Chemistry Division. His cutting edge technology, ENABLE, for Energetic Neutral Atom Beam Lithography/Epitaxy, is a process that comprises a dual-function nanofabrication technology capable of growing thin films and etching high-aspect-ratio nanostructures from an energetic collimated beam of neutral nitrogen or oxygen atoms. Its unique low-temperature operation prevents activation of diffusive and other unwanted chemical changes that are drawbacks for existing nanofabrication processes. The ENABLE technology is theoretically capable of fabricating details down to one nanometer or less in size, giving it greater versatility than current processes.

Industrial applications of ENABLE-based films and etching capabilities extend from fabrication of semi-

conductors, solar cell devices, light emitting diodes, and solid-state lasers, to many other areas important to our nation's energy security. Through Hoffbauer's efforts, Los Alamos has both a CRADA and an Exclusive License Option with RoseStreet Labs Energy, Inc., to bring the technology to commercial readiness for use in a variety of applications. Hoffbauer's innovative outlook and belief in potential commercial applications has led to multiple new invention disclosures and patent applications.

Hoffbauer was instrumental in bringing awareness of technical and commercial opportunities to numerous companies by actively promoting his work during industrial interactions in conjunction with the Technology Transfer Division. His significant efforts to supply critical information during contract negotiations as well as his spirit of cooperation with Tech Transfer and company executives were key elements in the successful implementation of a collaboration and licensing framework.

### **Programmatic Impact Award**

This award honors individuals or groups who have made advancements to the programmatic mission of Los Alamos National Laboratory through their interactions with industry partners. Nominees have interacted with industry partners through any technology transfer mechanism (Cooperative Research and Development Agreement, Work

for Others, Licensing, User Facility or Memorandum of Understanding) to add value to the technology field in which they work for programmatic and commercial uses.

The recipients of this award have demonstrated stellar technical prowess as well as the innovation and creativity needed to demonstrate excellence in both programmatic and commercial applications.

#### *2008 Award Winners*

The Subsurface Flow and Transport Team, which was developed by Kay Birdsell, Shaoping Chu, Zora Dash, Zhenxue Dai, Al Eddebbbarh, Carl Gable, Elizabeth Keating, Ed Kwicklis, Gordon Keating, Sharad Kelkar, Zhiming Lu, Terry Miller, Rajesh Pawar, Bruce Robinson, Philip Stauffer, Velimir Vesselinov, Hari Viswanathan, and Andrew Wolfsberg, George Zyvoloski, all of the Earth and Environmental Sciences Division, is the recipient of the 2008 Programmatic Impact Award for its work on the Finite Element Heat and Mass Transfer Code (FEHM).

This team has been involved in large-scale projects including performance assessment of Yucca Mountain, environmental remediation of the Nevada Test Site, the LANL Groundwater protection program and geologic CO<sub>2</sub> sequestration, oil shale extraction, and related environmental issues. FEHM is a numerical simulation code for subsurface transport processes. FEHM possesses unique features and capabilities that have been used to

simulate groundwater and contaminant flow and transport in deep and shallow, fractured and unfractured porous media throughout the U.S. DOE complex. It is also of general interest to the subsurface flow and transport community. Recently, the oil and gas industry has been investing in FEHM for both conventional and unconventional energy development.

### **Technology Transfer Regional Impact Award**

This award honors individuals, organizations, or programs that have made a significant contribution to the northern New Mexico economy. Recipients must have a tie to LANL technology, personnel, or expertise. (Per Appendix N of the LANS LLC M&O Prime contract, the Laboratory actively encourages the development of new businesses based on Laboratory technology or expertise.)

Nominees for this award must demonstrate northern New Mexico economic impact through the creation or growth of LANL-affiliated venture(s), creation of new jobs or new products, or implementation of a unique resource for entrepreneurs. In addition, the individual, organization or program must reflect the spirit of entrepreneurship through personal risk taking, strong personal commitment, ingenuity, and as a role model for regional innovation.

#### *2008 Award Winners*

The recipients of the 2008 Regional Impact Award are Laboratory inventor and co-founder of Knowledge Reef Systems Inc., Marko Rodriguez of the Theoretical Division, Jennifer Watkins of the International and Applied Technology Division, and Knowledge Reef Systems, Inc.

Knowledge Reef Systems Inc. of Santa Fe, N.M., provides a service for hosting online, information-intensive knowledge communities found in businesses, government, academia, professional societies and even consumer-oriented groups. Members of these knowledge communities, where learning and sharing information drive their community involvement, offer highly targeted audiences that will accept relevant, data-rich product promotions from business-to-business advertisers.

Rodriguez's patent-pending algorithm, "Social Semantic Networks for Distributing Contextualized Information," has been licensed from the Laboratory by Knowledge Reef Systems and serves as a core element of the kReef™ platform. The innovative kReef information recommender system employs the power of social behavior to automatically discover and intelligently route new information to members based on their interests and needs.

A 2007 recipient of a LANS Venture Acceleration Fund award, KRS has attracted investments by Flywheel Ventures, New Mexico Angels, and private investors. The company is targeting "natural" knowledge communities formed around the estimated 75 million knowledge workers in the U.S.

## IDEAS

The Technology Transfer Division's IDEAS (Information Disclosure Electronic Application System) automates the first and most critical step in the technology transfer process—receiving invention disclosures from the Laboratory's research staff. This collaboration tool allows multiple users to author and edit disclosure drafts via a Web browser, helping inventors create, modify, review, and submit invention disclosures electronically.

The disclosure process provides Laboratory Legal Counsel with the information necessary to file a patent application and the TT Division with the vital information needed for successful, commercial, noncommercial, and academic licensing and transfer of an invention to the public/private sector.

After submission, invention disclosures are routed electronically for approvals, archiving, and entry into TT Division's Opportunity Module. Launched in November 2005 as a part of TT Division's commitment to streamlining, IDEAS has had an immediate impact on the disclosure process by enabling enhanced collaboration and reducing the total time required to produce high quality disclosures and expedite the approval process. The total number of invention disclosures submitted annually has continued to increase over the past four years since the launch of IDEAS.

Coming soon, IDEAS 1.1, a more robust system will enable the electronic submission of copyright disclosures as well.

To process a disclosure visit:  
[www.lanl.gov/my\\_idea](http://www.lanl.gov/my_idea)

Hey,  
What  
About  
My  
Bright  
Idea?

[www.lanl.gov/my\\_idea](http://www.lanl.gov/my_idea)

**ideas**  
Invention disclosure  
electronic application system  
LOS ALAMOS NATIONAL LABORATORY  
Technology Transfer Division



## Regional Economic Development Programs

Since 1997, the Technology Transfer Division has offered a variety of programs and services to facilitate spinoffs from the Laboratory. These programs have also been instrumental in strengthening the northern New Mexico startup community as a whole.

### Technology Maturation Fund

In 2002, an internal Technology Maturation Fund was developed to provide small amounts of funding for highly focused projects within the Laboratory to move early stage technologies along the road to commercialization. Unlike many types of funding within the Laboratory, these awards are not for a specific time period but rather to achieve a specific milestone in a defined development path leading to commercialization. The funds are meant to remove specific hurdles to development of early stage technologies in the Laboratory. To date, the fund has shown an impressive return on its investment of around \$3 million in 64 projects.

## Entrepreneurial Leave of Absence (ELOA) Policy

In 1998, the Laboratory adopted an ELOA policy for the first time. The ELOA policy allows employees to take an unpaid leave, for a limited period, to pursue entrepreneurial activities utilizing Laboratory technology or intellectual property. The policy also allows the employee to retain access to certain Laboratory benefits. The purpose of the program is to reduce risk for Laboratory employees and to facilitate the attempt to start new businesses. Since its inception, 37 employees have taken entrepreneurial leave of absence.

## Market and Business Planning Assistance

Technology Transfer works with the Lab's technical staff to assess and package technologies that could form the basis of a new company. In addition, through TT's MBA Internship Program, initiated in 1996, MBA candidates evaluate Los Alamos inventions for commercialization potential, working with the inventors to develop technology transfer strategies. In addition, TT works with regional entrepreneurs to help them access the knowledge, skills, funds, and business connections necessary for success. Since 1997, we have assisted over 600 clients; 91 of these are startups.



## Northern New Mexico Connect

Launched in December 2007, sponsored by LANS and LANL in partnership with the Regional Development Corporation, NNM Connect is growing an ecosystem for enterprise development and networking for long-term economic growth in the region. It is designed to help build an innovation community in northern New Mexico through the investment of stakeholders. The NNM Connect network includes the following programs:

### *Education and Networking*

The Education and Networking program is designed to promote the exchange of ideas, explore new business avenues, and create regional partnerships. It also provides entrepreneurs with opportunities to gain business know-how and establish new networks.

### *LANS Venture Acceleration Fund (VAF)*

Each year the LANS VAF will provide investments of up to \$100,000 to facilitate three to five commercialization projects with regional entrepreneurs, companies, investors, or strategic partners.

### *LINK*

The LINK program helps communities establish and adapt sustainable business consulting models by engaging local leadership in networking and investing in community enterprises.

### *Market Intelligence Resource*

The MIR program will assist northern New Mexico businesses in becoming more successful and competitive by providing them with timely, reliable, and actionable information regarding markets, customers, competitors, and industry conditions.

### *New Mexico Small Business Assistance (NMSBA)*

The NMSBA program provides access to diverse national laboratory technical expertise and resources to benefit New Mexico small businesses.



### *Springboard*

Springboard is a business mentoring and coaching program for high tech companies in all stages of development, including those in concept, start-up, and growth.

## Los Alamos Venture Acceleration (LAVA) Initiative

This pilot program is designed to strategically spin off technology-based companies from the Laboratory with emphasis on establishing new businesses in northern New Mexico. The selected partners, ARCH Venture Partners and the Verge Fund, have an agreement with the Laboratory with a contribution by it valued at up to \$1 million over three years, and a contribution of time and effort from the ARCH-Verge team of 20 investment professionals, including 8 located in New Mexico. The partners have established LabStart with an office in Los Alamos to help spin out strategically selected start-up companies based on LANL technologies. Labstart will provide the external business guidance, market validation, maturation funding, and assemble the external technical and management teams required to bring promising technologies to the equity financing stage. Labstart will also be responsible for securing pre-seed and/or seed financing for subject ventures, as appropriate.



## Contact List

Outstanding innovation is the cornerstone that enables patents, copyrights, licenses, and the ensuing entrepreneurial ventures to occur. The teams cited below are key to the Laboratory's activities required to protect our intellectual property and encourage the transfer of technology to the private sector. For questions or assistance please contact any of these individuals.

### **Technology Transfer Division**

*Division Leader*

Steve Girrens, 667-9473

*Chief of Staff*

David Holmes, 665-6747

### **Contracts Management**

*Contract Compliance Manager*

Tarianne Gallegos, 665-6707

### **Policy and Strategy/LAVA Program**

*Program Manager*

John Mott, 665-0883

*Team Leaders*

Laura Barber, 667-9266

Kathleen McDonald, 667-5844

David Pesiri, 665-7279

John Russell, 665-9597

*Intellectual Property Specialists*

Christine Ramos, 665-6846

Angelica Romero, 665-3089

### **Regional Economic Development Programs**

*Program Manager*

Belinda Padilla, 667-9896

### **Laboratory Counsel**

*Laboratory Counsel*

David A. Sosinski, 667-3970

### **Intellectual Property Office**

*Group Leader*

Bruce Cottrell, 667-9168

*Patent Agent*

Sam Borkowsky, 665-3111

*Business Law*

David Salazar, 665-6697

*Patent Attorneys*

Cindy Blackwell, 667-7512

Juliet Jones, 606-2235

Meredith Schoenfeld, 665-1595

### **Technology Transfer Division**

[www.lanl.gov/partnerships/](http://www.lanl.gov/partnerships/)

### **Laboratory Counsel**

[www.lanl.gov/orgs/lc/](http://www.lanl.gov/orgs/lc/)

