

# *Outstanding Innovation*

2007 Technology Transfer Awards



*Carrying on the tradition of world-changing innovation*



*Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Los Alamos National Security, LLC, for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the Los Alamos National Security, LLC, the U.S. Government, or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of Los Alamos National Security, LLC, the U.S. Government, or any agency thereof.*

*Outstanding  
Innovation*  
2007 Technology Transfer Awards

*Carrying on the tradition of world-changing innovation*

Thursday, May 29, 2008  
Los Alamos National Laboratory  
Los Alamos, New Mexico







**W**elcome to the tenth Annual Technology Transfer Awards Reception. This evening is a celebration of Los Alamos National Laboratory's innovators and recognition of their vital role in transferring state-of-the-art technologies from the Laboratory to the private sector.

According to the Department of Energy, estimates are that half the growth in the U.S. economy over the past 50 years resulted from funding for scientific and technological innovation. DOE's investments have increased intellectual capital, advanced medical and health care needs, enhanced economic competitiveness, and improved the quality of life of the American people.

Many of these scientific breakthroughs have come directly from Los Alamos National Laboratory. I am proud to honor our Laboratory innovators for their outstanding efforts in creating, protecting, licensing, and working with industry and academia to achieve such impressive collaborations and advances in science.

On behalf of the senior management team and the entire Laboratory community, I extend congratulations and appreciation to this evening's honorees for their achievements. And I encourage ongoing participation by all Laboratory innovators in technology transfer activities. It is this partnership with the business community that will allow Los Alamos National Laboratory to continue its vital role in regional and national economic competitiveness for decades to come.

A handwritten signature in black ink that reads "Michael Anastasio". The signature is fluid and cursive, with the first name and last name clearly distinguishable.

Michael R. Anastasio  
Laboratory Director



## Keynote Speaker: Manuel E. Gonzalez Chevron Energy Technology Company

As Chevron's manager for the Advanced Energy Solutions Alliance with the Laboratory, Manuel (Manny) Gonzalez brings more than a quarter century of experience with oil exploration and technology transfer to the job. Gonzalez's expertise in technology transfer goes back to the early 1980s when he worked with both NASA and LANL to bring advances to the oil industry, including a high temperature insulating technology developed with LANL—an innovation that saved over \$300,000 per well. In the 1990s, Gonzalez founded a company named Isotag Inc. (now called Authentix) based on a LANL technology for molecular marking of liquids. Isotag became the first U.S. company to receive Germany's International Jurgen Schneider Technology Award for the "Highest Innovative and Technological Achievement" and was recently acquired by The Carlyle Group. The company is credited with recovering more than \$5 billion in lost revenue for its clients by preventing fraudulent adulteration of products from gasoline to pharmaceuticals.

In addition to helping to transfer technologies from the laboratory to industry, Gonzalez holds 21 U.S. and international patents with many of these licensed to the oil industry. Gonzalez also has published widely in numerous technical journals, served on several committees for national technical organizations, been quoted by the *Wall Street Journal* and *Business Week*, and testified to the National Academy of Sciences on technology transfer. All of this follows a distinguished military career recognized with numerous medals.

Gonzalez currently leads the Chevron-LANL research alliance, overseeing a diverse array of projects with impact on multiple aspects of the oil industry from deepwater drilling to refining. Gonzalez brings an ability to rapidly and effectively connect technology to industry-critical problems, concurrently advancing the state of the art while improving profitability.

## Abstracts of Issued Patents

Listings are in accordance with issue dates from beginning to end of fiscal year 2007

### Preparation of High Nitrogen Compound and Material Therefrom

My Hang V. Huynh (DE-1)  
Michael A. Hiskey (DE-1)  
U.S. Patent 7,119,179

The high-nitrogen compound of the formula ##STR00001## was prepared. Pyrolysis of the compound yields carbon nitrides  $C_2N_3$  and  $C_3N_5$ . The carbon nitrides vary in their density, texture, and morphology.

### Durable Electrooptic Devices Comprising Ionic Liquids

Benjamin P. Warner (MPA-MC)  
Thomas M. McCleskey (MPA-MC)  
Anthony K. Burrell (MPA-MC)  
U.S. Patent 7,119,937

Electrolyte solutions for electrochromic devices such as rear view mirrors and displays with low leakage currents are prepared using inexpensive, low conductivity conductors. Preferred electrolytes include bifunctional redox dyes and molten salt solvents with enhanced stability toward ultraviolet radiation. The solvents include lithium or quaternary ammonium cations and perfluorinated sulfonylimide anions selected from trifluoromethylsulfonate ( $CF_3SO_3^-$ ), bis(trifluoromethylsulfonyl)imide ( $((CF_3SO_2)_2N^-)$ ), bis(perfluoroethylsulfonyl)imide ( $((CF_3CF_2SO_2)_2N^-)$ ) and tris(trifluoromethylsulfonyl)methide ( $((CF_3SO_2)_3C^-)$ ). Electroluminescent, electrochromic and photoelectro-

chromic devices with nanostructured electrodes include ionic liquids with bifunctional redox dyes.

### Photoinduced Charge-Transfer Materials for Nonlinear Optical Applications

Duncan W. McBranch (PADSTE)  
U.S. Patent 7,125,578

A method using polyelectrolyte self-assembly for preparing multilayered organic molecular materials having individual layers which exhibit ultrafast electron and/or energy transfer in a controlled direction occurring over the entire structure. Using a high molecular weight, water-soluble, anionic form of polyphenylene vinylene (PPV), self-assembled films can be formed which show high photoluminescence quantum efficiency (QE). The highest emission QE is achieved using poly(propylene-imine) (PPI) dendrimers as cationic binders. Self-quenching of the luminescence is observed as the solid polymer film thickness is increased and can be reversed by inserting additional spacer layers of transparent polyelectrolytes between each active conjugated layer, such that the QE grows with thickness. A red shift of the luminescence is also observed as additional PPV layers are added. This effect persists as self-quenching is eliminated. Charge transfer superlattices can be formed by additionally incorporating  $C_{60}$  acceptor layers.

## Stable Isotope, Site-Specific Mass Tagging for Protein Identification

Xian Chen (B-2)  
U.S. Patent 7,125,685

Proteolytic peptide mass mapping as measured by mass spectrometry provides an important method for the identification of proteins, which are usually identified by matching the measured and calculated  $m/z$  values of the proteolytic peptides. A unique identification is, however, heavily dependent upon the mass accuracy and sequence coverage of the fragment ions generated by peptide ionization. The present invention describes a method for increasing the specificity, accuracy and efficiency of the assignments of particular proteolytic peptides and consequent protein identification by the incorporation of selected amino acid residue(s) enriched with stable isotope(s) into the protein sequence without the need for ultrahigh instrumental accuracy. Selected amino acid(s) are labeled with  $^{13}\text{C}/^{15}\text{N}/^2\text{H}$  and incorporated into proteins in a sequence-specific manner during cell culturing. Each of these labeled amino acids carries a defined mass change encoded in its monoisotopic distribution pattern. Through their characteristic patterns, the peptides with mass tag(s) can then be readily distinguished from other peptides in mass spectra. The present method of identifying unique proteins can also be extended to protein complexes

and will significantly increase data search specificity, efficiency and accuracy for protein identifications.

## Vectorized Image Segmentation via Trixel Agglomeration

Lakshman Prasad (ISR-2)  
Alexei N. Skourikhine (ISR-2)  
U.S. Patent 7,127,104

A computer implemented method transforms an image comprised of pixels into a vectorized image specified by a plurality of polygons that can be subsequently used to aid in image processing and understanding. The pixelated image is processed to extract edge pixels that separate different colors and a constrained Delaunay triangulation of the edge pixels forms a plurality of triangles having edges that cover the pixelated image. A color for each one of the plurality of triangles is determined from the color pixels within each triangle. A filter is formed with a set of grouping rules related to features of the pixelated image and applied to the plurality of triangle edges to merge adjacent triangles consistent with the filter into polygons having a plurality of vertices. The pixelated image may be then reformed into an array of the polygons that can be represented collectively and efficiently by standard vector image.

## Quantitative Method of Determining Beryllium or a Compound Thereof in a Sample

T. Mark McCleskey (MPA-MC)  
Deborah S. Ehler (MPA-MC)  
Kevin D. John (C-IIAC)  
Anthony K. Burrell (MPA-MC)  
Gavin E. Collis (C-SIC)  
Edel M. Minogue (C-ADI)  
Benjamin P. Warner (MPA-MC)  
U.S. Patent 7,129,093

A method of determining beryllium or a beryllium compound thereof in a sample, includes providing a sample suspected of comprising beryllium or a compound thereof, extracting beryllium or a compound thereof from the sample by dissolving in a solution, adding a fluorescent indicator to the solution to thereby bind any beryllium or a compound thereof to the fluorescent indicator, and determining the presence or amount of any beryllium or a compound thereof in the sample by measuring fluorescence.

## Buffer Layer for Thin Film Structures

Stephen R. Foltyn (MPA-STC)  
Quanxi Jia (MPA-STC)  
Paul N. Arendt (MPA-STC)  
Haiyan Wang (MPA-STC)  
U.S. Patent 7,129,196

A composite structure including a base substrate and a layer of a mixture of strontium titanate and strontium ruthenate is provided. A superconducting article can include a composite structure including



an outermost layer of magnesium oxide, a buffer layer of strontium titanate or a mixture of strontium titanate and strontium ruthenate and a top layer of a superconducting material such as YBCO upon the buffer layer.

### High Throughput Screening of Ligand Binding to Macromolecules using High Resolution Powder Diffraction

Robert B. Von Dreele (LANSCE)  
U.S. Patent 7,130,747

A process is provided for the high throughput screening of binding of ligands to macromolecules using high resolution powder diffraction data including producing a first sample slurry of a selected polycrystalline macromolecule material and a solvent; producing a second sample slurry of a selected polycrystalline macromolecule material, one or more ligands and the solvent; obtaining a high resolution powder diffraction pattern on each of said first sample slurry and the second sample slurry; and comparing the high resolution powder diffraction pattern of the first sample slurry and the high resolution powder diffraction pattern of the second sample slurry whereby a difference in the high resolution powder diffraction patterns of the first sample slurry and the second sample slurry provides a positive indication for the formation of a complex between the selected polycrystalline macro-

molecule material and at least one of the one or more ligands.

### Magnetic Infrasond Sensor

Frederick M. Mueller (MPA-STC)  
Lawrence E. Bronisz (IAT-2)  
Holger Grube (MST-8)  
David C. Nelson (AET-5)  
Jonathan L. Mace (DE-6)  
U.S. Patent 7,134,342

A magnetic infrasond sensor is produced by constraining a permanent magnet inside a magnetic potential well above the surface of superconducting material. The magnetic infrasond sensor measures the position or movement of the permanent magnet within the magnetic potential well, and interprets the measurements. Infrasond sources can be located and characterized by combining the measurements from one or more infrasond sensors. The magnetic infrasond sensor can be tuned to match infrasond source types, resulting in better signal-to-noise ratio. The present invention can operate in frequency modulation mode to improve sensitivity and signal-to-noise ratio. In an alternate construction, the superconductor can be levitated over a magnet or magnets. The system can also be driven, so that time-resolved perturbations are sensed, resulting in a frequency modulation Version with improved sensitivity and signal-to-noise ratio.

### Method to Amplify Variable Sequences without Imposing Primer Sequences

andrew M. Bradbury (B-9)  
Ahmet Zeytun (B-7)  
U.S. Patent 7,135,310

The present invention provides methods of amplifying target sequences without including regions flanking the target sequence in the amplified product or imposing amplification primer sequences on the amplified product. Also provided are methods of preparing a library from such amplified target sequences.

### Functionalized Polymers for Binding to Solutes in Aqueous Solutions

Barbara F. Smith (C-CSE)  
Thomas W. Robison (C-CSE)  
U.S. Patent 7,138,462

A functionalized polymer for binding a dissolved molecule in an aqueous solution is presented. The polymer has a backbone polymer to which one or more functional groups are covalently linked. The backbone polymer can be such polymers as polyethylenimine, polyvinylamine, polyallylamine, and polypropylamine. These polymers are generally water-soluble but can be insoluble when cross-linked. The functional group can be, for example, diol derivatives, polyol derivatives, thiol and dithiol derivatives, guest-host groups, affinity groups, beta-diphosphonic acids, and beta-diamides

## Preparation of Nanoporous Metal Foam from High Nitrogen Transition Metal Complexes

Bryce C. Tappan (DE-6)  
 My Hang V. Huynh (DE-1)  
 Michael A. Hiskey (DE-1)  
 Steven F. Son (DE-6)  
 David M. Oswald (DE-6)  
 David E. Chavez (DE-1)  
 Darren L. Naud (DE-1)  
 U.S. Patent 7,141,675

Nanoporous metal foams are prepared by ignition of high nitrogen transition metal complexes. The ammonium salts of iron(III) tris[bi(tetrazolato)-amine], cobalt(III) tris[bi(tetrazolato)amine], and high nitrogen compounds of copper and silver were prepared as loose powders, pressed into pellets and wafers, and ignited under an inert atmosphere to form nanoporous metal foam monoliths having very high surface area and very low density.

## Flexible Composite Radiation Detector

David W. Cooke (MST-8)  
 Bryan L. Bennett (MST-8)  
 Ross E. Muenchausen (MST-8)  
 Debra A. Wroblewski (MST-7)  
 Edward B. Orler (MST-7)  
 U.S. Patent 7,145,149

A flexible composite scintillator was prepared by mixing fast, bright, dense, rare-earth doped powdered oxyorthosilicate (such as LSO:Ce, LSO:Sm, and GSO:Ce) scintillator

with a polymer binder. The binder is transparent to the scintillator emission. The composite is seamless and can be made large and in a wide variety of shapes. Importantly, the composite can be tailored to emit light in a spectral region that matches the optimum response of photomultipliers (about 400 nanometers) or photodiodes (about 600 nanometers), which maximizes the overall detector efficiency.

## Through-the-Earth Radio

David W. Reager (MPA-STC)  
 Jose Vasquez-Dominquez (MPA-STC)  
 U.S. Patent 7,149,472

A through-the-earth communication system that includes a digital signal input device; a transmitter operating at a predetermined frequency sufficiently low to effectively penetrate useful distances through-the-earth; a data compression circuit that is connected to an encoding processor; an amplifier that receives encoded output from the encoding processor for amplifying the output and transmitting the data to an antenna; and a receiver with an antenna, a band pass filter, a decoding processor, and a data decompressor.

## Nanocrystal Structures

Victor I. Klimov (C-PCS)  
 U.S. Patent 7,150,910

A structure including a grating and a semiconductor nanocrystal layer on the grating can be a laser. The semiconductor nanocrystal layer can include a plurality of semiconduc-

tor nanocrystals including a Group II VI compound, the nanocrystals being distributed in a metal oxide matrix. The grating can have a periodicity from 200 nm to 500 nm.

## Continuous Equal Channel Angular Pressing

Yuntian T. Zhu (MPA-STC)  
 Terry C. Lowe (CAO-AM)  
 U.S. Patent 7,152,448

An apparatus that continuously processes a metal workpiece without substantially altering its cross section includes a wheel member having an endless circumferential groove and a stationary constraint die that surrounds the wheel member, covers most of the length of the groove, and forms a passageway with the groove. The passageway has a rectangular shaped cross section. An abutment member projects from the die into the groove and blocks one end of the passageway. The wheel member rotates relative to the die in the direction toward the abutment member. An output channel in the die adjacent the abutment member has substantially the same cross section as the passageway. A metal workpiece is fed through an input channel into the passageway and carried in the groove by frictional drag in the direction towards the abutment member, and is extruded through the output channel without any substantial change in cross section.

## Magnetic Process for Removing Heavy Metals from Water Employing Magnetites

F. Coyne Prenger (AET-1)  
Dallas D. Hill (AET-1)  
U.S. Patent 7,153,435

A process for removing heavy metals from water is provided. The process includes the steps of introducing magnetite to a quantity of water containing heavy metal. The magnetite is mixed with the water such that at least a portion of, and preferably the majority of, the heavy metal in the water is bound to the magnetite. Once this occurs the magnetite and absorbed metal is removed from the water by application of a magnetic field. In most applications the process is achieved by flowing the water through a solid magnetized matrix, such as steel wool, such that the magnetite magnetically binds to the solid matrix. The magnetized matrix preferably has remnant magnetism, but may also be subject to an externally applied magnetic field. Once the magnetite and associated heavy metal is bound to the matrix, it can be removed and disposed of, such as by reverse water or air and water flow through the matrix. The magnetite may be formed *in situ* by the addition of the necessary quantities of Fe(II) and Fe(III) ions, or pre-formed magnetite may be added, or a combination of seed and *in situ* formation may be used. The invention also relates to an apparatus for performing the removal of

heavy metals from water using the process outlined above.

## Immunogenic Peptides Comprising a T-helper Epitope and a B-cell Neutralizing Antibody Epitope

Bette T. M. Korber (T-10)  
U.S. Patent 7,153,509

The present invention relates, generally, to a polyvalent immunogen and, more particularly, to a method of inducing neutralizing antibodies against HIV and to a polyvalent immunogen suitable for use in such a method.

## Nucleic Acid Sequence Detection Using Multiplexed Oligonucleotide PCR

John P. Nolan (B-5)  
P. Scott White (B-7)  
U.S. Patent 7,153,656

Methods for rapidly detecting single or multiple sequence alleles in a sample nucleic acid are described. Provided are all of the oligonucleotide pairs capable of annealing specifically to a target allele and discriminating among possible sequences thereof, and ligating to each other to form an oligonucleotide complex when a particular sequence feature is present (or, alternatively, absent) in the sample nucleic acid. The design of each oligonucleotide pair permits the subsequent high-level PCR amplification of a specific amplicon when the

oligonucleotide complex is formed but not when the oligonucleotide complex is not formed. The presence or absence of the specific amplicon is used to detect the allele. Detection of the specific amplicon may be achieved using a variety of methods well known in the art, including, without limitation, oligonucleotide capture onto DNA chips or microarrays, oligonucleotide capture onto beads or microspheres, electrophoresis, and mass spectrometry. Various labels and address-capture tags may be employed in the amplicon detection step of multiplexed assays, as further described herein.

## Method of Transferring a Thin Crystalline Semiconductor Layer

Michael A. Nastasi (MPA-CINT)  
Lin Shao (MPA-CINT)  
U.S. Patent 7,153,761

A method for transferring a thin semiconductor layer from one substrate to another substrate involves depositing a thin epitaxial monocrystalline semiconductor layer on a substrate having surface contaminants. An interface that includes the contaminants is formed in between the deposited layer and the substrate. Hydrogen atoms are introduced into the structure and allowed to diffuse to the interface. Afterward, the thin semiconductor layer is bonded to a second substrate and the thin layer is separated away at the interface, which results in transferring the thin epitaxial semiconductor layer from one substrate to the other substrate.

## Handheld Isotope Identification System

Christen M. Frankle (ISR-1)  
U.S. Patent 7,161,150

A portable radiation detector using a high-purity germanium crystal as the sensing device. The crystal is fabricated such that it exhibits a length to width ratio greater than 1:1 and is oriented within the detector to receive radiation along the width of said crystal. The crystal is located within a container pressurized with ultra-pure nitrogen, and the container is located within a cryostat under vacuum.

## Statistical Density Modification Using Local Pattern Matching

Thomas C. Terwilliger (B-9)  
U.S. Patent 7,167,808

A computer implemented method modifies an experimental electron density map. A set of selected known experimental and model electron density maps is provided and standard templates of electron density are created from the selected experimental and model electron density maps by clustering and averaging values of electron density in a spherical region about each point in a grid that defines each selected known experimental and model electron density maps. Histograms are also created from the selected experimental and model electron density maps that relate the value of electron density at the center of each of the spherical

regions to a correlation coefficient of a density surrounding each corresponding grid point in each one of the standard templates. The standard templates and the histograms are applied to grid points on the experimental electron density map to form new estimates of electron density at each grid point in the experimental electron density map.

## Off-axis Cooling of Rotating Devices Using a Crank-shaped Heat Pipe

Todd A. Jankowski (AET-1)  
F. Coyne Prenger (AET-1)  
Joseph A. Waynert (ESA-AET)  
U.S. Patent 7,168,480

The present invention is a crank-shaped heat pipe for cooling rotating machinery and a corresponding method of manufacture. The crank-shaped heat pipe comprises a sealed cylindrical tube with an enclosed inner wick structure. The crank-shaped heat pipe includes a condenser section, an adiabatic section, and an evaporator section. The crank-shape is defined by a first curve and a second curve existing in the evaporator section or the adiabatic section of the heat pipe. A working fluid within the heat pipe provides the heat transfer mechanism.

## Polyvalent Immunogen

Bette T. M. Korber (T-10)  
U.S. Patent 7,172,761

The present invention relates, generally, to a polyvalent immunogen and, more particularly, to a method of inducing neutralizing antibodies against HIV and to a polyvalent immunogen suitable for use in such a method.

## Early Leukemia Diagnostics Using Microsphere Arrays

John P. Nolan (B-5)  
Feng Zhou  
U.S. Patent 7,179,598

The present invention provides methods and kits for detecting chromosome translocations. The present invention further provides methods for diagnosing cancer.

## Methods for Sequencing GC-Rich and CCT Repeat DNA Templates

Donna L. Robinson (EES-6)  
U.S. Patent 7,179,602

The present invention is directed to a PCR-based method of cycle sequencing DNA and other polynucleotide sequences having high GC content and regions of high GC content, and includes for example DNA strands with a high Cytosine and/or Guanosine content and repeated motifs such as CCT repeats.

## Fabrication of Multilayered Thin Films via Spin-assembly

Jeanne M. Robinson (C-PCS)  
 Joanna L. Casson (C-PCS)  
 Malkiat S. Johal (C-PCS)  
 Hsing-Lin Wang (C-PCS)  
 U.S. Patent 7,179,679

A process of forming multilayer thin film heterostructures is disclosed and includes applying a solution including a first water-soluble polymer from the group of polyanionic species, polycationic species and uncharged polymer species onto a substrate to form a first coating layer on the substrate, drying the first coating layer on the substrate, applying a solution including a second water-soluble polymer from the group of polyanionic species, polycationic species and uncharged polymer species onto the substrate having the first coating layer to form a second coating layer on the first coating layer wherein the second water-soluble polymer is of a different material than the first water-soluble polymer, and drying the second coating layer on the first coating layer so as to form a bilayer structure on the substrate. Optionally, one or more additional applying and drying sequences can be repeated with a water-soluble polymer from the group of polyanionic species, polycationic species, and uncharged polymer species so that a predetermined plurality of layers are built up upon the substrate.

## Waveguide-based Optical Chemical Sensor

Karen M. Grace (ISR-4)  
 Basil I. Swanson (C-DO)  
 U.S. Patent 7,190,851

The invention provides an apparatus and method for highly selective and sensitive chemical sensing. Two modes of laser light are transmitted through a waveguide, refracted by a thin film host reagent coating on the waveguide, and analyzed in a phase sensitive detector for changes in effective refractive index. Sensor specificity is based on the particular species selective thin films of host reagents which are attached to the surface of the planar optical waveguide. The thin film of host reagents refracts laser light at different refractive indices according to what species are forming inclusion complexes with the host reagents.

## Polyvalent Immunogen

Bette T. M. Korber (T-10)  
 U.S. Patent 7,195,768

The present invention relates, generally, to a polyvalent immunogen and, more particularly, to a method of inducing neutralizing antibodies against HIV and to a polyvalent immunogen suitable for use in such a method.

## Quenching Methods for Background Reduction in Luminescence-based Probe-target Binding Assays

Hong Cai (B-7)  
 Peter M. Goodwin (MPA-CINT)  
 Richard A. Keller (B-9)  
 Rhiannon L. Nolan (B-5)  
 U.S. Patent 7,202,036

Background luminescence is reduced from a solution containing unbound luminescent probes, each having a first molecule that attaches to a target molecule and having an attached luminescent moiety and luminescent probe/target adducts. Quenching capture reagent molecules are formed that are capable of forming an adduct with the unbound luminescent probes and having an attached quencher material effective to quench luminescence of the luminescent moiety. The quencher material of the capture reagent molecules is added to a solution of the luminescent probe/target adducts and binds in a proximity to the luminescent moiety of the unbound luminescent probes to quench luminescence from the luminescent moiety when the luminescent moiety is exposed to exciting illumination. The quencher capture reagent does not bind to probe molecules that are bound to target molecules and the probe/target adduct emission is not quenched.

## Electrodes for Solid State Gas Sensor

Rangachary Mukundan (MPA-11)  
Eric L. Broscha (MPA-11)  
Fernando Garzon (MPA-11)  
U.S. Patent 7,214,333

A mixed potential electrochemical sensor for the detection of gases has a ceria-based electrolyte with a surface for exposing to the gases to be detected, and with a reference wire electrode and a sensing wire electrode extending through the surface and fixed within the electrolyte as the electrolyte is compressed and sintered. The electrochemical sensor is formed by placing a wire reference electrode and a wire sensing electrode in a die, where each electrode has a first compressed planar section and a second section depending from the first section with the second section of each electrode extending axially within the die. The die is filled with an oxide-electrolyte powder and the powder is pressed within the die with the wire electrodes. The wire-electrodes and the pressed oxide-electrolyte powder are sintered to form a ceramic electrolyte base with a reference wire electrode and a sensing wire electrode depending therefrom.

## High Specific Power, Direct Methanol Fuel Cell Stack

John C. Ramsey (P-25)  
Mahlon S. Wilson (MPA-11)  
U.S. Patent 7,214,442

The present invention is a fuel cell stack including at least one direct methanol fuel cell. A cathode manifold is used to convey ambient air to each fuel cell, and an anode manifold is used to convey liquid methanol fuel to each fuel cell. Tie-bolt penetrations and tie-bolts are spaced evenly around the perimeter to hold the fuel cell stack together. Each fuel cell uses two graphite-based plates. One plate includes a cathode active area that is defined by serpentine channels connecting the inlet manifold with an integral flow restrictor to the outlet manifold. The other plate includes an anode active area defined by serpentine channels connecting the inlet and outlet of the anode manifold. Located between the two plates is the fuel cell active region.

## Apparatus and Method for Hydrogen and Oxygen Mass Spectrometry of the Terrestrial Magnetosphere

Herbert O. Funsten (ISR-DO)  
Eric E. Dors (ISR-1)  
Ronnie W. Harper (ISR-1)  
U.S. Patent 7,217,918

A detector element for mass spectrometry of a flux of heavy and light ions, that includes: a first detector to detect light ions that transit through

a foil operatively placed in front of the first detector, and a second detector that detects the flux of heavy and light ions.

## Spray Shadowing for Stress Relief and Mechanical Locking in Thick Protective Coatings

Kendall Hollis (MST-6)  
Brian Bartram (DE-9)  
U.S. Patent 7,220,458

A method for applying a protective coating on an article, comprising the following steps: selecting an article with a surface for applying a coating thickness; creating undercut grooves on the article, where the grooves depend beneath the surface to a bottom portion with the grooves having an upper width on the surface and a lower width on the bottom portion connected by side walls, where at least one of the side walls connects the upper width and the lower width to form an undercut angle with the surface less than 90°; and, applying the protective coating onto the article to fill the undercut grooves and cover the surface, thereby forming weak paths within the protective coating.

## Gold-coated Nanoparticles for Use in Biotechnology Applications

Douglas E. Berning (N-2)  
Robert H. Kraus, Jr. (LDRD-PO)  
Robert W. Atcher (B-DO)  
Jurgen G. Schmidt (B-9)  
U.S. Patent 7,226,636

A process of preparing gold-coated magnetic nanoparticles is disclosed and includes forming a suspension of magnetic nanoparticles within a suitable liquid, adding an amount of a reducible gold compound and a reducing agent to the suspension, and, maintaining the suspension for time sufficient to form gold-coated magnetic nanoparticles.

## Nanocrystal/Sol-gel Nanocomposites

Melissa A. Petruska (C-PCS)  
Victor L. Klimov (C-PCS)  
U.S. Patent 7,226,953

The present invention is directed to solid composites including colloidal nanocrystals within a sol-gel host or matrix and to processes of forming such solid composites. The present invention is further directed to alcohol soluble colloidal nanocrystals useful in formation of sol-gel based solid composites.

## Noninvasive Characterization of a Flowing Multiphase Fluid Using Ultrasonic Interferometry

Dipen N. Sinha (MPA-11)  
U.S. Patent 7,228,740

An apparatus for noninvasively monitoring the flow and/or the composition of a flowing liquid using ultrasound is described. The position of the resonance peaks for a fluid excited by a swept-frequency ultrasonic signal have been found to change frequency both in response to a change in composition and in response to a change in the flow velocity thereof. Additionally, the distance between successive resonance peaks does not change as a function of flow, but rather in response to a change in composition. Thus, a measurement of both parameters (resonance position and resonance spacing), once calibrated, permits the simultaneous determination of flow rate and composition using the apparatus and method of the present invention.

## Environmental Continuous Air Monitor Inlet with Combined Preseparator and Virtual Impactor

John C. Rodgers (HSR-4)  
U.S. Patent 7,232,477

An inlet for an environmental air monitor is described wherein a preseparator interfaces with ambient environment air and removes debris

and insects commonly associated with high wind outdoors and a deflector plate in communication with incoming air from the preseparator stage that directs the air radially and downward uniformly into a plurality of accelerator jets located in a manifold of a virtual impactor, the manifold being cylindrical and having a top, a base, and a wall, with the plurality of accelerator jets being located in the top of the manifold and receiving the directed air and accelerating directed air, thereby creating jets of air penetrating into the manifold, where a major flow is deflected to the walls of the manifold and extracted through ports in the walls. A plurality of receiver nozzles are located in the base of the manifold coaxial with the accelerator jets, and a plurality of matching flow restrictor elements are located in the plurality of receiver nozzles for balancing and equalizing the total minor flow among all the plurality of receiver nozzles, through which a lower, fractional flow extracts large particle constituents of the air for collection on a sample filter after passing through the plurality of receiver nozzles and the plurality of matching flow restrictor elements.

## Bioassay and Biomolecular Identification, Sorting, and Collection Methods using Magnetic Microspheres

Robert H. Kraus, Jr. (LDRD-PO)  
Feng Zhou  
John P. Nolan (B-5)  
U.S. Patent 7,232,691

The present invention is directed to processes of separating, analyzing and/or collecting selected species within a target sample by use of magnetic microspheres including magnetic particles, the magnetic microspheres adapted for attachment to a receptor agent that can subsequently bind to selected species within the target sample. The magnetic microspheres can be sorted into a number of distinct populations, each population with a specific range of magnetic moments and different receptor agents can be attached to each distinct population of magnetic microsphere.

## Method and Apparatus for Detecting Chemical Binding

Benjamin P. Warner (MPA-MC)  
George J. Havrilla (C-CSE)  
Thomasin C. Miller (C-ACS)  
Cyndi A. Wells (IAT-1)  
U.S. Patent 7,241,381

The method for screening binding between a target binder and potential pharmaceutical chemicals involves sending a solution (preferably an aqueous solution) of the target binder through a conduit to a size exclusion filter, the tar-

get binder being too large to pass through the size exclusion filter, and then sending a solution of one or more potential pharmaceutical chemicals (preferably an aqueous solution) through the same conduit to the size exclusion filter after target binder has collected on the filter. The potential pharmaceutical chemicals are small enough to pass through the filter. Afterwards, x-rays are sent from an x-ray source to the size exclusion filter, and if the potential pharmaceutical chemicals form a complex with the target binder, the complex produces an x-ray fluorescence signal having an intensity that indicates that a complex has formed.

## RF Transmission Line and Drill/Pipe String Switching Technology for Down-hole Telemetry

David D. Clark (P-23)  
Don M. Coates  
U.S. Patent 7,256,707

A modulated reflectance well telemetry apparatus having an electrically conductive pipe extending from above a surface to a point below the surface inside a casing. An electrical conductor is located at a position a distance from the electrically conductive pipe and extending from above the surface to a point below the surface. Modulated reflectance apparatus is located below the surface for modulating well data into a RF carrier transmitted from the surface and reflecting the modu-

lated carrier back to the surface. A RF transceiver is located at the surface and is connected between the electrically conductive pipe and the electrical conductor for transmitting a RF signal that is confined between the electrically conductive well pipe and the electrical conductor to the modulated reflectance apparatus, and for receiving reflected data on the well from the modulated reflectance apparatus.

## High Rate Buffer Layer for IBAD MgO Coated Conductors

Stephen R. Foltyn (MPA-STC)  
Quanxi Jia (MPA-STC)  
Paul N. Arendt (MPA-STC)  
U.S. Patent 7,258,927

Articles are provided including a base substrate having a layer of an oriented material Thereon, and, a layer of hafnium oxide upon the layer of an oriented material. The layer of hafnium oxide can further include a secondary oxide such as cerium oxide, yttrium oxide, lanthanum oxide, scandium oxide, calcium oxide and magnesium oxide. Such articles can further include thin films of high temperature superconductive oxides such as YBCO upon the layer of hafnium oxide or layer of hafnium oxide and secondary oxide.



## Multifunctional Nanocrystals

Victor I. Klimov (C-PCS)  
Jennifer A. Hollingsworth (C-PCS)  
Scott A. Crooker (MPA-NHMFL)  
Hyungrak Kim (C-PCS)  
U.S. Patent 7,261,940

Multifunctional nanocomposites are provided including a core of either a magnetic material or an inorganic semiconductor, and, a shell of either a magnetic material or an inorganic semiconductor, wherein the core and the shell are of differing materials, such multifunctional nanocomposites having multifunctional properties including magnetic properties from the magnetic material and optical properties from the inorganic semiconductor material. Various applications of such multifunctional nanocomposites are also provided.

## Oxygen Detection Using Evanescent Fields

Yixiang Duan (C-CSE)  
Weenqing Cao (MPA-STC)  
U.S. Patent 7,263,246

An apparatus and method for the detection of oxygen using optical fiber based evanescent light absorption. Methylene blue was immobilized using a sol-gel process on a portion of the exterior surface of an optical fiber for which the cladding has been removed, thereby forming an optical oxygen sensor. When light is directed through the optical fiber, transmitted light intensity varies as a result of changes in the absorption of evanescent light by

the methylene blue in response to the oxygen concentration to which the sensor is exposed. The sensor was found to have a linear response to oxygen concentration on a semi-logarithmic scale within the oxygen concentration range between 0.6% and 20.9%, a response time and a recovery time of about 3 s, and to exhibit good reversibility and repeatability. An increase in temperature from 21°C to 35°C does not affect the net absorption of the sensor.

## Thin Film Mixed Potential Sensors

Fernando H. Garzon (MPA-11)  
Eric L. Brosha (MPA-11)  
Rangachary Mukundan (MPA-11)  
U.S. Patent 7,264,700

A mixed potential sensor for oxidizable or reducible gases and a method of making. A substrate is provided and two electrodes are formed on a first surface of the substrate, each electrode being formed of a different catalytic material selected to produce a differential voltage between the electrodes from electrochemical reactions of the gases catalyzed by the electrode materials. An electrolytic layer of an electrolyte is formed over the electrodes to cover a first portion of the electrodes from direct exposure to the gases with a second portion of the electrodes uncovered for direct exposure to the gases.

## Directed Evolution Methods for Improving Polypeptide Folding and Solubility and Superfolder Fluorescent Proteins Generated Thereby

Geoffrey S. Waldo (B-9)  
U.S. Patent 7,271,241

The current invention provides methods of improving folding of polypeptides using a poorly folding domain as a component of a fusion protein comprising the poorly folding domain and a polypeptide of interest to be improved. The invention also provides novel green fluorescent proteins (GFPs) and red fluorescent proteins that have enhanced folding properties.

## Copyrights Asserted in Fiscal Year 2007

### Blackbox, Version 1.0

Johan Bollen (STBPO-RL)  
Herbert Van De Sompel (STBPO-RL)

Digital library usage logs are a highly valuable source of information that can be exploited for science-support services on the level of local institutions and the global scientific community. The Blackbox project has developed as standards-based architecture for the recording, storage, and distribution of digital library usage logs. Local usage events are recorded by OpenURL, enable linking servers (such as the SFX Link Resolver), and are stored as ContextObjects, which are then serialized as XML objects. The latter can then be locally exposed and centrally harvested by means of the Open Archives Initiative Protocol for Metadata Harvesting. A set of analysis mechanisms and services have been developed to make use of both local and aggregated logs, such as a software to rank items according to their scientific impact and a system to generate document recommendations.

### EpiCast, Version 1.0

Timothy Clark Germann (T-12)

The EpiCast software models infectious disease spread throughout a spatially distributed population of individuals, each of whom belongs to a variety of contact (mixing) groups in which person-to-person transmission may occur (e.g., household, school, workplace, daycare, neighborhood, etc., as appropri-

ate for each individual's age and employment status). The time-step resolution of the model is 12 hours, so each individual has a set of daytime and nighttime contact groups, which may be geographically separated (particularly for working adults who commute). In addition, people may take occasional random long-distance trips with specified frequency, destination choice, and trip duration algorithms. The output typically consists of daily or half-daily files with the current and cumulative number of symptomatic individuals in each geographic location, typically a U.S. Census tract, and various population-wide data on the numbers of incubating and asymptomatic individuals, the number of affected locations, usage of vaccines or antiviral drugs, and so forth. The model runs on either serial or parallel computers, enabling simulations of populations with arbitrary numbers of individuals (280 million people are routinely used in U.S. studies, utilizing 100–500 processors).

The EpiCast software may be utilized in planning for potential pandemic outbreaks of influenza or other infectious diseases. This includes but is not limited to: risk assessment (potential medical manpower, and infrastructure costs), resource prioritization, development and assessment of mitigation strategies, and as a real-time tabletop exercise simulation model. More broadly, the underlying agent-based model may be adapted

to other applications such as “social-epidemics,” including the spread of fashion trends.

## LED Tree

Terrence F. Bott (D-5)

Stephen Ward Eisenhower (D-5)

This computer program allows the user to construct logic gate trees using a graphical interface. A hyperlink capability is provided.

## Tailorable Rapid Acquisition and Visualization Software (TRAViS), Version 1.0 (formerly known as ORCA PC)

Mark Naivar (B-9)

The TRAViS software runs on a desktop computer, and the C++ code has been designed to run on Windows, Mac, or Linux computers. The software communicates with the acquisition hardware to set up and acquire data from a flow cytometer. The software has basic acquisition and analysis capabilities including: real-time data displays with stats, real-time gating, a virtual scope to display the raw captured waveforms from any detector, persistent and named instrument settings with the ability to save data in FCS 3.0 Format. The list mode data files are compatible with a number of commercial analysis packages. The code currently compiles without modification for all three supported platforms, but the Windows version does not implement the FireWire interface and therefore cannot talk to the acquisi-

tion hardware. The code is modular and uses a hardware abstraction layer to allow either the acquisition hardware or the communication protocol to easily be changed.

## MPI-FTW, Version 1.0

Gary Grider (HPC-DO)

Alfred Torrez (HPC-1)

MPI-File Tree Walk (MPI-FTW) navigates a directory tree by dynamically allocating processes when new directories are found. When a process completes a walk through a directory (no more subdirectories), the process is flagged as not busy. That process is then free to walk a new directory encountered by another process. Commands can be executed at each new directory found. Upon completion, file and directory counts as well as time to complete are reported.

## gfortran2xml, Version 0.6

Craig E Rasmussen (CCS-1)

Christopher Douglas Rickett (CCS-1)

Matthew Joseph Sottile (CCS-2)

The software tool, gfortran2xml, creates an XML representation of a parse tree created by the GNU Fortran Compiler. The XML output file describes Fortran interfaces (procedure names and associated parameters and return values). gfortran2xml is useful for projects that perform static analysis to modify existing Fortran source files. For example, from information in the XML output files, tools can automatically insert performance monitoring calls to aid in improving the speed of paral-

lel applications. gfortran2xml is used in projects that generate code for Fortran and C/C++ language interoperability.

## ROMPIO, Version 1.0.0

Stephen W. Hodson (HPC-5)

ROMPIO, Version 1.0.0 is software designed to measure MPI collective, independent, asynchronous, and POSIX file I/O performance, synthesizing how applications utilize file systems in the LANL ASC computing environment. File layouts include N processors to N files and N processors to 1 file. Write access patterns include non-strided and strided. Network performance measurements can also be obtained for relevant MPI collective calls.

## Miniature Cytometric Acquisition System (MiCAS DSP), Version 1.0

Mark Naivar (B-9)

We have created a capable yet inexpensive and low power single-chip acquisition system for flow cytometric applications. Using a commercial DSP chip from Texas Instrumentals (TMS320F2808), we acquire continuous data from up to four analog detectors using the integrated ADC, as well as up to two digital photon-counting detectors. The DSP firmware detects the events (pulses) in the raw data streams, processes the raw waveforms of interest into correlated peak and area measurements, and sends the list mode

data over an RS-232 port to a host computer for display, analysis, and storage. The firmware has been optimized so the ADC can be run at full speed, which allows pulse widths as small as 2.5 $\mu$ Sec to be measured from a single detector, or 10  $\mu$ sec pulse widths when acquiring from 4 detectors simultaneously. The system can be easily scaled by adding more chips and/or changing the number of detectors each chip handles.

### **Open Reconfigurable Cytometric Acquisition System (ORCAS DSP), Version 1.0**

Mark Naivar (B-9)

The ORCA DSP firmware runs on a commercial embedded DSP board. It is written in C++ and uses no operating system or task scheduling software. The firmware is responsible for collecting raw data from one or more custom electronic boards, processing the data into list mode parameters, and sending the processed results to a host computer over the IEEE 1394 (FireWire) interface. Parts of the code are highly optimized because the performance directly impacts the maximum throughput of the system. The code also implements the communication protocol for the host to send commands and get status from the DSP board.

### **Rational Vaccine Design Code, Version 1.0**

Tanmoy Bhattacharya (T-08)  
William Mclean Fischer (T-10)  
Simon John Perkins (IRS-2)  
James Theiler (ISR-2)

The Rational Vaccine Design Code is a set of software utilities written in C++ and Perl that assist with the task of finding one or more sequences of amino acids that maximally match amino acid sequences and can then, potentially, be used as the basis for synthetic vaccines that provide better cross protection against HIV than vaccines made from natural virus strains.

### **EEG Boundary Elements Toolbox, Version 0.1**

Sergey M. Plis (P-21)

The toolbox provides an opportunity to perform forward calculations for EEG. Several available approaches described in the literature are implemented. Dual layer approach is represented in four modifications that vary in the implementation and running time complexity and the accuracy of the results. A symmetric BEM approach is also implemented. The toolbox can be used to calculate stiffness matrices that can later be used to calculate the final potential distribution.

### **SAMRSolvers, Version 0.1**

Michael Pernice (CCS-3)  
Bobby Philip (T-07)

SAMRSolvers is a collection of multilevel solvers for systems of linear equations that result from finite volume discretization of an elliptic partial differential equation on a block-structured (or patch-based) locally refined grid. SAMRSolvers provides implementations of the Fast Adaptive Composite grid (FAC) method, Asynchronous Fast Adaptive Composite grid (AFAC) method, and the AFACx method, which is a less expensive version of AFAC that smooths the error instead of solving for it on all but the coarsest level. These methods can be shown to converge at rates that are independent of the number of refinement levels. SAMRSolvers is intended for use with SAMRAI v2.0 and requires the SAMRUtilities package, also available from the same authors.

### **SAMRUtilities, Version 0.1**

Michael Pernice (CCS-3)  
Bobby Philip (T-07)

SAMRUtilities is a collection of utilities that we have found to be useful for certain operations required on block-structured (or patch-based) locally refined grids. SAMRUtilities provides a high-level means to represent the structure of the boundaries of refinement levels—so-called coarse/fine interfaces, since these are the locations where local resolution changes. At these

interfaces, coarse grid information often must be interpolated to finer resolution, and SAMRUtilities also provides methods to interpolate independently in directions tangential and normal to the coarse/fine interface. Implementations of several higher-order interpolation schemes for transferring information interior to a patch are also provided.

### **Muon Tomography Reconstruction and Analysis Code (MURAD)**

Michael J. Sossong (X-1-TA)

The software is an implementation of an analysis framework to aid in the analysis of muon scattering data. Within this analysis framework, an EM algorithm to find maximum likelihood scattering density solution to a muon-scattering dataset is implemented. Other functionality includes muon trajectory reconstruction, voxel reconstruction visualization and file I/O.

### **Muon Tomography Vehicle Scanner Simulation Suite**

Michael J. Sossong (X-1-TA)

This is an implementation of the GEANT4 toolkit to simulate the performance of a vehicle scanner to search for SNM in passenger vehicles. The software performs physics simulations to be used in evaluating the performance of a vehicle scanner. The software contains original work including detector design, a muon-source generator, and vehicle and scene designs.

### **Truchas, Version 2.2**

Juan Carlos Ramirez (MST-8)  
 Marius Stan (CCS-2)  
 Yunghee Kang (CCS-2)  
 Michael Lynn Hall (CCS-2)  
 Edward Dwight Dendy (X-3)  
 Sharen Jane Cummins (CCS-2)  
 Lawrence James Cox (CCS-DO)  
 Mark A. Christon (CCS-2)  
 Neil N. Carlson (CCS-2)  
 Markus Berndt (T-07)  
 Travis Mitchell Austin (T-07)  
 Robert M. Aikin (MST-6)  
 Matthew Wayne Williams (X-1-TA)  
 John Alexander Turner (CCS-2)

Truchas is software for simulating casting processes currently in use in LANL and industrial foundries. Truchas could be used to simulate castings on scales from dental fillings to engine blocks to large mining equipment because of the breadth and generality of the physical models Truchas embodies to simulate these processes. However, it is also a very general engineering analysis tool for a wide variety of industrial and natural phenomena. Truchas is written in Fortran 90, primarily for high-performance parallel computing platforms, but the software is portable to any platform possessing a modern Fortran 90 compiler (including PCs). The Truchas software targets simulating the entire casting process, beginning with the preheat of mold materials by electromagnetic induction, free surface flow of a molten alloy being poured into a mold, followed by the rapid initial cooling and solidification of that alloy, ending with the

slower cooling of the solidified part down to room temperature.

Truchas has realistic physical models for electromagnetic radiation, alloy solidification and resulting micro/macro segregation phenomena, free surface incompressible flow heat, heat transfer, complex three-dimensional geometric effects microstructural nucleation and evolution, surface tension, solid/solid phase transition effects, and residual stress buildup and response. Truchas can be viewed as a tool useful for foundry people in understanding, Truchas can also aid in the design of improved casting processes which lead to cast metal alloy parts which meet microstructural, geometrical, and property specifications. This software can also be useful in simulating any physical process where incompressible fluid flow, convective/conductive heat transfer, solid/solid phase change, and thermoelastic material response take place.

### **SIF C I/O Library**

Damian R. Eads (ISR-2)

The Sparse Image Format (SIF) is a file format for storing sparse raster images. It works by breaking an image down into tiles. Space is saved by only storing tiles that are non-uniform, (i.e., tiles with two different pixel values). If a tile is completely uniform, its common pixel value is stored instead of the complete tile raster. A C library is provided to manipulate files in SIF format.

## Cohesive Zone Model User Element (CZM UEL), Version 1.0

Trevor Bair Tippetts (WT-2)

Cohesive Zone Model User Element (CZM UEL) is an implementation of a Cohesive Zone Model as an element for use in finite element fracture simulations.

## Tracked Vehicle, Revision 75

Eric Y. Raby (ISR-3)

Revision 75 of the tracked vehicle software, based on tank 57 is a soft real-time simulation of differentially steered, tracked mobile robot, which, because of the track flippers, resembles the iRobot PackBot. Open source libraries are used for the physics engine, the display and user interface, and the program command line and configuration file parameters. The simulation can be controlled by a USB joystick or the keyboard. The configuration file contains demonstration model parameters of no particular vehicle. The simulation can be used as a starting point for those doing tracked vehicle simulations.

## SampleCollector, Version 1.0

Craig Blackhart (AET-5)

This software provides a Graphical User Interface (GUI) to enable the user of Multi-Purpose Sampling Device to interface and record information. The software manages collection of data from the multitude of hardware components in the gun.

## Gazebo, Version 1.0

Craig Warne Idler (HPC-5)  
Richard Alan Light (HPC-5)

Gazebo is a suite of software components used to test, monitor, and analyze the health of a supercomputer. The goal is to minimize the time it takes to find problems.

Gazebo is designed to be modular with many individual parts contributing to the whole. Current components include:

- Web-based test execution and test run output analysis package
- Cluster-resident test execution package
- Server/client communication package
- Acceptance testing package
- Hooks in place for future expansion—viewing and analysis of hardware monitoring data; and statistical analysis of test run results and execution times.

## Genie Pro, Version 2.0

Steven Brumby (ISR-2)  
Damian R. Eads (ISR-2)  
Kimberley Edlund (ISR-2)  
Diana M. Esch-mosher (ISR-3)  
Mark Galassi (ISR-1)  
Neal Harvey (ISR-2)  
Simon John Perkins (ISR-2)  
Reid B. Porter (ISR-2)  
James Theiler (ISR-2)

Genie Pro is a general purpose interactive adaptive tool for automatically labeling regions and finding objects in large amounts of image data. Genie Pro was origi-

nally developed for analyzing multispectral satellite data and has been applied to panchromatic (grayscale) and hyperspectral satellite data, aerial imagery, and various kinds of ground-based camera (including frames from video imagery) and biomedical imagery. Applications for Genie Pro include:

- Terrain-type mapping, including agricultural crops and natural vegetation;
- Road, rail, and river network mapping;
- Broad area search for vehicles and buildings;
- Cancer identification in histological images.

## PFLOTRAN, Version 1.0

Glenn Edward Hammond (EES-6)  
Peter C. Lichtner (EES-6)  
Chuan Lu (EES-6)  
Richard T. Mills (EES-6)

Pflotran is a massively parallel, multiphase, multicomponent, reactive flow and transport code. Parallelization is based on domain decomposition achieved through the use of the PETSc parallel libraries (Portable Extensible Toolkit for Scientific Computing developed at Argonne National Laboratory [ANL]). Pflotran is being used to model CO<sub>2</sub> sequestration, plutonium migration at the Nevada Test Site, uranium migration at the Hanford DOE facility, an many other applications to groundwater contaminant migration under partially saturated, nonisothermal conditions.

**SEL, Version 1.0**

Alan Herbert Glasser (T-15)

SEL is an advanced 2-dimensional fluid simulation code with the following principal features: spatial discretization, harmonic grid generation, time discretization, static condensation, flux-source form. It is extensively tested and verified and it is efficiently operated on massively parallel distributed computers.

**MESA2D, Version 8.0**

Sean Patrick Clancy (X-3)

Wayne N. Weseloh (X-4)

MESA2D is a two-dimensional (Cartesian and Cylindrical) Eulerian hydrodynamics code with high explosives and material strength models. Among special features of MESA2D are its high-order advection algorithm, its material interface tracking scheme and van Leer monotonic advection-limiting.

**LANL/Sandia DNS Code**

Mark Alan Taylor (SNL-ASCI)

Beth Ann Wingate (CCS-2)

This code solves the 3D and 2D incompressible Navier-Stokes equations and the Boussinesq equations in a periodic domain. The code is used for Direct Numerical Simulation (DNS) of idealized flow such as decaying homogeneous isotropic turbulence.

**Patch for CNS**

Paul Alfred Langan (B-8)

Marat Mustyakimov (B-8)

CNS or Crystallography and NMR System (<http://cns.csb.yale.edu/v1.1/>) is software that was developed for protein crystal structure determination. CNS has a hierarchical structure: a high-level hypertext markup language (HTML) user interface, task-oriented user input files, module files, a symbolic structure determination language (CNS language), and low-level Fortran source code. The CNS language is sufficiently powerful and flexible that new algorithms can be implemented and tested without changes to the low-level source code. CNS was designed so it could be easily adapted by the general scientific community.

**General Spectral Modeling (GSM), Version 1.1**

Justin R Oelgoetz (X-1-NAD)

GSM is a general atomic kinetics code for the calculation of emission spectra, developed as part of a Ph.D. thesis at Ohio State University and extended here at LANL. Details of the theory, approximations, and methodologies it uses can be found in LA-UR-06-4569 (part of Justin Oelgoetz's Ph.D. Dissertation). Its capabilities include the solving of the atomic kinetics rate equations, calculating emission spectra, and performing basic analysis on these calculations. Extensions in version 1.1 include faster methods, new

input/output routines, ability to more intelligently extrapolate input data and some improvements to certain numerical methods that aid in accurately solving large systems.

**IDL Routines**

Cindy R. Christensen (NSTEC)

Interactive Data Language (IDL) procedures used for interpretation of highly time resolved signals. IDL is used to deconvolute detector signals to remove the instrumental response.

**N-sim, Version 0.9**

Sean M. Brennan (ISR-3)

N-sim is an emulation/simulation engine for studying and developing wireless sensor networks. Wireless sensor networks are typically composed of small detecting, computing, and communicating platforms cooperatively monitoring a given environment *in situ*. N-sim allows software developers to program and test these programs' platforms more easily, and researchers to virtualize experiments before going out into the field. Utilizing new virtualization technologies, N-sim emulates the computational portion of a sensor platform, simulates the wireless communication portion, and allows for plug-in modules to simulate source propagation and the detection capabilities of an *in-situ* sensor platform. With enough standard scientific computing resources, N-sim can emulate networks at large scales, which are problematic in the field.

## **Thermonucleotide BLAST**

Jason David Gans (B-7)

ThermonucleotideBLAST is a software program for searching a target database of nucleic acid sequences using an assay specific query.

## **Ciao Peer-to-Peer Blackboard Module**

Sean M. Brennan (ISR-3)

Ciao Peer-to-Peer Blackboard Module is a fault-tolerant blackboard communication module for clustered computers. Facilitates distributed blackboard computations where each process has its own copy of the data posting space. It is for use with the Ciao Prolog system.



## Fiscal Year 2007 License Income Recipients

### Alvarez, Marc (B-8)

*Synthesis of [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}_2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfones and Sulfoxides*

*Synthesis of [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}_2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfides*

*Synthesis of Labelled Oxalic Acid Derivatives*

*Synthesis of Isotopically Labeled D or L [ $^{13}\text{C}$ ,  $^2\text{H}$ ] Glycerols*

*Synthesis of  $^2\text{H}$ - and  $^{13}\text{C}$ -Substituted Dithanes*

### Arendt, Paul (MPA-STC)

*Improved Buffer Layer Compound for Coated Conductors*

*Substrates Structure for Growth of Highly Oriented and/or Epitaxial Layers Thereon*

*Architecture for Coated Conductors*

*High-Rate Buffer Layer for IBAD MgO Coated Conductors*

*Coated Conductors*

*Use of High Current Density Electropolishing for the Preparation of Very Smooth Substrate Tapes for Coated Conductor Applications*

### Asay, Blaine (DE-6)

*Lead-Free Electric Match Compositions*

### Audia, Jeffrey (N-1)

*1K ADC Unattended Monitoring firmware (actual name of firmware program is MINIADC)*

### Backhaus, Scott (MPA-10)

*Traveling-Wave Device with Mass Flux Suppression*

*Cascaded Thermoacoustic Devices*

*Circulating Heat Exchangers for Oscillating-Wave Engines and Refrigerators*

### Bai, Ying (N)

*MiniGrand Family of Software*

### Barbe, Michael (MST-6)

*Laser Production of Articles from Powders*

### Billen, James (LANSCE)

*Phase and Radial Motion in Electron Linear Accelerators (PARMELA), Version 3.0*

*Phase and Radial Motion in Ion Linear Accelerators (PARMELA)*

### Bollen, Johan (STBPO-RL)

*Blackbox, Version 1.0*

*Usage Based Indicators to Assess the Impact of Scholarly*

### Bott, Terrence (D-5)

*LED Tree*

### Bouret, Steven (N-1)

*MiniGrand Family of Software*

*Cosmic-Ray Neutron Background Reduction Using Localized Coincidence Veto Neutron Counting*

### Bowles, Jeffrey (N)

*MiniGrand Family of Software*

### Bradbury, Andrew (B-9)

*An Antibody Recognizing Sulfation as a Post-translational Modification*

### Bradley, Johnathan (CCS)

*Storage and Retrieval of Large Digital Images*

### Briles, Scott (N)

*Identification Coding Schemes for Modulated Reflectance*

*Long-Range, Full Duplex, Modulated-Reflector Cell Phone for Voice/Data Transmission*

### Brockway, Dennis (D)

*Graphical Input Aggregate Control (GIAC)*

### Bronisz, Lawrence (IAT-2)

*Use of High Current Density Electropolishing for the Preparation of Very Smooth Substrate Tapes for Coated Conductor Applications*

### Brown, Donald (EES-11)

*Geothermal Energy Production with Supercritical Fluids*

### Brunson, Glen (N-2)

*MiniGrand Family of Software*

### Burrell, Anthony (MPA-MC)

*Fluorescent Beryllium Detection*

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

*Electrolytes for Electrooptic Devices  
Comprising Ionic Liquids  
Polymer-Assisted Deposition of Films  
Extension to MXRF IP Portfolio  
Reversible Electro-Optic Device Employ-  
ing Aprotic Molten Salts and Method  
Electrochromic, Salts, Solutions and  
Devices*

**Busick, Deanna (MPA-11)**  
*Composite Bipolar Plate for Electro-  
chemical Cells*

**Busse, James (C-ADI)**  
*Lead-Free Electric Match Compositions*

**Cabantous, Stephanie (B-9)**  
*Self-Assembling Split-Fluorescent Pro-  
tein Systems  
Circular Permutant GFP Insertion Fold-  
ing Reporters  
Protein Subcellular Localization Assays  
Using Split Protein-Protein Interac-  
tion Detection System*

**Cai, Hong (B-7)**  
*DNA Base Mismatch Detection Using  
Flow Cytometry  
DNA Polymorphism Identity Determina-  
tion Using Flow Cytometry*

**Cannon, T. Michael (CCS-3)**  
*Quality Assessment, Restoration and  
oCr. (QUARC)*

**Carey, James (EES-6)**  
*Detection of Alkali-Silica Reaction Swell-  
ing in Concrete by Staining  
Detection of Concrete Deterioration by  
Staining*

**Chen, Liaohai (B)**  
*Method for Detecting Biological Agents*

**Clark, David (P-23)**  
*Identification Coding Schemes for Modu-  
lated Reflectance*

**Coates, Don (PA/ P-DO)**  
*Identification Coding Schemes for Modu-  
lated Reflectance  
Fuel Injector Utilizing Plasma Activation  
Long-Range, Full Duplex, Modulated-  
Reflector Cell Phone for Voice/Data  
Transmission*

**Cole, Dean (B)**  
*Method of Using 5, 10, 15, 20-Tetrakis(4-  
Carboxyphenyl) Porphine*

**Collins, Michael (N-4)**  
*Hybrid K-Edge/X-Ray Fluorescence  
Densitometer (HKED), Version 3.X*

**Coulter, J. Yates (MPA-STC)**  
*Apparatus for Measurement of Critical  
Current in Superconductive Tapes*

**Cremers, David (MPA)**  
*Laser Production of Articles from Powders*

**Davey, John (MPA-11)**  
*Catalyst Inks and Method of Application  
for Direct Methanol Fuel Cells*

**Dearing, James (D)**  
*Graphical Input Aggregate Control  
(GIAC)*

**Depaula, Raymond (MPA-STC)**  
*Arrays of Long Carbon Nanotubes for  
Fiber Spinning  
Apparatus for Measurement of Critical  
Current in Superconductive Tapes*

**Dixon, Raymond (MST-6)**  
*Controlled Laser Production of Elongated  
Articles from Particulates*

**Dreiskott, Sascha (MPA)**  
*Use of High Current Density Electropol-  
ishing for the Preparation of Very  
Smooth Substrate Tapes for Coated  
Conductor Applications*

**Driscoll, Judith (MPA-STC)**  
*Enhanced Pinning in Mixed Rare  
Earth-123 Films*

**Dziewinski, Jacek (WCM-4)**  
*Nitrate Reduction  
Electrochemical Reduction of Nitrate in  
the Presence of an Amide*

**Ehler, Deborah (C-SIC)**  
*Fluorescent Beryllium Detection  
Water-Soluble Polymers for Recovery of  
Metals from Solids  
Process for the Displacement of Cyanide  
Ions from Metal-Cyanide Complexes*

**Eisenhower, S.W. (D-5)**  
*LED Tree*

**Estep, Robert (N-2)**  
*MiniGrand Family of Software*

**Ferreri, Vincent (P-24)**  
*Field Enhanced Electrodes for Additive  
Injection Non-thermal Plasma (NTP)  
Processor*

**Fisk, Michael (ACS-PO)**  
*Network Topology Mapper*

**Foltyn, Stephen (MPA-STC)**  
*Improved Buffer Layer Compound for  
Coated Conductors  
Substrates Structure for Growth of  
Highly oriented and/or Epitaxial Lay-  
ers Thereon  
Enhanced Pinning in Mixed Rare  
Earth-123 Films  
Structure for Improved High Critical  
Current Densities in YBCO  
Architecture for Coated Conductors  
High-Rate Buffer Layer for IBAD MgO  
Coated Conductors  
Coated Conductors  
Architecture for High Critical Current  
Superconducting Tapes  
High Critical Current Superconducting  
Tapes  
Use of High Current Density Electropol-  
ishing for the Preparation of Very  
Smooth Substrate Tapes for Coated  
Conductor Applications*

**Freund, Samuel (LANSCE-LC)**  
*Long-Range, Full Duplex, Modulated-  
Reflector Cell Phone for Voice/Data  
Transmission*

**Gardner, David (MPA-11)**  
*Pulse Tube Refrigerator with Variable  
Phase Shift  
Traveling-Wave Device with Mass Flux  
Suppression  
Cascaded Thermoacoustic Devices*

**Gavrilov, Eugene (CTN-5)**  
*Network Topology Mapper*

**Germann, Timothy (T-12)**  
*EpiCast, Version 1.0*

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

*Ultrasonic Analyte Concentration and Application in Flow Cytometry*

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

*Water-Soluble Polymers and Compositions Thereof*

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

*Preventing CO Poisoning in Fuel Cells Flow Channel Device for Electrochemical Cells*

*Catalyst Inks and Method of Application for Direct Methanol Fuel Cells*

*Methanol Sensor Operated in Driven Mode*

*Methanol Sensor Operated in Passive Mode*

*Air Breathing Direct Methanol Fuel Cell*

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

*Ultrasonic Analyte Concentration and Application in Flow Cytometry*

*A System and Method for Measuring Particles in a Sample*

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

*Substrates Structure for Growth of Highly oriented and/or Epitaxial Layers Thereon*

**Guthrie, George (SPO-FE)**

*Detection of Alkali-Silica Reaction Swelling in Concrete by Staining*

*Detection of Concrete Deterioration by Staining*

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

*A System and Method for Measuring Particles in a Sample*

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

*MiniGrand Family of Software*

**Hall, Simon (C-SIC)**

*Reversible Electro-Optic Device Employing Aprotic Molten Salts and Method Radiofrequency Attenuator and Method*

**Hamada, Michael (CCS-6)**

*Optimizing the Availability of a Buffered Industrial Process*

**Hansen, Walter (N-4)**

*MiniGrand Family of Software*

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

*International Neutron Coincidence*

*Counting (INCC) , Version 3.0031 NCCWIN (English Version)*

*Neutron Coincidence Counting for Windows (Russian Version) (NCCWIN) , Version 1.3*

*SuperHENC Neutron Coincidence Code (Super HENC), Version 1.0*

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

*Method and Apparatus for Measuring Binding Constants*

*Method for Detecting Binding Events Using Micro-X-Ray Fluorescence Spectrometry*

*Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence*

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

*Large Area Atmospheric-Pressure Plasma Jet*

*Processing Materials Inside an Atmospheric-Pressure Radiofrequency Non-thermal Plasma Discharge*

*Atmospheric Pressure Plasma Etching Reactor*

*Combined Plasma/Liquid Cleaning of Substrates*

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

*Atmospheric-Pressure Plasma Decontamination/Sterilization Chamber*

*Processing Materials Inside an Atmospheric-Pressure Radiofrequency Non-thermal Plasma Discharge*

*Atmospheric Pressure Plasma Etching Reactor*

**Hicks, Robert (P)**

*Deposition of Coatings Using an Atmospheric Pressure Plasma Jet*

*Large Area Atmospheric-Pressure Plasma Jet*

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

*Primary Explosives*

**Holesinger, Terry (MPA-STC)**

*Architecture for High Critical Current Superconducting Tapes*

*High Critical Current Superconducting Tapes*

**Hollingsworth, Jennifer (C-PCS)**

*Optical Amplifiers and Lasers*

**Horley, Earl (ISR-4)**

*Mechanical Drawings for Super-High Efficiency Neutron Coincidence (SuperHENC)*

**Howat, Andrew (X)**

*SABRINA*

**Hsu, Hsiao-Hua (P-24)**

*Neutron Dose Equivalent Meter*

**Hunke, Elizabeth (T-3)**

*CICE v 4.0*

**Huynh, My Hang Vo (DE-1)**

*Primary Explosives*

*Explosive Complexes*

*Lead-Free Primary Explosives*

**Ianakiev, Kiril (N-1)**

*MiniGrand Family of Software*

**Jia, Quanxi (MPA-STC)**

*Improved Buffer Layer Compound for Coated Conductors*

*Substrates Structure for Growth of Highly oriented and/or Epitaxial Layers Thereon*

*Polymer-Assisted Deposition of Films Structure for Improved High Critical*

*Current Densities in YBCO*

*High-Rate Buffer Layer for IBAD MgO Coated Conductors*

*Polymer-Assisted Aqueous Deposition of Metal Oxide Films*

*Architecture for High Critical Current Superconducting Tapes*

*Preparation of Energy Storage Materials High Critical Current Superconducting*

*Tapes*

*Method for Preparation of Semiconductive Films*

**John, Kevin (C-IIAC)**

*Fluorescent Beryllium Detection*

**Johnson, Jeffrey (HPC-3)**

*SABRINA*

**Jones, Philip (T-3)***CICE v 4.0***Kaduchak, Gregory (B-9)***Ultrasonic Analyte Concentration and Application in Flow Cytometry  
Acoustic Concentration of Particles in Fluid Flow**Apparatus for Separating Particles Utilizing Engineered**Apparatus and Method for Remote, Non-invasive Characterization of Structures and Fluids Inside Containers  
Cylindrical Acoustic Levitator/Concentrator Having Non-circular Cross-section***Kelley, Thomas (CCN-12)***PC/FRAM, Version 2.3**PC/FRAM, Version 3.3**PC/FRAM, Version 3.4**PC/FRAM, Version 4.3***Kelly, Patrick (CCS-3)***Quality Assessment, Restoration and oCr. (QUARC)***Kim, Yong Ho***Field Enhanced Electrodes for Additive Injection Non-thermal Plasma (NTP) Processor***Klimov, Victor (C-PCS)***Nanocrystal Structures  
Optical Amplifiers and Lasers***Klosteruer, Shirley (N-4)***MiniGrand Family of Software***Koscielniak, Michael (D-6)***Graphical Input Aggregate Control (GIAC)***Krick, Merlyn (N)***International Neutron Coincidence Counting (INCC) , Version 3.0031  
NCCWIN (English Version)**Neutron Coincidence Counting for Windows (Russian Version) (NCCWIN) , Version 1.3**Cosmic-Ray Neutron Background Reduction Using Localized Coincidence Veto Neutron Counting***Kwiatkowski, Christopher (IAT-2)***Ultrasonic Analyte Concentration and Application in Flow Cytometry***Lamartine, Bruce (MST)***Ultrahigh, Vacuum Focused, Ion Beam Micromill and Articles Therefrom  
Depth Enhancement of Ion Sensitized Data***Less, Richard (MST-6)***Deposition Head for Laser Multiple Feed Powder Splitter  
Rotary Powder Feed Through Apparatus  
Multiple Feed Powder Splitter  
Rotary Powder Feed Through Apparatus***Lewis, Gary (MST-6)***Laser Production of Articles from Powders  
Deposition Head for Laser Multiple Feed Powder Splitter  
Rotary Powder Feed Through Apparatus  
Controlled Laser Production of Elongated Articles from Particulates  
Multiple Feed Powder Splitter  
Rotary Powder Feed Through Apparatus***Lewis, Cris (C-CDE)***Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence***Li, Alexander (MST)***Polymer-Assisted Aqueous Deposition of Metal Oxide Films***Li, Lin Song (MST)***Preparation of Energy Storage Materials  
Method for Preparation of Semiconductive Films***Lin, Yuan (MST)***Polymer-Assisted Deposition of Films***Lipscomb, William (T-3)***CICE v 4.0***Lunsford, James (P-14)***Offset Stabilizer for Comparator Output***Maas, Lynn (D-6)***Graphical Input Aggregate Control (GIAC)***Mahan, Cynthia (C-DO)***Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence***Mann, Grace (C-SIC)***Method for Detecting Binding Events  
Using Micro-X-Ray Fluorescence Spectrometry***Marczak, Stanislaw (WES-EDA)***Nitrate Reduction  
Electrochemical Reduction of Nitrate in the Presence of an Amide***Martin, John (B-9)***Ultrasonic Analyte Concentration and Application in Flow Cytometry***Martin, Richard (P-25)***Acoustic Cryocooler***Martinez, Rodolfo (B-8)***Synthesis of [<sup>2</sup>H<sub>1</sub>, <sup>13</sup>C], [<sup>2</sup>H<sub>2</sub>, <sup>13</sup>C] and [<sup>2</sup>H<sub>3</sub>, <sup>13</sup>C] Methylaryl Sulfones and Sulfoxides  
Synthesis of [<sup>2</sup>H<sub>1</sub>, <sup>13</sup>C], [<sup>2</sup>H<sub>2</sub>, <sup>13</sup>C] and [<sup>2</sup>H<sub>3</sub>, <sup>13</sup>C]Methylaryl Sulfides  
Synthesis of Labelled Oxalic Acid Derivatives  
Synthesis of Isotopically Labeled D or L [<sup>13</sup>C,<sup>2</sup>H] Glycerols  
Synthesis of <sup>2</sup>H- and <sup>13</sup>C- Substituted Dithanes***Martz, Harry (D-1)***Optimizing the Availability of a Buffered Industrial Process***Matias, Vladimir (MPA-STC)***Use of High Current Density Electropolishing for the Preparation of Very Smooth Substrate Tapes for Coated Conductor Applications***McBranch, Duncan (C)***Method for Detecting Biological Agents***McCleskey, Thomas (MPA-MC)***Fluorescent Beryllium Detection  
Reversible Electro-Optic Device Employing Aprotic Molten Salts and Method Electrolytes for Electrooptic Devices Comprising Ionic Liquids  
Polymer-Assisted Deposition of Films*

*Extension to MXRF IP Portfolio  
Reversible Electro-Optic Device Employ-  
ing Aprotic Molten Salts and Method  
Electrochromic, Salts, Solutions and  
Devices  
Radiofrequency Attenuator and Method*

**McGhee, John (CCS-4)**  
ATTILA

**Melton, Sheila (N-2)**  
*Combined Thermal/Epithermal Neutron  
(CTEN-FIT EXE), Version 1.0  
LIST-LIB (object library), Version 1*

**Menlove, Howard (N-1)**  
*Electrical Drawings for Super-High Effi-  
ciency Neutron Coincidence (Super-  
HENC)  
Mechanical Drawings for Super-High  
Efficiency Neutron Coincidence  
(SuperHENC)  
Cosmic-Ray Neutron Background Reduc-  
tion Using Localized Coincidence Veto  
Neutron Counting*

**Migliori, Albert (MPA-NHMFL)**  
*Intrinsically Irreversible Heat Engine*

**Mikhailovski, Alexandre (C)**  
*Optical Amplifiers and Lasers*

**Milewski, John (MST-6)**  
*Controlled Laser Production of Elongated  
Articles from Particulates*

**Miller, Thomasin (C-ACS)**  
*Method and Apparatus for Measuring  
Binding Constants  
Flow Method and Apparatus for Screen-  
ing Chemicals Using Micro X-Ray  
Fluorescence*

**Minogue, Edel (C-CDE)**  
*Fluorescent Beryllium Detection*

**Moody, David (RD)**  
*Method of Using 5, 10, 15, 20-Tetrakis(4-  
Carboxyphenyl) Porphine*

**Naivar, Mark (B-9)**  
*Open Reconfigurable Cytometric Acquisi-  
tion System (ORCAS DSP), Version 1.0  
Miniature Cytometric Acquisition System  
(MiCAS DSP), Version 1.0*

*Tailorable Rapid Acquisition and Visu-  
alization Software (TRAViS), Version  
1.0 (formerly known as ORCA PC)*

**Naud, Darren (DX-2)**  
*Lead-Free Electric Match Compositions*

**Neagley, Daniel (ISR)**  
*Identification Coding Schemes for Modu-  
lated Reflectance  
Long-Range, Full Duplex, Modulated-  
Reflector Cell Phone for Voice/Data  
Transmission*

**Neutzler, Jay (T-DO)**  
*Annular Feed Air Breathing Fuel Cell  
Stack*

**Nolan, John (B-2)**  
*DNA Base Mismatch Detection Using  
Flow Cytometry  
DNA Polymorphism Identity Determina-  
tion Using Flow Cytometry*

**Olsher, Richard (RP-2)**  
*Neutron Dose Equivalent Meter  
Proton Recoil Scintillator Neutron REM  
Meter*

**Olson, Jeffrey (MPA)**  
*Tapered Pulse Tube for Pulse Tube  
Refrigerators*

**Park, Jaeyoung (P-24)**  
*Processing Materials Inside an Atmo-  
spheric-Pressure Radiofrequency  
Nonthermal Plasma Discharge*

**Parker, Robert (N-4)**  
*MiniGrand Family of Software*

**Pautz, Shawn (CCS-4)**  
ATTILA

**Pelowitz, David (N-4)**  
*Falcon, Version 2*

**Platts, David (P-21)**  
*Identification Coding Schemes for Modu-  
lated Reflectance*

**Prime, Michael (WT-2)**  
*System and Method for Measuring  
Residual Stress*

**Qian, Jiang (LANSCE-LC)**  
*Diamond-Silicon Carbide Composite and  
Method for Preparation*

**Quist, Daniel (IAT-2)**  
*Network Quarantine Code  
Network Topology Mapper*

**Reager, David (MPA-STC)**  
*Underground Radio  
Narrowband High Temperature Supercon-  
ducting Receiver for Low Frequency  
Radio Waves*

**Reass, Pamela (ISR-4)**  
*MiniGrand Family of Software*

**Reed, Theodore (D-6)**  
*Graphical Input Aggregate Control  
(GIAC)*

**Ren, Xiaoming (MPA-11)**  
*Flow Channel Device for Electrochemical  
Cells  
Air Breathing Direct Methanol Fuel Cell  
Catalyst Inks and Method of Application  
for Direct Methanol Fuel Cells  
Methanol Sensor Operated in Driven  
Mode  
Methanol Sensor Operated in Passive  
Mode  
Air Breathing Direct Methanol Fuel Cell*

**Robison, Thomas (C-CDE)**  
*Water-Soluble Polymers and Composi-  
tions Thereof  
Water-Soluble Polymers for Recovery of  
Metals from Solids  
Water-Soluble Polymers for Recovery of  
Metal Ions from Aqueous Streams  
Water-Soluble Polymers and Composi-  
tions Thereof*

**Rodgers, John (HSR-4)**  
*Apparatus Having Reduced Background  
for Measuring Radiation Activity in  
Aerosol Particles  
Quick-Change Filter Cartridge  
Elbow Mass Flow Meter  
Alpha-Environmental Continuous Air  
Monitor Inlet*

**Romero, Amos (LANSCE-6)**  
*MiniGrand Family of Software*

**Rosocha, Louis (P-24)**

*Nonthermal Plasma Processor Utilizing Additive Gas Injection and/or Gas Extraction*

*Fast-Pulse Nonthermal Plasma Processor Field Enhanced Electrodes for Additive Injection Non-thermal Plasma (NTP) Processor*

*Fuel Injector Utilizing Plasma Activation*

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

*Work Package Generator (WPG), Version 1.0*

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

*MiniGrand Family of Software*

**Salzman, Gary**

*Ultrasonic Analyte Concentration and Application in Flow Cytometry*

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

*PC/FRAM, Version 4.3*

*PC/FRAM, Version 3.3*

*PC/FRAM, Version 3.4*

*PC/FRAM, Version 2.3*

**Sandoval, Darryl (CTN-5)**

*Network Quarantine Code*

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

*Water-Soluble Polymers for Recovery of Metals from Solids*

*Process for the Displacement of Cyanide Ions from Metal-Cyanide Complexes*

**Schmidt, Jürgen (B-9)**

*Synthesis of [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}_2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfones and Sulfoxides*

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

*Proton Recoil Scintillator Neutron REM Meter*

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

*Atmospheric-Pressure Plasma Jet Deposition of Coatings Using an Atmospheric Pressure Plasma Jet Large Area Atmospheric-Pressure Plasma Jet*

*Processing Materials Inside an Atmospheric-Pressure Radiofrequency Nonthermal Plasma Discharge*

*Atmospheric Pressure Plasma Etching Reactor*

*Combined Plasma/Liquid Cleaning of Substrates*

**Shera, Brooks (P-21)**

*Ordered Transport and Identification of Particles*

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

*Synthesis of [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}^2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfones and Sulfoxides*

*Synthesis of [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}_2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfones Methylaryl Sulfides*

*Synthesis of  $^2\text{H}$ - and  $^{13}\text{C}$ -Substituted Dithanes*

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

*Noninvasive Characterization of a Flowing Multiphase Fluid*

*Ultrasonic Analyte Concentration and Application in Flow Cytometry*

*Apparatus and Method for Comparing Corresponding Acoustic Resonances in Liquids*

*Ultrasonic Characterization of Single Drops of Liquids*

*Noninvasive Method for Determining the Liquid Level and Density Inside of a Container*

*Noninvasive Identification of Fluids by Swept-Frequency Acoustic Interferometry*

*Apparatus and Method for Remote, Noninvasive Characterization of Structures and Fluids Inside Containers*

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

*Water-Soluble Polymers for Recovery of Metals from Solids*

*Water-Soluble Polymers for Recovery of Metal Ions from Aqueous Streams*

**Snyder, Hans (N-2)**

*Atmospheric Pressure Plasma Etching Reactor*

**Son, Steven (DE-6)**

*Lead-Free Electric Match Compositions*

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

*Architecture for Coated Conductors*

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

*Ultrahigh, Vacuum Focused, Ion Beam Micromill and Articles Therefrom*

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

*MiniGrand Family of Software*

**Swift, Gregory (MPA-10)**

*Intrinsically Irreversible Heat Engine Acoustic Cryocooler*

*Tapered Pulse Tube for Pulse Tube Refrigerators*

*Pulse Tube Refrigerator with Variable Phase Shift*

*Traveling-Wave Device with Mass Flux Suppression*

*Cascaded Thermoacoustic Devices*

*Circulating Heat Exchangers for Oscillating-Wave Engines and Refrigerators*

**Takeda, Harunori (X)**

*Phase and Radial Motion in Ion Linear Accelerators (PARMELA)*

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

*RESOLVE, Version 2.0*

*SOLVE, Version 2.0*

*SOLVE, Version 1.0*

*RESOLVE, Version 1.0*

*Likelihood-Based Modification of Experimental Crystal Structure Electron Density Maps*

*Maximum Likelihood Density Modification by Pattern Recognition of Structural Motifs*

*Method for Removing Atomic-Model Bias in Macromolecular Crystallography*

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

*Catalyst Inks and Method of Application for Direct Methanol Fuel Cells*

**Turner, Cameron (PMT-4)**

*Hyperdimensional Performance Maps (HyPerMaps), Version 1.10.3.23*

**Unkefer, Clifford (B-8)**

*Synthesis of [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}_2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfones and Sulfoxides*

*Synthesis of Labelled Oxalic Acid Derivatives*

*Synthesis of Isotopically Labeled D or L [ $^{13}\text{C}$ ,  $^2\text{H}$ ] Glycerols*

*Synthesis of  $^2\text{H}$ - and  $^{13}\text{C}$ - Substituted Dithanes*

**Vacarro, Henry (N)**  
*WISDOM & SENSE (W&S)*

**Van De Sompel, Herbert (STBPO-RL)**  
*Blackbox, Version 1.0*  
*Usage Based Indicators to Assess the Impact of Scholarly*

**Van Riper, Kenneth (X)**  
*SABRINA*

**Vasilik, Dennis (HSR)**  
*Neutron Dose Equivalent Meter*

**Vasquez-Dominquez, Jose (MPA-STC)**  
*Underground Radio*

**Vo, Duc T (N-1)**  
*PC/FRAM, Version 4.3*

**Waldo, Geoffrey (B-9)**  
*Self-Assembling Split-Fluorescent Protein Systems*  
*Circular Permutant GFP Insertion Folding Reporters*  
*Protein Subcellular Localization Assays Using Split*  
*Method for Determining and Modifying Protein/Peptide*  
*Protein-Protein Interaction Detection System Using*  
*Method for Determining and Modifying Protein/Peptide*

**Wang, Haiyan (MPA-STC)**  
*Improved Buffer Layer Compound for Coated Conductors*  
*Architecture for Coated Conductors*

**Wang, Hsing-Lin**  
*Method for Detecting Biological Agents*

**Ward, Michael (B)**  
*Acoustic Concentration of Particles in Fluid Flow*  
*Apparatus for Separating Particles Utilizing Engineered*

**Waring, Todd (CCS-4)**  
*ATTILA*

**Warner, Benjamin (MPA-MC)**  
*Fluorescent Beryllium Detection Reversible Electro-Optic Device Employing Aprotic Molten Salts and Method and Apparatus for Measuring Binding Constants*  
*Electrolytes for Electrooptic Devices Comprising Ionic Liquids*  
*Extension to MIXRF IP Portfolio Reversible Electro-Optic Device Employing Aprotic Molten Salts and Method for Detecting Binding Events Using Micro-X-Ray Fluorescence Spectrometry*  
*Electrochromic, Salts, Solutions and Devices*  
*Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence*

**Weisbrod, Kirk (AET-5)**  
*Corrosion Test Cell for Bipolar Plates*

**Wells, Cyndi (IAT-1)**  
*Method and Apparatus for Measuring Binding Constants*  
*Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence*

**West, James (X)**  
*SABRINA*

**Wheatley, John (C)**  
*Intrinsically Irreversible Heat Engine*

**White, Paul (B-7)**  
*DNA Base Mismatch Detection Using Flow Cytometry*  
*DNA Polymorphism Identity Determination Using Flow Cytometry*

**Whitten, David (B)**  
*Method for Detecting Biological Agents*

**Wilson, Mahlon (MPA-11)**  
*Annular Feed Air Breathing Fuel Cell Stack*

*Fuel Cell with Interdigitated Porous Flow-Fields*  
*Fuel Cell Membrane Humidification Annular Feed Air Breathing Fuel Cell Stack*

*Fuel Cell with Metal Screen Flow-Field Composite Bipolar Plate for Electrochemical Cells*  
*Ambient Pressure Fuel Cell System*

**Young, Lloyd (ISR-6)**  
*Phase and Radial Motion in Electron Linear Accelerators (PARMELA), Version 3.0*

**Zawodzinski, Christine (MPA-11)**  
*Fuel Cell with Metal Screen Flow-Field*

**Zelenay, Piotr (MPA-11)**  
*Catalyst Inks and Method of Application for Direct Methanol Fuel Cells*

**Zhao, Yusheng (LANSCE-LC)**  
*Diamond-Silicon Carbide Composite and Method for Preparation*

## **Fiscal Year 2007 Executed Cooperative Research and Development Agreements (CRADAs)**

### **Next Generation Hand Held Multiplicity Register (HHMR)**

Matthew Newell (N-1)

Jointly develop and commercialize the portable multiplicity shift register and subsequent unattended mode shift register technology having the capability for high speed neutron data acquisition and multiplicity analysis. This next generation shift register would allow application of existing and potentially new analysis techniques to be applied to a wider range of applications and a greater range of plutonium bearing material types. LANL will support the solution of certain technical design and testing issues. The Participant will support technical, engineering, and manufacturing solutions that are required to achieve a viable commercial product.

### **The Laser Induced Breakdown Spectroscopy for Monitoring Carbon Sequestration**

Ronny Harris (EES-2)

Measurement of carbon in soils is important for determining the capture of carbon and for characterizing soil productivity. The first objective is connected to monitoring and verification of CO<sub>2</sub> sequestration sites. The second can help guide effective land management practices. Both would benefit from the development of fast, low-cost sampling methods. The ideal analyzer for carbon in soil and subsoil

would be able to address both applications and would be field portable, require minimal sample preparation, provide carbon depth profiling with a resolution of ~1 mm, require only a few minutes per sample, be fully automated, and operate without consumable reagents. The CRADA partner and Los Alamos National Laboratory (LANL) propose development of the laser-induced breakdown spectroscopy (LIBS) technique as a low-cost, field portable, and automated method for quantifying carbon in soils and subsoils that will have significant commercial potential.

### **2G Superconductor Technology with Nanoengineered YBCO Films**

Leonardo Civale (MPA-STC)

Coated conductor (CC) technology (superconductor wires based on yttrium barium copper oxide [YBCO] films) is maturing rapidly. Wires hundreds of meters long with critical current (I<sub>c</sub>) exceeding 100 A/cm width at liquid nitrogen (T~77K) in the absence of applied magnetic fields have been demonstrated. Reaching commercialization level will still require large increases in I<sub>c</sub> both in self-field and in external fields, utilizing cost-efficient industrial production methods. The Los Alamos National Laboratory / Superconductivity Technology Center (LANL/STC) has led the area of improving I<sub>c</sub> through incorporation of BaZrO<sub>3</sub> nanoparticles and fabrication of



YBCO/CeO<sub>2</sub> multilayers. The Participant will build upon this success by utilizing their nanoparticle-generating suite of technologies to explore even more effective pinning centers that can be economically combined with industrial scale CC processing. Specifically, Laser Assisted Molecular Beam and Pulsed Arc Molecular Beam technologies will be used to co-deposit a wide variety of nanoparticles with YBCO.

### **Muon Tomography for Detection of Potential Non-Nuclear Threat Objects**

Chris Morris (P-25)

Engage in collaborative research to refine existing technologies that have broad applicability to homeland security applications, including border and port inspections.

Investigating the use of LANL's muon tomography technology to detect and identify potential nuclear threat objects. The goal of this research and development project is to develop a muon tomography sensor for this purpose.

### **Multipathogan Microarray Development**

Murray Wolinsky (B-7)

The CRADA project will integrate and evaluate the CRADA Partner's microfluidic controlled microarray platform with the Los Alamos National Laboratory's (LANL) Allele-specific Primer Extension

(APE) and Moligo assays. The CRADA Partner's system and the LANL assays have undergone extensive development and validation and are being integrated for the first time by the CRADA Partners. The final product will be a portable, low-cost, rapid, user-friendly genetic analysis system for commercial applications. Personnel could use the field device, with minimal training and expense, to perform testing for the presence of infectious diseases and biowarfare agents and have definitive results within thirty minutes or less.

### **Development and Evaluation of Next Generation Gallium-68 Targeted Radiopharmaceuticals**

Kevin John (C-IIAC)

The CRADA Participant is a national resource for the development of applications for unique medically useful radioisotopes available from Los Alamos National Laboratory (LANL) Isotope Production Facility (IPF). The LANL IPF is a beam spur on the LANL linear accelerator (LINAC) that will produce unique gamma emitting and positron emitting (PET) unique isotopes that until now have not been available in sufficient quantities for product development. The CRADA Participant, the University of New Mexico, New Mexico Center for Isotopes in Medicine, a research center of the College of Pharmacy, Health Sciences Center, brings UNM's long-standing expertise in

handling, formulation, research and development of medical isotopes to establish medically useful radiopharmaceuticals.

### **Acoustic Drilling Optimization and Nonlinear Acoustic Reservoir Imaging**

Dipen Sinha (MPA-11)

Investigating the use of LANL's advanced acoustic sensor technology in a whole range of applications related to the optimization of drilling efficiency, oil production, and reservoir management in deep wells. This is important from the perspective of improving well yields and hence to national energy security.

### **GMRS Bore Stress**

Christopher Bradley (EES-11)

The objective of the collaboration is to provide the CRADA Participant with a theoretical material model for reservoir rock that reflects the observed behavior of the rock during deflation and inflation of the reservoir. Material models of this type are not typically handled with purely elastic rock models. Los Alamos National Laboratory will develop an invariant form of a plasticity model for rock. LANL will develop and test a theoretical material model using analytical and computational methods and provide guidance to the CRADA Participant to test this model in the laboratory.

## LabView Version of PeakDoctor Software

Scott Garner (N-2)

Cooperate in the further development of the PeakDoctor program initially created by LANL. The PeakDoctor software is a gamma spectroscopy analysis tool useful for providing very accurate peak fit analysis on a wide range of gamma spectra (HPGe). The Participant has recent experience commercializing LANL-developed technology, technical expertise in the area of gamma spectroscopy, and has established relations with the technical experts from LANL's NWIS-SWO and N2 groups.

## High Speed Wavelength AO Turning for CO<sub>2</sub> Heterodyne Remote Sensing of Aerosols

George Busch (C-CDE)

Work to be performed under this CRADA involves the development of two wavelength agile CO<sub>2</sub> lasers that will be locked to each other in frequency at high pulse repetition rates (>200 Hz). Waveguide lasers will be used for compactness, and high pulse repetition rates.

## Hollow Fiber Separations

Dali Yang (MST-7)

Explore the operational parameters and economic feasibility of replacing the conventional tray-type distillation towers in petroleum refineries with hollow fiber membranes. The

effort is a lab-scale test on typical industrial process streams identified by the CRADA participant with the goal of providing sufficient technical data to carry out an economic analysis of the process change by the CRADA participant. This would include both capital equipment savings as well as anticipated energy savings due to lower separation temperatures.

## Mechanical Polishing of Substrates for Coated Conductors

Vladimir Matias (MPA-STC)

This project involves evaluating the CRADA Participant's proprietary polishing process for use in coated conductors fabricated using ion-beam assisted deposition (IBAD) textured templates and high temperature superconductors (HTS). For this purpose, the Participant will supply a number of mechanically polished metal substrates and mechanically polished layers on top of metal substrates. LANL will deposit IBAD templates and HTS layers using LANL's coated conductor technology on these polished materials. Furthermore, LANL will characterize coated conductor tapes made with MIPOX polished substrates with electrical measurements of critical currents, magnetic field dependence thereof, and ac losses. LANL will also perform electron microscopy on these samples.

## Elemetric Magnetron Power Supply

Gregory Dale (ISR-6)

The work under this project will consist of the development of a preproduction prototype 200 watt, 2.45 GHz Microwave Power Supply subassembly, including an electrically matched and integrated plasma chamber.

## Construction of Prototype Muon Tomography Scanner for Detection of Potential Threat Objects

Chris Morris (P-25)

Investigate the use of LANL's muon tomography technology to detect and identify potential threat objects. The goal of this research and development project is to develop a muon tomography scanner for this purpose.

## Brake Pad Defect Detection

Dipen Sinha (MPA-11)

Automobile brake pads may have defects such as cracks or delaminations during manufacturing. These defects need to be detected and the defective unit removed before the product is ready for market. The current approach to detecting defects involves manual examination of the brake pads that is both subjective and slow. The proposed work will evaluate an acoustic technique for defect detection that can provide an automated and rapid detection of brake pad defects.

## **Detection of foreign Bodies in Beverages**

Dipen Sinha (MPA-11)

During the beverage bottling process, small particulate matter such as microscopic pieces of pipe material, rubber O-ring, and dried up liquid residue may fall into the bottle. Filters are not always effective in preventing such contamination. Although these particulate matters can be a few microns in size, they tend to coalesce and grow to visible sizes. Normally, this is detected during visual inspection of bottles that are transparent. Such visual inspection is a slow process and not perfect. The purpose of this effort is to explore acoustic and other techniques to determine whether such foreign objects can be detected noninvasively.

## **Software Development for Design and Operation of Prototype Muon Tomography Scanner**

Michael Sossong (X-1-TA)

Investigating the use of LANL's muon tomography technology to detect and identify potential threat objects. The goal of this research and development project is to develop a muon tomography sensor for this purpose.

## **Oil and Gas Environmental Protection Science and Technology Program**

Cathy Wilson (EES-DO)

Develop and apply a diverse suite of environmental protection science and technology tools under this CRADA project to ensure environmental protection at Chevron oil and gas sites, with particular attention to unconventional fuel resource production (e.g., oil shale) sites.

## **Combustion-Powered Thermoacoustic Natural Gas Liquefaction**

Gregory Swift (MPA-10)

Develop a 20,000 gallon/day combustion-powered thermoacoustic natural gas liquefier. Heavier hydrocarbons will be condensed and removed in higher-temperature stages in the cascade refrigeration system. We seek a package size small enough to transport by rail without a special permit, a low projected manufacturing cost once the design is complete, and an energy efficiency such that 80% to 85% of a clean gas stream is liquefied while 15% to 20% is burned. This represents a dramatic increase in power (more than a factor of 40) above previous thermoacoustic equipment, and a significant increase in energy efficiency.

## **Fiscal Year 2007 Work for Others – Non-Federal Agreements Executed**

### **Research Library – Mellon Grant**

Johan Bollen (STBPO-RL)

The project will benefit the scholarly community involved with usage-based evaluation metrics by the definition of a formal model of the scholarly communication process, lessons learned from the generation of a large-scale reference data set, the definition and validation of a range of usage-based scholarly evaluation metrics, the formulation of a set of guidelines on their semantics and a resulting taxonomic model of the concept of scholarly status.

### **Molecular Characterization of Clostridium Botulinum and Related Isolates**

Karen Hill (B-7)

The purpose of this Work Agreement is to characterize by molecular DNA techniques approximately 1200 strains of Clostridium botulinum and related clostridia that have caused infant botulism in California or that are otherwise of interest to the California Department of Health Services (CDHS). This characterization will be done using special DNA primers, probes, techniques and equipment that LANL uniquely possesses. Molecular DNA techniques to be used include polymerase chain reaction (PCR), amplified fragment length polymorphism (AFLP), variable number tandem repeat (VTNR), and regional gene sequencing of the toxin gene complex. LANL has

prior experience in applying these techniques to the characterization of various bacterial DNAs, including the DNA of C. botulinum.

### **Integration of RF/EO Technologies for Electronics Detection and Location**

Clifford Fortgang (IAT-2)

The Sponsor has been briefed on several LANL technologies relevant to the detection and defeat of IEDs. The Sponsor believes, and LANL agrees, that if these technologies can be integrated, then the integrated system will work better than the individual technologies working separately. The objective of this project is to demonstrate multiple LANL technologies working together as a system for detecting IEDs. The transferring of data and the ability of each technology to work well in the presence of the others without electrical interference will be the greatest challenges.

### **The Feasibility Study of NDA Holdup Measurements for the Rokkasho Uranium Enrichment Plant**

Johnna Franco (N-1)

This work involves the development of the nondestructive assay (NDA) systems and techniques for the Rokkasho Uranium Enrichment Plant (REP) of JNFL. The study will evaluate the technical approaches for measuring the uranium process hold-up of the REP RE-1 facility that

is under the International Atomic Energy Agency (IAEA) safeguards inspection. The results of this work will derive and improve knowledge and technology on nuclear material control, accountancy, and verification to ensure efficient and effective safeguards as required by IAEA.

### **Demonstration Run of EPICAST**

Timothy Germann (T-12)

LANL will use its large-scale epidemiological simulation model “Epi-Cast” to predict the potential spread of pandemic influenza within the United States for two scenarios: (1) An unmitigated outbreak in which no medical or social interventions are employed; and (2) A situation in which a heightened response level is activated, involving the therapeutic and prophylactic use of antiviral drugs. The heightened response level is that expected to be achieved as a result of Raytheon’s proposed situational awareness network. Some exploratory studies are anticipated for (2) to determine necessary requirements for the situational awareness network to lead to successful containment. Movies and data for each scenario will be provided to Raytheon, as well as the basic results of the exploratory studies. LANL involvement is required due to the unique capabilities of its copyrighted simulation model, as well as the high-performance computing resources required.

### **MCNPX Visual Editor Support and Consulting**

Gregg McKinney (X-3)

The MCNPX Monte Carlo radiation transport code is an extension of MCNP4C to all particles and all energies, in addition to retaining the functionality of MCNP. It is widely used by universities, national laboratories, and industry especially to analyze accelerator target and health physics applications, space shielding, cosmic radiation effects and medical cancer therapy—especially using charged particle beams. Considerable expertise is needed to run the code, and we often find that users benefit from supplementary support. By providing a consulting contract directly from the code developers in X-3, we will be able to help users properly install the code, provide training, and consultation for specific problems. This is essential for proper software management, which puts direct responsibility for the proper use of code upon the code developers, especially when customers are involved in nuclear applications. We will also give customers access to the latest code Versions and keep them fully apprised of bugs and fixes as they develop. Although the standard MCNP code is widely used and considerable expertise is available outside the lab, the extensions provided by MCNPX are new and quite specialized. We consider it essential that cost-effective and dedicated help be available directly from the code developers.

### **Thermally-Driven Acoustic Generator**

Scott Backhaus (MPA-10)

Thermoacoustic engines convert high-temperature heat into acoustic power which may then be converted into electrical power via a linear alternator. We will develop a prototype engine-generator, designed to address a micro-cogeneration need for combined heat and power at the residential level. Requirements for this application are approximately 500–1000 watts capacity and 15% or better thermal efficiency, combined with extremely high reliability and minimal service needs, comparable to present home heating appliances. Los Alamos has unique abilities in the modeling of thermoacoustic engines that are crucial to the success of the project.

### **Fluorescent Immunoassay Development for PrPSc Detection and Antemortem Diagnosis of TSEs**

Perry Gray (D-6)

The work will improve the performance of a fluorescence spectrometer, and develop a new system for use with existing FIA assays for ante-mortem testing of TSEs. The Sponsor does not have at his disposal personnel within or in the private industrial sector with the expertise to perform this task. Part of the work involves analyzing the entire optical train of elements including the fluorescence source and detection mechanisms of the

existing detection hardware. The overall requirement is to increase the sensitivity of the apparatus by at least a factor of two while retaining low sensitivity to scattered light. We will also develop an improved instrument, for use with FIA assays, with sensitivity and dynamic range applicable to antemortem TSE diagnosis.

### Performance Prediction

Adolfy Hoisie (CCS-1)

Performance analysis, modeling and prediction of a computer code (WRF) on a novel IBM-developed parallel system architecture (PERCS).

### Thermoacoustic Converter for Space Power

Scott Backhaus (MPA-10)

Thermoacoustic engines convert high-temperature heat into acoustic power which may then be converted into cooling power via a thermoacoustic refrigerator or into electrical power via a linear alternator. We will design a prototype engine-refrigerator-alternator combination to meet the electrical and cooling needs of a conceptual space probe to a planet whose surface temperature is higher than can be tolerated by conventional solid-state electronics. Los Alamos has unique abilities in the modeling and design of thermoacoustic engines, refrigerators, and associated components that are crucial to the success of the project.

### Pathogenesis of SIV in African Monkeys

Ruy Ribeiro (T-10)

The Tulane National Primate Research Center was financed by the National Institutes of Health to develop research in the area of non-pathogenic SIV infection. Part of their objectives calls for a quantitative understanding of viral dynamics and immune system dynamics. Although the External Partner has full experimental capabilities, they lack the expertise in this quantitative approach to fulfill their purposes. R. Ribeiro, at T-10, LANL, has been working in this field for 7 years and understands the biological tenets of the subject as well as being an expert in the modeling of both viral infections and immune responses to them. The objective of the project is to develop models for non-pathogenic SIV infection in support of the experimental research of the External Partner and to help analyze the data that they produce.

### The Role of Dust and Non-Equilibrium Chemistry in the Atmospheres of L and T Dwarfs as Constrained by Spitzer IRS and IRAC Observations

Didier Saumon (X-1 SMMP)

Brown dwarfs (BDs) are substellar objects that represent the transition between stars and giant planets like Jupiter. Two spectral types of brown

dwarfs have been recognized, L and T dwarfs. There is strong evidence that the atmospheres of L dwarfs harbor layers of iron and silicate clouds while the atmospheres of T dwarfs are mostly cloudless. The transition between the two appears rather sudden. The mechanism of this transition is not well known and is a focus of this project. This is an exciting field at the frontier of stellar astrophysics that is making extensive use of data from the Spitzer Space Telescope. One unexpected discovery from this space data is a flattening of the spectrum of L dwarfs in the 8–10 micron range. We aim to understand how this can be modeled and we strongly suspect that it is related to the particle size distribution in the cloud layers and the nature (composition) of the particles. This will provide new insights into the cloud physics in brown dwarfs. It has been recognized for some time that the atmospheres of planets show disequilibrium abundances of certain chemical species and there is growing evidence that cool brown dwarfs share this phenomenon. An important focus of this work is the systematic modeling and study of this phenomenon.

### Science Team Support for the Messenger Mission

David Lawrence (ISR-1)

The objective of this work is to carry out data reduction, analysis, and scientific studies with data from the MESSENGER neutron spectrometer

(MNS). While the Planetary Science Institute (PSI) has scientific expertise for understanding this data, PSI is not equipped to carry out the detailed data reduction and analysis tasks required for delivering the scientific products to the MESSENGER mission. This expertise resides at LANL and is based on a history of understanding the MNS sensor in particular and planetary neutron data in general.

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

Catherine Macken (T-10)

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. If the customer did not appeal to LANL for this work, then it would be necessary for the customer to establish their own database: such an undertaking would be inefficient for both parties. This proposed project draws on the basic expertise of the ISD, and covers possible extensions of current capabilities, designed in consultation with ISD staff, to serve the specialized data management and analysis needs of the influenza research and

surveillance community. Thus, the proposed project fits well within the guidelines established for the goals of the ISD.

### **SOA Framework-Tactical Decision System**

G. Loren Toole (D-4)

Raytheon wants to incorporate the features and functionality of the LANL-developed Scenario Library Visualizer into programs and interfaces that it is developing for client use. The Scenario Library Visualizer (SLV) tool currently executes in a Visual Basic code environment from ESRI ArcGIS 8.3. Raytheon has stated interest in migrating this code, in whole, to JAVA.

### **Theory and Simulation of Laser Initiated Plasma Channel (LIPC) Experiments**

Mark Schmitt (X-1-PTA)

LANL will be providing theory and simulation support to experiments being conducted at Ionatron, Inc. in Tucson, AZ. Since Ionatron is mainly an experimental R&D company, and owing to the complex multi-disciplinary physics associated with these experiments, they have requested LANL's assistance in understanding the physical principles that are needed to optimize their experimental results. LANL will be providing expertise in the areas of ultra-short pulse laser propagation, laser filamentation and ionization, radiation-hydrodynamic

evolution of electrically heated gases, and the modeling of self-consistent high-voltage discharges through gases.

### **HTLN Automated Sample Archival and Accessioning Systems**

Tony Beugelsdijk (C-CDE)

The objective for this Statement of Work is to prepare an overall feasibility study for the UCLA/LANL High Throughput Laboratory Network (HTLN) project's automated sample archival and accessioning systems.

UCLA is under challenging schedule constraints to make this key acquisition. The combination of project knowledge, domain expertise, and key networks within the vendor community uniquely positions LANL to perform this study within the time constraints.

### **Physics-Based Prediction of Brand Transport in the Context of Large Fires (Spotting)**

Eunmo Koo (EES-2)

LANL is uniquely qualified to perform this research due to its widely recognized wildfire model, computational resources, and expertise in science-based prediction of wildfire behavior. Eunmo Koo is the perfect candidate to do this work due to his understanding of fire brand dynamics and combustion as well as HIGRAD/FIRETEC. LANL has

developed HIGRAD/FIRETEC, a premier physics-based model for the prediction of continuous-spread fire behavior which is recognized as a world leader for this type of tool. Unfortunately, spotting is not currently incorporated in HIGRAD/FIRETEC. Spotting transport phenomena and the nature of its strong coupling to the environmental conditions are not well understood. This lack of knowledge is especially true when the influences of the coupling between the atmosphere, fire, topography, and vegetation on the transport of the brands is considered. This knowledge gap has a significant impact on the ability to anticipate risk, develop mitigation safety strategies, and manage fuels.

### **High Speed High Volume Laboratory Network for Infectious Disease**

Tony Beugelsdijk (C-CDE)

Government agencies and expert panels have recognized the need for laboratories capable of analyzing tens of thousands of biological samples per day that have hundreds of times more capability than at present. This project aims to develop a new high speed, high volume (high-throughput) laboratory capability that will be linked in a network and operated by several premier institutions. The automated, networked capability will make us stronger against natural diseases and bioterrorist attacks. The combination of high-throughput and automated systems will enable processing of tens of thousands of

samples and provide critical laboratory capacity. The overall project will facilitate rapid expansion to multiple networked sites.

LANL, as the technology provider, is complementary to UCLA School of Public Health. The UCLA School is a premier R&D and educational institution dedicated to the worldwide study of emerging infectious disease. As such it has a far-reaching surveillance charter and system in place to guide the technology development and provide samples to the high throughput experimental capabilities that LANL will design and deliver. LANL has institutional strengths in complex experimentation and systems, bioinformatics, high performance computing, design of software architectures, quality assurance programs, and biological protocol development.

### **Improvements to a Major Digital Archive of Seismic Waveforms from Nuclear Explosions**

Howard Patton (EES-11)

The objective of this 3-year project is to develop a digital archive of high-quality useable seismograms recorded at the Borovoye Observatory (BRV) in northern Kazakhstan. BRV data were made available to western scientists in 2001, but the form of the data prevented wide usage in the seismological community due to the presence of glitches and incomplete knowledge of the instrument responses for a number

of recording systems. LANL personnel have developed software for de-glitching seismic signals and are experts in methods for deconvolving instrument effects and in yield/source discrimination research, which this data will support.

### **Field Device for Avian Surveillance**

Torsten Staab (C-CDE)

Given the imminent threat of avian influenza developing into a global epidemic, LANL proposes to develop a specialized Version of its patented, multi-purpose sample collection and tracking device for avian field surveillance. This multi-media, handheld sample collection and tracking device will enable ornithologists and others to rapidly collect and disseminate avian surveillance-related field data.

The overall requirement calls for the production and deployment of several hundred avian field surveillance devices. UCLA cannot meet these requirements without LANL's assistance, since the underlying core technology and software is LANL-owned. Given LANL's pre-existing IP in this area and its in-house engineering experience and capabilities, only LANL can customize the device for its intended use. UCLA currently does not have the technical know-how and the production capabilities to adopt LANL's existing technology for its unique application.



## Measurements of Retro-Reflections Using Flash Photography

David Thompson (C-CDE)

LANL is participating in a team preparing a U.S. Defense Department Advanced Research Projects Agency (DoD-DARPA) proposal in the area of sniper detection. As part of the proposal preparation process, we wish to quantify some of the signals we expect to detect. Using flash photography techniques and a standard digital camera and photo flash, we will measure retro-reflections (the usual "red-eye" effect) with and without intervening optics such as binoculars. Measurements will enable calculation of both optical cross sections and return divergence angles. The photographed scene will also include references, such as white diffusers, for calibration of the reflectivity.

## LWA Ionospheric Imaging

William Junor (ISR-2)

This work will research the results of several different processes including Ionospheric Calibration, Wide-field Imaging, and Ionospheric and Meteor Characterization. LANL will investigate the constraints imposed by the Earth's ionosphere on (1) the calibration of signals detected by the Long Wavelength Array (LWA) and (2) the construction of radio astronomical images using the LWA. This work is unique to LANL in the ability to perform the needed tasks for this particular research.

This research will allow LANL to foresee the applicability of these approaches to LWA calibration issues and the applicability of these methods to LWA's projected needs.

## Research Library

Herber Van de Sompel (STBPO-RL)

On behalf of the sponsor, LANL will initiate and coordinate the development of specifications that allow distributed repositories to exchange information about their constituent digital objects. These specifications will include approaches for representing digital objects and repository services that facilitate access and ingest of these representations. The specifications will enable a new generation of cross-repository services that leverage the intrinsic value of digital objects beyond the borders of hosting repositories. This work is expected to be completed in a two-year timeframe.

## Finite Element Models Relating Fault Slip Rates, Geodetic Deformation, Fault Geometries and Stress Evolution in the Southern California Fault System

Carl Gable (EES-6)

LANL has developed unique expertise and tools (LaGriT: Los Alamos Grid Toolkit) for building finite element meshes for geological applications. The task of building finite element meshes and the training of MIT student, Jingning Lu,

as required for the project outlined above, will be the main objective of the LANL portion of this project. This involves LANL because the capability to build these finite element meshes specialized for geologic applications that seamlessly interface with the PyLith physics code is unique to LANL.

## High Surface Area Nano-Structured Cobalt Foams for Catalysis Discovery

Bryce Tappan (DE-6)

Development of nanoporous cobalt foams containing the properties needed by Total American Services, namely, monolith size, strength and surface area. The method was developed by Tappan et al. for production of nanostructured monolithic metals, including the catalyst of interest, metallic cobalt, and draw on the unique capabilities of LANL in the areas of energetic materials synthesis and handling, as well as facilities to perform combustion synthesis experimentation. The self-propagating high temperature synthesis method produces unique nano-structured metals, yet the exact structure, surface area and monolith particle size pertinent to this work have not been fully explored. This synthesis method is rapid and produces a nanostructured material with tremendous exposed surface area – ideal for improved catalysis. The study of transitional metal complexes containing high nitrogen complexes, and the metal monoliths formed

in the combustion synthesis is a fertile and relatively unexplored field. Due to the numerous high nitrogen ligand/transition metal combinations, a wide variety of novel materials can be made and possibly tailored to study their ability to form nanoporous metallic structures. We have already discovered the highly promising result that the thermal decomposition of a high-nitrogen iron (III) and cobalt (III) complex under an inert atmosphere can lead to the generation of porous metal materials containing cells on the micron and nanometer scale. This material was generated to provide a material with the incredibly low density of 0.01 g/cm<sup>3</sup> (for comparison, ultra-low density aluminum foam has a density of 0.08-0.16 g/cm<sup>3</sup>), with surface areas as high as 258 m<sup>2</sup>/g. The objective of this work here is to provide nanostructured Co foam with the required structural integrity to undergo catalytic testing, which will also have significantly greater surface areas than existing supported Co catalysts.

### **Statistical and Data Manager – Pediatric Analyses**

Brian Foley (T-10)

The HIV Databases at LANL ([www.hiv.lanl.gov](http://www.hiv.lanl.gov)) are the global repository of HIV-1 DNA and protein sequence data, as well as data on HIV-1 drug resistance mutations. The analysis of HIV-1 sequence data from AIDS clinical trials can be complex and expertise at the LANL

HIV Databases has proven useful in understanding the mutations, which have led to drug resistant viruses and treatment failure among individuals in AIDS clinical trials.

### **Statistical and Data Management – Adult Analyses**

Brian Foley (T-10)

LANL will be devoted to developing protocols, methods, and software programs for the analysis of AIDS Clinical Trials Group (ACTG) data being analyzed by the Harvard AIDS Institute's Statistical and Data Analysis Center. Areas of expertise in HIV/AIDS research are the phylogenetic analyses of genetic sequence data, and the evolution of drug resistance in HIV-1. Part time is devoted to reading the current literature on HIV drug resistance to stay updated on recent studies. LANL will also utilize the complete data set in the HIV Genetic Sequences and Drug Resistances Databases at LANL to provide "background" sets against which the ACTG trial data sets can be compared.

### **Techfam Basic Training**

Timothy White (NN)

This block of instruction is designed to prepare personnel in support of national emergency response priorities in the fields of nuclear non-proliferation, detection, and consequence management. Sponsor receives technical instruction and

information as it pertains to their mission focus.

### **GHAVE Sequence Database; 10 Sequence Analysis/AIDS Vaccine Discovery Comprehensive Antibody Vaccine Immune Monitoring Consortium**

Bette Korber (T-10)

The proposed study will enable both standardization and detailed characterization of neutralizing antibody characteristics of sera derived from HIB positive individuals during acute infection and vaccine recipients. This will provide a framework to define subtle improvements in vaccine elicited neutralizing antibody intensity and cross-reactivity and to combine strategies that show promise, as well to rationally selected and design new vaccine reagents based on antigenic characteristics of proteins of known sequences. A critical element will be the integration of the results from different studies enabling direct comparisons. The Los Alamos-specific compartment of our larger database, tailored to meet the needs of this project. Second, we will provide a web-based, publicly searchable face of the published data from the consortium to facilitate open exchange of information. Third, we will assist with the analysis and interpretation of complex patterns of immunological reactivity and sequence variation.

## Thermoacoustic Space Power Generator

Scott Backhaus (MPA-10)

Los Alamos National Laboratory (LANL) will develop a design for a thermoacoustic engine to be mated to an electrodynamic linear alternator that is suited for operation aboard satellites in low-earth orbit. The design of the thermoacoustic engine will take place at LANL because LANL has significant experience in this area which is not present in the private sector.

## Isotopic Uranium Analysis of Groundwater

Michael Murrell (C-NR)

Uranium processing within the nuclear and defense industrial complex has been developed to produce a range of different compositions with differing amounts of isotopic components. Primarily these compositions involve enrichment or depletion in  $^{235}\text{U}$ . The three nominal end-member compositions for uranium present at Rocky Flats Environmental Technology Sites (RFETS) are natural, highly-enriched, and depleted. In general, highly enriched uranium was carefully physically controlled, recycled and subject to accounting. Depleted uranium was less valuable and substantial amounts were discharged to waste treatment systems, with relatively high levels discharged to the Solar Ponds. Natural uranium was not directly processed at RFETS, but

is present in relatively high concentrations in the geologic units that underlie the facility.

The purpose of this effort is to quantitatively evaluate the isotopic compositions of field samples from RFETS. Uranium isotopic compositions include four isotopes (masses 234, 235, 236 and 238). Of these isotopes, three are naturally present (masses 234, 235, 238), and the isotope with mass 236 is present due to reactions that occur within nuclear reactors. The RFETS Actinide Migration Evaluation project has, therefore, utilized the presence and amount of  $^{236}\text{U}$  as the indicator of uranium contamination. Uranium isotopic measurements are conventionally presented as ratios to  $^{238}\text{U}$ , and for the purpose of evaluating isotopic compositions at RFETS, LANL will utilize ratios of atoms.

## Center for Evolutionary and Theoretical Immunology

Alan Perelson (T-10)

The Center for Evolutionary and Theoretical Immunology (CETI) was established as a Center of Biomedical Research Excellence (COBRE) in September 2003, with funding from the National Center for Research Resources (NCRR) of the National Institutes of Health (NIH) and was awarded Category I Center status from the College of Arts and Sciences at the University of New Mexico in April 2006.

CETI is an interdisciplinary initiative that conducts empirical and

theoretical research on innate and adaptive immunity using a wide array of approaches and models. CETI is formed by scientists from the University of New Mexico's Department of Biology and Department of Computer Science, Los Alamos National Laboratory, and the Santa Fe Institute. CETI's administrative offices are located on UNM's main campus within the Biology Department in Castetter Hall.

CETI's main purpose is to foster the career development of junior scientists with expertise in evolutionary and theoretical immunology. It is expected that junior scientists supported by this project will compete successfully for NIH grants, which will allow them to continue their projects funded initially by CETI.

This project involves modeling the immune system and its response to viral and bacterial infections to increase our understanding of basic biological processes underlying disease pathogenesis, such as the rate of viral production *in vivo* and the death rates of productive infected cells.

## User Facility Agreements Executed in Fiscal Year 2007

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.

### Weapons Neutron Research Facility

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

The NSEU Sensitivity of Static Latch and Flash Based Programmable Logic

Neutron-induced Soft Error and Latch-up Sensitivity in 65 nm and 90 nm SRAM Memories and Logic Devices

Accelerated Characterization of the Rate of Soft Errors Caused by Cosmic Neutrons in 0.065 micron SPARC Microprocessor Cells

Single Event Effects on SOI Devices and on DRAM Memories

Accelerated Soft Error Rate Testing of AMD's Single and Multicore Opteron Microprocessors

Soft Error Characterization of Advanced CMOS Technologies on Asics and Other Components

New Measurement Techniques for DRAM Single-Event Upsets

Single-Event Effect of Neutron Test on Microelectronics Devices

Measurement of Neutron Induced Event on Latest CMOS Technologies: SEU, SEL, SEFI and Other Failures: Application to Logic Devices

Measurements of neutron-induced soft error rate in 65 nm-generation servers, and high performance 90 nm and 65 nm microprocessor chips as well as 90 nm, 65 nm, and 45 nm test structures

Neutron SEU and SEL Testing of Commercial SRAMs, DRAMs, FPGAs, ASICs, and Logic and Linear Devices

Power Device Evaluation

Accelerated Characterization of the Rate of Cosmic Neutron Induced Soft Errors in Multi-core 0.065 micron SPARC Microprocessors

Neutron Soft Error Time-to-fail and Data Corruption Rate Measurements  
Study of Advanced SOI Technologies – Investigation of SEU and SET

## Distinguished Awards

### 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.

#### *2007 Award Winner*

The 2007 Distinguished Patent Award goes to the patent titled "Noninvasive Characterization of a Flowing Multiphase Fluid Using Ultrasonic Interferometry," submitted by Dipen N. Sinha of MPA-11 (Sensors and Electrochemical Devices). This patent, along with several other pieces of intellectual property, has been licensed to Safety Scan and Chevron and was previously licensed to Edge Technologies for use in water testing and oil and gas applications.

The patented invention is an apparatus and method that uses ultrasound to noninvasively monitor the flow rate and/or the composition of a flowing fluid. The basis of the invention is the finding that changes in the composition and flow rate of a flowing fluid can be determined by exciting the fluid with a swept frequency

ultrasonic signal. In particular, Sinha found that the positions of the resonance peaks for the fluid change as the composition of the fluid and the flow rate of the fluid change.

He also found that the spacings between successive resonance peaks change in response to changes in composition but not to changes in flow rate. Thus, by measuring the resonance positions and the spacings between them, the flow rate and composition of the flowing fluid may be determined.

### Distinguished Copyright Award

The Distinguished Copyright Award honors the authors of disclosed copyrighted materials that are considered extraordinary creations. Nominated copyrights for this award demonstrate a breadth of commercial applications, potential to create economic value, and the highest level of technical excellence. In addition, these works represent vital contributions to the Laboratory's mission and provide reciprocal benefit to the Laboratory programs under which they were developed.

Recipients of this award are true innovators in their field and advance the Laboratory's reputation in scientific excellence through their copyrighted works and software.

#### *2007 Award Winner*

The 2007 Distinguished Copyright Award goes to the copyright "EpiCast™" by Tim Germann of the

Theoretical Chemistry and Molecular Physics Group (T-12). EpiCast™ (epidemiological forecasting) was designed to help epidemiologists understand the spread and impact of an avian influenza (H5N1) pandemic. The system models the pandemic at the individual human level using the most current data on the natural and deliberate spread of pathogens in human populations.

The computer simulation models a synthetic population that matches available census demographics and worker mobility data by randomly assigning the simulated individuals to households, workplaces, and schools and using travel data to model long-distance trips, realistically capturing the spread of the pandemic virus by airplane and other passenger travel. Additionally, the model of disease transmission involves probabilities that any two people in a population will meet on any given day in any one of a number of settings, such as home or workplace.

EpiCast™ can be used to assist corporate and government policymakers with planning strategies at all levels (community, work, school, etc.) to help mitigate the effects of serious disease outbreaks while maintaining critical business and government operations. It has the additional advantages of being flexible with regard to data type and input methods and adaptable to other virulent and seemingly random processes.

## 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, recipients' commercialization track record has served to enhance the reputations of Los Alamos National Security LLC and the Laboratory.

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.

### *2007 Award Winner*

The 2007 recipient of the Distinguished Licensing Award is Yusheng Zhao of LANSCE-LC (Lujan Neutron Scattering Center). Zhao is the inventor of a novel nanostructured composite that consists of diamond particles embedded in a matrix of nanocrystalline silicon carbide. The superhard, ultratough nanocomposites have been exclusively licensed to US Synthetic, which leads the industry in the development and production of polycrystalline diamond cutters for

oil and gas exploration. Along with this breakthrough technology, Zhao has demonstrated outstanding success in transferring this technology with his participation in technical discussions in understanding the value of the technology and how it could be integrated into the existing processes of the company. He has demonstrated the strengths and limitations of the technology and how to best facilitate the technology's entrance into the commercial world. Zhao provided valuable written descriptions to the company that allowed it to effectively apply the technology to create the world's toughest synthetic drill bits. US Synthetic's super hard drill bits, made possible by Zhao's innovation and participation in the transfer of this technology, are being used today in oil exploration all over the globe. Without enthusiastic and dedicated scientists such as Zhao the world would still be using inferior drill bits for oil exploration.

## Programmatic Impact Award

The Programmatic Impact 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 a technology transfer mechanism (Cooperative Research and Development Agreement, Work for Others, Licensing, User Facility Agreement, 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 demonstrate stellar technical prowess as well as the innovation and creativity needed to demonstrate excellence in both programmatic and commercial applications.

#### *2007 Award Winners*

Geoffrey S. Waldo and Stephanie Cabantous, of Bioscience, Advanced Measurement Sciences Group (B-9), are the recipients of the 2007 Programmatic Impact Award for their work on the Green Fluorescent Protein (GFP) technology. One of their major accomplishments in this field is development of the GFP Toolbox designed to help scientists understand and solve the mysteries of protein dysfunction—the cause of many diseases—including misfolding, aggregation, and abnormal movement.

The GFP Toolbox includes four GFP-based tools: Folding Reporter, SuperFolder, Insertion, and Split GFP. This suite enables researchers to perform experiments impossible to do with conventional GFP. Folding Reporter reports on the success of a target protein's folding and solubility. It is used by over 100 labs and has been cited in over 300 publications in a wide range of fields including structural genomics and drug discovery. SuperFolder reports on a target protein's expression and is a more robustly folded Version of Folding Reporter. Insertion GFP, a

suite of four unique GFP variants, is the most advanced protein-folding reporter tool currently available. Split GFP solves problems associated with tagging target proteins using standard, somewhat bulky GFP by providing a GFP  $\mu$ Tag—a small, 15 amino acid fragment of the GFP. Split GFP, the most advanced tool in the toolbox, can be used to localize proteins and determine protein-protein interactions.

The GFP technology supports the Laboratory's Structural Genomics program. Structural genomics is an effective short-term means of obtaining structural information on proteins of high medical, biological, or biophysical interest, including proteins from pathogens or those involved in human disease. As part of a team that pioneered the field of structural genomics and assisted in founding the International Structural Genomics organization, Waldo's and Cabantous's work focuses on development of technologies that allow rapid protein structure determination and on production of purified proteins and determination of their three-dimensional structures as part of the National Institutes of Health Protein Structure Initiative for the Laboratory.

GFP has been licensed to Merck & Co. Inc. and Johnson & Johnson for commercial uses and many non-commercial licensees have used the GFP technology. The participation by industry allows our inventors to improve the technology for both industrial uses and NIH mission-critical uses.

## **2007 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 act as a role model for regional innovation.

#### *2007 Award Winners*

The recipients of the 2007 Regional Impact Award are Laboratory inventors Steven Graves, Gregory Goddard, John Martin, Robert Habbersett, and Mark Naivar of the Bioscience Division, and Gregory Kaduchak and Michael Ward of Acoustic Cytometry Systems Inc. of Los Alamos.

The Los Alamos-based company is a biotech startup commercializing

a revolutionary method developed at the Laboratory for concentrating and aligning particles in a capillary. The company's first product line will be a platform of novel cell analysis instruments initially targeted at life science research and ultimately deployed for clinical diagnostics. The company's commercial goal is to create proprietary instruments and applications with unique capabilities starting with breakthrough solutions in cellular analysis and sample preparation. The second product line will be used to wash and concentrate cells and particles. Washing and concentration are standard manual steps in clinical and research sample preparation. Acoustic focusing provides the unique capability to automate this process—saving time and labor and improving quality.

One of the inventors, Greg Kaduchak, is currently on Entrepre-

neurial Leave of Absence from the Laboratory to help ACS commercialize its invention. The company's proprietary technology provides the unprecedented ability to concentrate and align particles in a flow system. With acoustic focusing, density-based separations are possible in automated flow systems rather than a centrifuge. Acoustic focusing also enables a wide range of new cell analysis techniques.

In 2007, ACS received an award from the LANS Venture Acceleration Fund that supported development of the company's first integrated working prototype.

Founder, president, and CEO John Elling, says, "The technical success of the project has enabled ACS to grow to eight employees in less than a year and to secure critical seed funding from private seed investors."



## IDEAS

The Technology Transfer (TT) 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 three years since the launch of IDEAS.

Coming soon, IDEAS 2.0, a more robust system, will expedite the disclosure process even more and 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



## Technology Transfer Division Regional Economic Development Programs

Since 1997, the Technology Transfer (TT) 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. Specific programs and initiatives include:

### Internal 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 \$2.4 million in 45 projects, including helping to launch five startup companies that have cumulatively raised over \$7 million in private investment.

### LANS Venture Acceleration Fund

The LANS Venture Acceleration Fund (VAF) supports projects that facilitate the creation and growth of regional businesses

based on Los Alamos National Laboratory (LANL) technology or expertise. Each year, the LANS Venture Acceleration Fund provides investments of up to \$100,000 to facilitate 3–5 projects with regional entrepreneurs, companies, investors, or strategic partners. Proposals submitted to the LANS Venture Acceleration Fund must describe projects that develop and refine novel solutions for which strong market demand has been demonstrated and through which regional economic development can be achieved. Projects must be driven by clear, distinct, and achievable commercial milestones within a specified timeframe. Evaluation criteria include regional impact, team composition, technical feasibility, market opportunity, and the availability of matching funds or in-kind contributions. To date, six LANL licensees have received VAF funds to advance company milestones.

### Entrepreneurial Leave of Absence (ELOA) Program

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**

TT works with our 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; 87 of these are startups

### **Visiting Entrepreneurs**

The Visiting Entrepreneurs program seeks to build on successful experience while tailoring new approaches

to foster entrepreneurial efforts within the Laboratory and to pioneer a streamlined process for spinning out certain strategic technologies. The Visiting Entrepreneurs work closely with TT and technical staff to help them identify product concept roadblocks, product development technical milestones and funding requirements, viable commercialization paths and, as appropriate, key staff that may be needed for a new spin-out opportunity.

### **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.



## 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*

John Mott, 665-0883

*Chief of Staff*

David Holmes, 665-6747

### **Contracts Management**

*Contract Compliance Manager*

Susan Brockway, 665-7677

### **Technology Management Office**

*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 Management**

*Program Manager*

Ken Freese, 667-1928

*Intellectual Property Specialist*

Christine Ramos, 665-6846

*Patent Analyst*

Marcus Lucero, 665-6569

*Competitive Intelligence Analyst*

Donna Berg, 667-8129

### **Laboratory Counsel**

*Laboratory Counsel*

Steven Porter, 667-3970

### **Intellectual Property Office**

*Group Leader*

Bruce Cottrell, 667-9168

*Patent Agent*

Sam Borkowsky, 665-3111

*General Law*

David Salazar, 665-6697

*Patent Attorney*

Juliet Jones, 606-2235

### **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/)

