

# *Outstanding Innovation*

2006 Technology Transfer Awards



*Carrying on the tradition of world-changing innovation*



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Thursday, May 10, 2007  
Los Alamos National Laboratory  
Los Alamos, New Mexico







**W**elcome to the ninth Annual Technology Transfer Awards Reception—previously known as the Patent and Licensing Awards. During the past year the national challenge to maintain leadership in innovation has been highlighted in reports by the National Academy of Sciences and Congress and in many articles in the media. The challenge is critical for government labs as competition in technology innovation and for funding and scientific talent increases worldwide, while threats to our national security continue to multiply.

That is why I am so pleased this evening to honor our Laboratory innovators for their impressive body of innovative work, protected by patents and copyrights, that we share with industry and other research institutions through licenses and cooperative work agreements.

In this time of transition and change, this assemblage of creative and enterprising Laboratory staff and their inventions demonstrates the Laboratory's ongoing commitment to ensuring the most effective and broadest applications of our science to solve society's technical challenges. This world-class science and involvement in commercialization activities brings public recognition and enhances the Laboratory's reputation for seeking opportunities to share our mission related work. This in turn helps us attract and retain some of the best scientists in the nation and helps ensure trust in our ability to continue generating exceptional work to meet the challenges of a rapidly changing world.

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

A handwritten signature in black ink that reads "Michael R. Anastasio". The signature is written in a cursive, flowing style.

Michael R. Anastasio  
Laboratory Director



## Keynote Speaker: Mark Crowell

University of North Carolina, Chapel Hill

Mark Crowell is Associate Vice Chancellor for Economic Development and Technology Transfer at the University of North Carolina at Chapel Hill. Prior to joining UNC, he held similar positions at North Carolina State University and at Duke University. He has extensive experience in technology transfer, new company development, seed capital formation, and research park development and marketing. Since his arrival in September 2000, UNC-Chapel Hill has helped launch 34 startup companies to commercialize research discoveries. On behalf of UNC, Mark sits on the boards of major statewide and regional economic development and entrepreneurial support agencies in North Carolina, including the North Carolina Biotechnology Center, the Council for Entrepreneurial Development, the Research Triangle Regional Partnership, and the Orange County Economic Development Commission.

Mr. Crowell was the President of the Association of University Technology Managers (AUTM) for 2005. AUTM is the pre-eminent international organization representing the field of academic technology transfer and has a membership of nearly 3,500 professionals, almost 12 percent of whom are from outside North America. Mr. Crowell has extensive national and international speaking, consulting, and management experience in organizations and initiatives related to technology transfer and innovation-based economic development. During the past two years, he has made keynote addresses on technology transfer and innovation-based economic development at conferences and symposia in Singapore, Japan, Korea, the Netherlands, the United Kingdom, Australia, Taiwan, Thailand, Israel, and the U.S. He consults with a number of U.S. academic and policy groups and associations, including the American Association for the Advancement of Science, the National Academies of Science, and the National Governors' Association.

Mr. Crowell is a member of the Los Alamos National Laboratory Technology Transfer External Advisory Board.

## Abstracts of Issued Patents

Listings are in accordance with issue dates from beginning to end of fiscal year 2006

### Sample Desorption/Ionization from Mesoporous Silica

Srinivas Iyer (B-2)  
Andrew M. Dattelbaum (MPA-CINT)  
U.S. Patent 6,958,480

Mesoporous silica is shown to be a sample holder for laser desorption/ionization of mass spectrometry. Supported mesoporous silica was prepared by coating an ethanolic silicate solution having a removable surfactant onto a substrate to produce a self-assembled, ordered, nanocomposite silica thin film. The surfactant was chosen to provide a desired pore size between about 1 nanometer diameter and 50 nanometers diameter. Removal of the surfactant resulted in a mesoporous silica thin film on the substrate. Samples having a molecular weight below 1000, such as C<sub>60</sub> and tryptophan, were adsorbed onto and into the mesoporous silica thin film sample holder and analyzed using laser desorption/ionization mass spectrometry.

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

Dipen N. Sinha (MPA-11)  
U.S. Patent 6,959,601

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.

### Durable Electrooptic Devices Comprising Ionic Liquids

Anthony K. Burrell (MPA-MC)  
Benjamin P. Warner (MPA-MC)  
Thomas M. McCleskey (MPA-MC)  
U.S. Patent No. 6,961,168

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<sub>3</sub> SO<sub>3</sub><sup>-</sup>), bis(trifluoromethylsulfonyl)imide ((CF<sub>3</sub> SO<sub>2</sub>)<sub>2</sub>N<sup>-</sup>), bis(perfluoroethylsulfonyl)imide ((CF<sub>3</sub> CF<sub>2</sub> SO<sub>2</sub>)<sub>2</sub> N<sup>-</sup>) and tris(trifluoromethylsulfonyl)methide ((CF<sub>3</sub> SO<sub>2</sub>)<sub>3</sub> C<sup>-</sup>).

Electroluminescent, electrochromic and photoelectrochromic devices with nanostructured electrodes include ionic liquids with bifunctional redox dyes.

### Methods of Conditioning Direct Methanol Fuel Cells

Cynthia A. Rice (MPA-11)  
Xiaoming Ren (MPA-11)  
Shimshon Gottesfeld (MPA-11)  
U.S. Patent No. 6,962,760

Methods for conditioning the membrane electrode assembly of a direct methanol fuel cell (DMFC) are disclosed. In a first method, an electrical current of polarity opposite to that used in a functioning direct methanol fuel cell is passed through the anode surface of the membrane electrode assembly. In a second method, methanol is supplied to an anode surface of the membrane electrode assembly, allowed to cross over the polymer electrolyte membrane of the membrane electrode assembly to a cathode surface of the membrane electrode assembly, and an electrical current of polarity opposite to that in a functioning direct methanol fuel cell is drawn through the membrane electrode assembly, wherein methanol is oxidized at the cathode surface of the membrane electrode assembly while the catalyst on the anode surface is reduced. Surface oxides on the direct methanol fuel cell anode catalyst of the membrane electrode assembly are thereby reduced.

### Method for Detecting Biological Agents

Liaohai Chen (B-4)  
Duncan McBranch (TT-DO)  
Hsing-Lin Wang (C-PCS)  
David G. Whitten (B-4)  
U.S. Patent 6,979,543

A sensor is provided including a polymer capable of having an alterable measurable property from the group of luminescence and electrical conductivity, the polymer having an intermediate combination of a recognition element, a tethering element and a property-altering element bound thereto and capable of altering the measurable property, the intermediate combination adapted for subsequent separation from the polymer upon exposure to an agent having an affinity for binding to the recognition element whereupon the separation of the intermediate combination from the polymer results in a detectable change in the alterable measurable property, and, detecting said detectable change in the alterable measurable property.

### Fuel Cell Stack with Passive Air Supply

Xiaoming Ren (MPA-11)  
Shimshon Gottesfeld (MPA-11)  
U.S. Patent 6,986,961

A fuel cell stack has a plurality of polymer electrolyte fuel cells (PEFCs) where each PEFC includes a rectangular membrane electrode assembly (MEA) having a fuel flow field along a first axis and an air flow field along a second axis perpendicular to the

first axis, where the fuel flow field is long relative to the air flow field. A cathode air flow field in each PEFC has air flow channels for air flow parallel to the second axis and that directly open to atmospheric air for air diffusion within the channels into contact with the MEA.

### Buffered Coscheduling for Parallel Programming and Enhanced Fault Tolerance

Fabrizio Petri (CCS-3)  
Wu-Chun Feng (N-2)  
U.S. Patent 6,993,764

A computer implemented method schedules processor jobs on a network of parallel machine processors or distributed system processors. Control information communications generated by each process performed by each processor during a defined time interval is accumulated in buffers, where adjacent time intervals are separated by strobe intervals for a global exchange of control information. A global exchange of the control information communications at the end of each defined time interval is performed during an intervening strobe interval so that each processor is informed by all of the other processors of the number of incoming jobs to be received by each processor in a subsequent time interval. The buffered coscheduling method of this invention also enhances the fault tolerance of a network of parallel machine processors or distributed system processors



## Multilayer Composites and Manufacture of Same

Terry G. Holesinger (MPA-STC)  
 Quanxi Jia (MPA-STC)  
 U.S. Patent 6,994,775

The present invention is directed toward a process of depositing multilayer thin films, disk-shaped targets for deposition of multilayer thin films by a pulsed laser or pulsed electron beam deposition process, where the disk-shaped targets include at least two segments with differing compositions, and a multilayer thin film structure having alternating layers of a first composition and a second composition, a pair of the alternating layers defining a bi-layer wherein the thin film structure includes at least 20 bi-layers per micron of thin film such that an individual bi-layer has a thickness of less than about 100 nanometers.

## Cross-Linked Polybenzimidazole Membrane for Gas Separation

Jennifer S. Young (X-2-N2)  
 Gregory S. Long (PMT-1)  
 Brent F. Espinoza (MST-7)  
 U.S. Patent 6,997,971

A cross-linked, supported polybenzimidazole membrane for gas separation is prepared by reacting polybenzimidazole (PBI) with the sulfone-containing crosslinking agent 3,4-dichloro-tetrahydro-thiophene-1,1-dioxide. The cross-linked

reaction product exhibits enhanced gas permeability to hydrogen, carbon dioxide, nitrogen, and methane as compared to the unmodified analog, without significant loss of selectivity, at temperatures from about 20 degrees Celsius to about 400 degrees Celsius.

## Method for Producing Carbon Nanotubes

Jonathan Phillips (MST-7)  
 William L. Perry (DE-6)  
 Chun Ku Chen, Penn State University  
 U.S. Patent 6,998,103

Method for producing carbon nanotubes. Carbon nanotubes were prepared using a low power, atmospheric pressure, microwave-generated plasma torch system. After generating carbon monoxide microwave plasma, a flow of carbon monoxide was directed first through a bed of metal particles/glass beads and then along the outer surface of a ceramic tube located in the plasma. As a flow of argon was introduced into the plasma through the ceramic tube, ropes of entangled carbon nanotubes, attached to the surface of the tube, were produced. Of these, longer ropes formed on the surface portion of the tube located in the center of the plasma. Transmission electron micrographs of individual nanotubes revealed that many were single-walled.

## Methanol-Tolerant Cathode Catalyst Composite for Direct Methanol Fuel Cells

Yimin Zhi (MST-11)  
 Piotr Zelenay (MPA-11)  
 U.S. Patent 7,014,931

A direct methanol fuel cell (DMFC) having a methanol fuel supply, oxidant supply, and its membrane electrode assembly (MEA) formed of an anode electrode and a cathode electrode with a membrane therebetween, a methanol oxidation catalyst adjacent the anode electrode and the membrane, an oxidant reduction catalyst adjacent the cathode electrode and the membrane, comprises an oxidant reduction catalyst layer of a platinum-chromium alloy so that oxidation at the cathode of methanol that crosses from the anode through the membrane to the cathode is reduced with a concomitant increase of net electrical potential at the cathode electrode.

## Influenza Sensor

Basil I. Swanson (C-PCS)  
 Xuedong Song (B-4)  
 Clifford J. Unkefer (B-3)  
 Louis A. Silks III (B-3)  
 Jurgen Schmidt (B-3)  
 U.S. Patent 7,018,792

A sensor for the detection of tetrameric multivalent neuraminidase within a sample is disclosed, where a positive detection indicates the presence of a target virus within the sample. Also disclosed is a trifunctional composition of matter including a trifunctional linker moiety with

groups bonded thereto including (a) an alkyl chain adapted for attachment to a substrate, (b) a fluorescent moiety capable of generating a fluorescent signal, and (c) a recognition moiety having a spacer group of a defined length thereon, the recognition moiety capable of binding with tetrameric multivalent neuraminidase.

### Foil Electron Multiplier

Herbert Funsten (ISR-DO)  
 Juan R. Baldonado (ISR-4)  
 Eric E. Dors (ISR-1)  
 Ronnie W. Harper (ISR-1)  
 Ruth M. Skoug (ISR-1)  
 U.S. Patent 7,019,446

An apparatus for electron multiplication by transmission that is designed with at least one foil having a front side for receiving incident particles and a back side for transmitting secondary electrons that are produced from the incident particles transiting through the foil. The foil thickness enables the incident particles to travel through the foil and continue on to an anode or to a next foil in series with the first foil. The foil, or foils, and anode are contained within a supporting structure that is attached within an evacuated enclosure. An electrical power supply is connected to the foil, or foils, and the anode to provide an electrical field gradient effective to accelerate negatively charged incident particles and the generated secondary electrons through the foil, or foils, to the anode for collection.

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

Gary S. Selwyn (P-24)  
 Ivars Henins (P-24)  
 Jaeyoung Park (P-24)  
 Hans W. Herrmann (P-24)  
 U.S. Patent 7,025,856

Apparatus for the processing of materials involving placing a material either placed between a radio-frequency electrode and a ground electrode, or which is itself one of the electrodes. This is done in atmospheric pressure conditions. The apparatus effectively etches or cleans substrates, such as silicon wafers, or provides cleaning of spools and drums and uses a gas containing an inert gas and a chemically reactive gas.

### Through-the-Earth Radio

David W. Reagor (MPA-STC)  
 Jose Vasquez-Dominguez (MPA-STC)  
 U.S. Patent 7,043,204

A method and apparatus for effective through-the-earth communication involves a signal input device connected to a transmitter operating at a predetermined frequency sufficiently low to effectively penetrate useful distances through-the earth, and having an analog to digital converter receiving the signal input and passing the signal input to a data compression circuit that is connected to an encoding processor, the encoding

processor output being provided to a digital to analog converter. An amplifier receives the analog output from the digital to analog converter for amplifying said analog output and outputting said analog output to an antenna. A receiver having an antenna receives the analog output, passes the analog signal to a band-pass filter whose output is connected to an analog to digital converter that provides a digital signal to a decoding processor whose output is connected to a data decompressor, the data decompressor providing a decompressed digital signal to a digital to analog converter. An audio output device receives the analog output from the digital to analog converter for producing audible output.

### Radial-Radial Single Rotor Turbine

David Platts (P-22)  
 U.S. Patent 7,044,718

A rotor for use in turbine applications has a radial compressor/pump having radially disposed spaced apart fins forming passages and a radial turbine having hollow turbine blades interleaved with the fins and through which fluid from the radial compressor/pump flows. The rotor can, in some applications, be used to produce electrical power.

## Method and Apparatus for Elemental and Isotope Measurements and Diagnostics—Microwave Induced Plasma-Cavity Ringdown Spectroscopy

Yixiang Duan (C-CSE)  
U.S. Patent 7,054,008

Provided is a novel system for conducting elemental measurements using cavity ring-down spectroscopy (CRDS). The present invention provides sensitivity thousands of times improved over conventional devices and does so with the advantages of low power, low plasma flow rate, and the ability being sustained with various gases.

## Diamond-Silicon Carbide Composite

Jiang Quian (LANSCE-LC)  
Yusheng Zhao (LANSCE-LC)  
U.S. Patent 7,060,641

Fully dense, diamond-silicon carbide composites are prepared from ball-milled microcrystalline diamond/amorphous silicon powder mixture. The ball-milled powder is sintered (P=5, 8 GPa, T=1400K-2300K) to form composites having high fracture toughness. A composite made at 5 GPa/1673K had a measured fracture toughness of  $12 \text{ MPa} \cdot \text{m}^{1/2}$ . By contrast, liquid infiltration of silicon into diamond powder at 5 GPa/1673K produces a composite with higher hardness but lower fracture toughness. X-ray diffraction patterns and Raman spectra

indicate that amorphous silicon is partially transformed into nanocrystalline silicon at 5 GPa/873K, and nanocrystalline silicon carbide forms at higher temperatures.

## Nonthermal Plasma Processor Utilizing Additive-Gas Injection and/or Gas Extraction

Louis A. Rosocha (P-24)  
U.S. Patent 7,063,819

A device for processing gases includes a cylindrical housing in which an electrically grounded, metal injection/extraction gas supply tube is disposed. A dielectric tube surrounds the injection/extraction gas supply tube to establish a gas modification passage therearound. Additionally, a metal high voltage electrode circumscribes the dielectric tube. The high voltage electrode is energizable to create nonthermal electrical microdischarges between the high voltage electrode and the injection/extraction gas supply tube across the dielectric tube within the gas modification passage. An injection/extraction gas and a process gas flow through the nonthermal electrical microdischarges within the gas modification passage and a modified process gas results. Using the device contaminants that are entrained in the process gas can be destroyed to yield a cleaner, modified process gas.

## Electrochromic Salts, Solutions and Devices

Anthony K. Burrell (MPA-MC)  
Benjamin P. Warner (MPA-MC)  
Thomas M. McCleskey (MPA-MC)  
U.S. Patent 7,064,212

Electrochromic salts. Electrochromic salts of dicationic viologens such as methyl viologen and benzyl viologen associated with anions selected from bis(trifluoromethylsulfonyl)imide, bis(perfluoroethylsulfonyl)imide, and tris(trifluoromethylsulfonyl) methide are produced by metathesis with the corresponding viologen dihalide. They are highly soluble in molten quarternary ammonium salts and together with a suitable reductant provide electrolyte solutions that are used in electrochromic windows.

## Preparation of DNA-Containing Extract for PCR Amplification

John M. Dunbar (B-1)  
Cheryl R. Kuske (B-1)  
U.S. Patent 7,074,565

Environmental samples typically include impurities that interfere with PCR amplification and DNA quantitation. Samples of soil, river water, and aerosol were taken from the environment and added to an aqueous buffer (with or without detergent). Cells from the sample are lysed, releasing their DNA into the buffer. After removing insoluble cell components, the remaining soluble DNA-containing extract is treated with N-phenacylthiazolium bromide, which causes rapid

precipitation of impurities. Centrifugation provides a supernatant that can be used or diluted for PCR amplification of DNA, or further purified. The method may provide a DNA-containing extract sufficiently pure for PCR amplification within 5–10 minutes.

### Chemical Synthesis of Chiral Conducting Polymers

Hsing-Lin Wang (C-PCS)  
Wenguang Li (C-PCS)  
U.S. Patent 7,074,887

A process of forming a chiral conducting polymer, e.g., polyaniline, is provided including reacting a monomer, e.g., an aniline monomer, in the presence of a chiral dopant acid to produce a first reaction mixture by addition of a solution including a first portion of an oxidizing agent, the first portion of oxidizing agent characterized as insufficient to allow complete reaction of the monomer, and further reacting the first reaction mixture in the presence of the chiral dopant acid by addition of a solution including a second portion of the oxidizing agent, the second portion of oxidizing agent characterized as insufficient to allow complete reaction of the monomer, and repeating the reaction by addition of further portions of the oxidizing agent until the monomer reaction is complete to produce a chiral conducting polymer, e.g., polyaniline. A preferred process includes addition of a catalyst during the reaction,

the catalyst selected from among the group consisting of phenylene diamine, aniline oligomers, and amino-capped aniline oligomers and metal salts. The processes of the present invention further provide a resultant polyaniline product having a chirality level defined by a molar ellipticity of from about  $40 \times 10^3$  degree-cm<sup>2</sup>/decimole to about  $700 \times 10^3$  degree-cm<sup>2</sup>/decimole. The processes of the present invention further provide a resultant polyaniline product having a nanofiber structure with a diameter of from about 30 nanometers to about 120 nanometers and from about 1 micron to about 5 microns in length.

### Preparation of High-Strength Nanometer Scale Twinned Coating and Foil

Xinghang Zhang (MPA-CINT)  
Amit Misra (MPA-CINT)  
Michael A. Nastasi (MPA-CINT)  
Richard G. Hoagland (MST-8)  
U.S. Patent 7,078,108

Very high strength single phase stainless steel coating has been prepared by magnetron sputtering onto a substrate. The coating has a unique microstructure of nanometer spaced twins that are parallel to each other and to the substrate surface. For cases where the coating and substrate do not bind strongly, the coating can be peeled off to provide foil.

### Neutron and Gamma Detector Using an Ionization Chamber with an Integrated Body and Moderator

Kiril D. Ianakiev (N-1)  
Martyn T. Swinhoe (N-1)  
John P. Lestone (N-1)  
U.S. Patent 7,078,705

A detector for detecting neutrons and gamma radiation includes a cathode that defines an interior surface and an interior volume. A conductive neutron-capturing layer is disposed on the interior surface of the cathode and a plastic housing surrounds the cathode. A plastic lid is attached to the housing and encloses the interior volume of the cathode forming an ionization chamber, into the center of which an anode extends from the plastic lid. A working gas is disposed within the ionization chamber and a high biasing voltage is connected to the cathode. Processing electronics are coupled to the anode and process current pulses which are converted into Gaussian pulses, which are either counted as neutrons or integrated as gammas, in response to whether pulse amplitude crosses a neutron threshold. The detector according to the invention may be readily fabricated into single or multilayer detector arrays.

## Letter-Box-Line Blackener for the HDTV/Conventional Analog Hybrid System

Frederick J. Wysocki (P-DO)  
George Nickel (P-22)  
U.S. Patent 7,079,192

A blackener for letter box lines associated with an HDTV/conventional-analog hybrid television transmission where the blackener counts horizontal sync pulses contained in the HDTV/conventional-analog hybrid television transmission and determines when the HDTV/conventional-analog hybrid television transmission is in letter-box lines: if it is, then the blackener sends substitute black signal to an output; and if it is not, then the blackener sends the HDTV/conventional-analog hybrid television transmission to the output.

## Vision-Based Obstacle Avoidance

John M. Galbraith (P-21)  
U.S. Patent 7,079,924

A method for allowing a robot to avoid objects along a programmed path: first, a field of view for an electronic imager of the robot is established along a path where the electronic imager obtains the object location information within the field of view; second, a population coded control signal is then derived from the object location information and is transmitted to the robot; finally, the robot then responds to the control signal and avoids the detected object.

## Apparatus and Method for Temperature Correction and Expanded Count Rate of Inorganic Scintillation

Kiril D. Ianakiev (N-1)  
Sin-Tao Hsue (N-1)  
Michael C. Browne (N-1)  
Jeffrey M. Audia (N-1)  
U.S. Patent 7,081,626

The present invention includes an apparatus and corresponding method for temperature correction and count rate expansion of inorganic scintillation detectors. A temperature sensor is attached to an inorganic scintillation detector. The inorganic scintillation detector, due to interaction with incident radiation, creates light pulse signals. A photoreceiver processes the light pulse signals to current signals. Temperature correction circuitry that uses a fast light component signal, a slow light component signal, and the temperature signal from the temperature sensor to corrected an inorganic scintillation detector signal output and expanded the count rate.

## Oxygen-Consuming Chlor-Alkali Cell Configured to Minimize Peroxide Formation

Jerzy B. Chlistunoff (MPA-11)  
Shimshon Gottesfeld (MPA-11)  
U.S. Patent 7,083,708

Oxygen-consuming zero gap chlor-alkali cell was configured to minimize peroxide formation. The cell

included an ion-exchange membrane that divided the cell into an anode chamber including an anode and a cathode chamber including an oxygen gas diffusion cathode. The cathode included a single-piece of electrically conducting graphitized carbon cloth. Catalyst and polytetrafluoroethylene were attached to only one side of the cloth. When the cathode was positioned against the cation exchange membrane with the catalyst side away from the membrane, electrolysis of sodium chloride to chlorine and caustic (sodium hydroxide) proceeded with minimal peroxide formation.

## Catalysts for Lean Burn Engine Exhaust Abatement

Kevin C. Ott (MPA-MC)  
Noline C. Clark (C-SIC)  
Mark T. Paffett (MST-6)  
U.S. Patent 7,083,765

The present invention provides a process for catalytically reducing nitrogen oxides in an exhaust gas stream containing nitrogen oxides and a reductant material by contacting the gas stream under conditions effective to catalytically reduce the nitrogen oxides with a catalyst comprising a aluminum-silicate type material and a minor amount of a metal, the catalyst characterized as having sufficient catalytic activity so as to reduce the nitrogen oxides by at least 60 percent under temperatures within the range of from about 200 degrees Celsius to about 400 degrees Celsius.

## Method for Removing Atomic-Model bias in Macromolecular Crystallography

Thomas C. Terwilliger (B-2)  
U.S. Patent 7,085,653

Structure factor bias in an electron density map for an unknown crystallographic structure is minimized by using information in a first electron density map to elicit expected structure factor information. Observed structure factor amplitudes are combined with a starting set of crystallographic phases to form a first set of structure factors. A first electron density map is then derived and features of the first electron density map are identified to obtain expected distributions of electron density. Crystallographic phase probability distributions are established for possible crystallographic phases of reflection  $k$ , and the process is repeated as  $k$  is indexed through all of the plurality of reflections. An updated electron density map is derived from the crystallographic phase probability distributions for each one of the reflections. The entire process is then iterated to obtain a final set of crystallographic phases with minimum bias from known electron density maps.

## Identification Coding Schemes for Modulated Reflectance Systems

Don M. Coates (P-DO)  
Scott D. Briles (ISR-3)  
Daniel L. Neagley (ISR-3)  
David Platts (P-22)  
David Clark (P-23)  
U.S. Patent 7,095,311

An identifying coding apparatus employing modulated reflectance technology involving a base station emitting an RF signal, with a tag, located remotely from the base station and containing at least one antenna and predetermined other passive circuit components, receiving the RF signal and reflecting back to the base station a modulated signal indicative of characteristics related to the tag.

## Methanol-Tolerant Cathode Catalyst Composite for Direct Methanol Fuel Cells

Yimin Zhu (MPA-11)  
Piotr Zelenay (MPA-11)  
U.S. Patent 7,101,635

A direct methanol fuel cell (DMFC) having a methanol fuel supply, oxidant supply, and its membrane electrode assembly (MEA) formed of an anode electrode and a cathode electrode with a membrane therebetween, a methanol oxidation catalyst adjacent the anode electrode and the membrane, an oxidant reduction catalyst adjacent the cathode electrode and the membrane, comprises an oxidant reduction catalyst layer of  $Pt_3Cr/C$  so that oxidation at the cathode of methanol that crosses from the anode through the membrane to the cathode is reduced with a concomitant increase of net electrical potential at the cathode electrode.

## Copyrights Asserted in Fiscal Year 2006 for Commercial Intent

### Nethead, Version 1.0

Susan Coulter (HPC-3)  
Paul Criscuolo (CTN-5)

Nethead is an Intrusion Detection System that utilizes a custom sniffing engine, capable of processing data on a Gigabit network to track conversations across a boundary point. These conversations are analyzed for protocol abuses and summarized into session headers with pertinent payload information. The traffic is analyzed in total to find patterns with other sessions. The results of this analysis are summarized in daily reports. The sessions summaries are saved and are ideal for network forensics.

### Work Package Generator (WPG), Version 1.0

Robert Ryan (CS-OCS-4)

Key features of the PMCP Work Package Generator (WPG) are the following:

1. Single repository for scope, schedule and cost data;
2. Provides consistent data input screens;
3. Server-based which allows for multiple users;
4. Built in revision tracking for change control purposes;
5. Uses the LANL CFO-approved institutional labor rates and categories, known as the Master Resource Dictionary;
6. Automatically loads milestone, deliverable and financial data

imported from P3 into the correct fields;

7. Allows user-selected data to be imported from other work packages;
8. Allows administrative control of data;
9. Provides for standardized work package format and reporting; and
10. Allows cross-cutting summaries of data.

### EnergyFit, Version 1.0

Wu-Chun Feng (N-2)  
Chung-Hsing Hsu (CCS-1)

Today, many computing platforms support a mechanism called dynamic frequency and voltage scaling. However, its use has been relegated to mobile devices (such as laptops) where the frequency and voltage scaling depends on CPU utilization, e.g., when a user is reading a document on his laptop, the CPU utilization is low; therefore, the frequency and voltage can be scaled down to save energy with virtually no performance impact. Unfortunately, such a simple-minded approach does not work for high-performance scientific applications where the CPU utilization is typically quite high. To address this shortcoming, we have developed a novel methodology that we call "beta adaptation." The methodology automatically and transparently scales the frequency and voltage of a processor at run-time based on our newly developed single-

coefficient performance model in order to save energy. The result is an energy savings as high as 70% with minimal performance degradation.

### **aDORe (A Digital Object Repository Environment), Version 1.0.1**

Lyudmila Balakireva (STBPO-RL)  
Jeroen Bekaert (STBPO-RL)  
Xiaoming Liu (STBPO-RL)  
Hans-Thorsten Schwander (STBPO-RL)  
Herbert Van de Sompel (STBPO-RL)

aDORe is a modular, standards-based Digital Object Repository. The aDORe repository architecture, designed and implemented for ingesting, storing, and accessing a vast collection of Digital Objects at the Research Library of the Los Alamos National Laboratory. The aDORe architecture is highly modular and standards-based. In the architecture, the MPEG-21 Digital Item Declaration Language is used as the XML-based format to represent Digital Objects that can consist of multiple datastreams as Open Archival Information System Archival Information Packages (OAIS AIPs).

### **DiSARM, Version 2.0**

Benjamin Uphoff (CTN-5)

Distributed Signature and Anomaly Real-time Monitoring is a data management solution for large, heterogeneous network security datasets, including log files and intrusion detection system alerts. Single query access to all data types is provided by way of a domain specific XML query language. Results are returned in a variety of ways including a server-side web interface, raw data or XML via sockets and relational databases created on the fly. The system uses a variety of techniques in storing data including flat-file B+ trees, Berkeley DB databases, and relation databases. Both the data capture and query capabilities of the system are scalable in that one or more nodes can be utilized for a given task, allowing parallel processing



## Fiscal Year 2006 License Income Recipients

### **Alvarez, Marc (B-3)**

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

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

*Synthesis of Labeled Oxalic Acid Derivatives*

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

*Improved Buffer Layer Compound for Coated Conductors*

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

*Arrays of Long Carbon Nanotubes for Fiber Spinning*

*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)**

*MiniGrand Family of Software*

### **Backhaus, Scott (MPA-10)**

*Traveling-Wave Device with Mass Flux Suppression*

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

*Cascaded Thermosacoustic Devices*

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

*MiniGrand Family of Software*

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

*Laser Production of Articles from Powders*

### **Bigio, Irving (B)**

*Apparatus and Method for Spectroscopic Analysis of Scattering Media*

*Method for Quantifying Optical Properties of the Human Lens*

*Characterization of Highly Scattering Media by Measurement of Diffusely Backscattered Polarized Light*

*Method for Measuring Changes in Light Absorption of Highly Scattering Media*

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

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

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

*MiniGrand Family of Software*

*Cosmic-Ray Neutron Background Reduction Using Localized Coincidence*

### **Bowles, Jeffrey (N)**

*MiniGrand Family of Software*

### **Bradbury, Andrew (B-1)**

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

### **Bradley, Johnathan (CCS)**

*Storage and Retrieval of Large Digital Images*

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

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

### **Brown, Donald (EES-11)**

*Downhole Sealing Method and Composition Corrosion Protection*

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

*Genie Pro, Version 0.6*

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

*MiniGrand Family of Software*

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

*Electrolytes for Electrooptic Devices Comprising Ionic Liquids*

*Reversible Electrooptic Device Employing Aprotic Molten Salts and Method Electrochromic, Salts, Solutions and Devices*

*Radiofrequency Attenuator and Method Extension to MXRF IP Portfolio*

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

*Composite Bipolar Plate for Electrochemical Cells*

### **Busse, James (C-ADI)**

*Lead-Free Electric Match Compositions*

**Cai, Hong (B-2)**

*DNA Base Mismatch Detection Using Flow Cytometry*  
*DNA Polymorphism Identity Determination Using Flow Cytometry*

**Cannon, T. Michael (CCS-3)**

*Quality Assessment, Restoration and oCr. (QUARC)*

**Chen, Liaohai (B, now EES-6)**

*Method for Detecting Biological Agents*

**Coates, Don (P-DO)**

*Fuel Injector Utilizing Plasma Activation*

**Collins, Michael (N-1)**

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

**Collis, Gavin (C-SIC)**

*Fluorescent Beryllium Detection*

**Coulter, James (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*

**Depaula, Raymond (MPA-STC)**

*Arrays of Long Carbon Nanotubes for Fiber Spinning*  
*Apparatus for Measurement of Critical Current in Superconductive Tapes*

**Dixon, Raymond (MST)**

*Controlled Laser Production of Elongated Articles from Particulates*

**Dreiskott, Sascha (MPA)**

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

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

*Electrochemical Reduction of Nitrate in the Presence of an Amide Nitrate Reduction*

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

*Genie Pro, Version 0.6*

**Edlund, Kimberly (ISR-2)**

*Genie Pro, Version 0.6*

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

*Fluorescent Beryllium Detection*  
*Water-Soluble Polymers for Recovery of Metals from Solids*

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

*Genie Pro, Version 0.6*

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

*MiniGrand Family of Software*

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

*Real-time, Software-Based Optimization for Energy-Efficient Computing*  
*Energy Fit, Version 1.0*

**Ferreri, Vincent (P-24)**

*Field Enhanced Electrodes for Additive Injection Non-Thermal Plasma (NTP) Processor*

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

*Improved Buffer Layer Compound for Coated Conductors*  
*Substrate Structure for Growth of High Oriented and/or Epitaxial Layers Thereon*  
*High Critical Current Superconducting Tapes*  
*Use of High Current Density Electropolishing for the Preparation of Very Smooth Substrate Tapes for Coated Conductor Applications*  
*Architecture for High Critical Current Superconducting Tapes*

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

*Genie Pro, Version 0.6*

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

*Pulse Tube Refrigerator with Variable Phase Shift*  
*Traveling-Wave Device with Mass Flux Suppression*  
*Cascaded Thermoacoustic Devices*

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

*Water-Soluble Polymers and Compositions Thereof*

**Gottesfeld, Shimshon (MST)**

*Air Breathing Direct Methanol Fuel Cell Catalyst Inks and Method of Application for Direct Methanol Fuel Cells*  
*Flow Channel Device for Electrochemical Cells*  
*Methanol Sensor Operated in Driven Mode*  
*Methanol Sensor Operated in Passive Mode*  
*Preventing CO Poisoning in Fuel Cells*

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

*Substrate Structure for Growth of High Oriented and/or Epitaxial Layers Thereon*  
*Arrays of Long Carbon Nanotubes for Fiber Spinning*

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

*MiniGrand Family of Software*

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

*Reversible Electrooptic Device Employing Aprotic Molten Salts and Method*  
*Radiofrequency Attenuator and Method*

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

*Optimizing the Availability of a Buffered Industrial Process*

**Hammond, Mark (B)**

*DNA Fragment Sizing and Sorting by Laser-Induced Fluorescence*

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

*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 (SuperHENC), Version 1.0*

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

*Genie Pro, Version 0.6*

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

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

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

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

*Atmospheric Pressure Plasma Processing Reactor*

*Combined Plasma/Liquid Cleaning of Substrates*

*Large Area Atmospheric-Pressure Plasma Jet*

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

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

*Atmospheric-Pressure Plasma Decontamination/Sterilization Chamber*

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

**Hicks, Robert (P)**

*Deposition of Coatings Using an Atmospheric Pressure Plasma Jet*

*Large Area Atmospheric-Pressure Plasma Jet*

**Hielscher, Andreas (X)**

*Characterization of Highly Scattering Media by Measurement of Diffusely Backscattered Polarized Light*

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

*Lead-Free Electric Match Compositions*

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

*High Critical Current Superconducting Tapes*

*Architecture for High Critical Current Superconducting Tapes*

**Horley, Earl (AET-1)**

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

**Howat, Andrew (X)**

SABRINA

**Hsu, Chung-Hsing (CCS-1)**

*Energy Fit, Version 1.0  
Real-Time, Software-Based Optimization for Energy-Efficient Computing*

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

*Neutron Dose Equivalent Meter*

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

*MiniGrand Family of Software*

**Jett, James (B-2)**

*DNA Fragment Sizing and Sorting by Laser-Induced Fluorescence*

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

*Improved Buffer Layer Compound for Coated Conductors*

*Substrate Structure for Growth of High Oriented and/or Epitaxial Layers Thereon*

*Architecture for High Critical Current Superconducting Tapes*

*High Critical Current Superconducting Tapes*

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

*Fluorescent Beryllium Detection*

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

SABRINA

**Kaduchak, Gregory (B-2)**

*Apparatus & Method for Remote Noninvasive Characterization of Structures & Fluids inside Containers*

*Cylindrical Acoustic Levitator/Concentrator Having Noncircular Cross-Section*

**Kane, Daniel (C)**

*Method and Apparatus for Measuring the Intensity and Phase of an Ultrashort Light Pulse*

**Keller, Richard (B-2)**

*DNA Fragment Sizing and Sorting by Laser-Induced Fluorescence*

**Kelly, Thomas (CCN)**

*PC-FRAM Software, Version 2.3*

*PC-FRAM Software, Version 3.3*

*PC-FRAM Software, Version 4.3*

*PC-FRAM Software, Version 3.4*

**Kelly, Patrick (CCS-3)**

*Quality Assessment, Restoration and oCr. (QUARC)*

**Kim, Yong Ho (P-24)**

*Field Enhanced Electrodes for Additive Injection Non-Thermal Plasma (NTP) Processor*

**Klosterbuer, Shirley (N-1)**

*MiniGrand Family of Software*

**Krick, Merlyn (N-1)**

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

*International Neutron Coincidence Counting (INCC), Version 3.0031*

*NCCWIN (English version)*

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

**Lamartine, Bruce (TT, previously at MST)**

*Depth Enhancement of Ion Sensitized Data*

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

**Less, Richard (MST-6)**

*Multiple Feed Powder Splitter*

**Lewis, Cris (C-CSE)**

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

**Lewis, Gary (MST)**

*Controlled Laser Production of Elongated Articles from Particulates  
Multiple Feed Powder Splitter*

**Li, Qingwen (MPA-STC)**

*Arrays of Long Carbon Nanotubes for Fiber Spinning*

**Liu, Jie (MPA)**

*Preparation of Single-Walled Carbon Nanotubes*

**Loree, Thomas (C)**

*Apparatus and Method for Spectroscopic Analysis of Scattering Media  
Method for Quantifying Optical Properties of the Human Lens*

**Lunsford, James (P-14)***Offset Stabilizer for Comparator Output***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 (ERSS-GS)***Electrochemical Reduction of Nitrate in the Presence of an Amide Nitrate Reduction***Marrone, Babetta (B-1)***DNA Fragment Sizing and Sorting by Laser-Induced Fluorescence***Martin, John (B-2)***DNA Fragment Sizing and Sorting by Laser-Induced Fluorescence***Martinez, Rodolfo (B-3)***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 [<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- and <sup>13</sup>C-Substituted Dithanes**Synthesis of Isotopically Labeled D or L [<sup>13</sup>C, <sup>2</sup>H] Glycerols**Synthesis of Labeled Oxalic Acid Derivatives***Martz, Harry (CCS-6)***Optimizing the Availability of a Buffered Industrial Process***Matias, Vladimir (MST-STC)***Use of High Current Density Electropolishing for the Preparation of Very Smooth Substrate Tapes for Coated Conductor Applications***McBranch, Duncan (TT, previously at C)***Method for Detecting Biological Agents***McCleskey, Thomas (MPA-MC)***Electrochromic Salts, Solutions, and Devices Electrolytes for Electrooptic Devices Comprising Ionic Liquids**Extension to MXRF IP Portfolio**Fluorescent Beryllium Detection**Radiofrequency Attenuator and Method**Reversible Electrooptic Device Employing Aprotic Molten Salts and Method***McGhee, John (CCS-4)***ATILA***Melton, Sheila (N-2)***Combined Thermal/Epithermal Neutron (CTEN-FIT EXE), Version 1.0**LIST-LIB (object library), Version 1.0***Menlove, Howard (N-1)***Cosmic-Ray Neutron Background Reduction Using Localized Coincidence Veto Neutron Counting**Electrical Drawings for Super-High Efficiency Neutron Coincidence***Milewski, John (MST-6)***Controlled Laser Production of Elongated Articles from Particulates***Miller, Thomasin (C-ACS)***Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence***Minogue, Edel (C-SIC)***Fluorescent Beryllium Detection***Mourant, Judith (B-3)***Characterization of Highly Scattering**Media by Measurement of Diffusely Backscattered Polarized Light**Method for Measuring Changes in Light Absorption of Highly Scattering Media***Naud, Darren (DE-1)***Lead-Free Electric Match Compositions***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 Determination Using Flow Cytometry***O'Connell, Michael (MPA)***Preparation of Single-Walled Carbon Nanotubes***Olsher, Richard (RP-2)***Neutron Dose Equivalent Meter**Proton Recoil Scintillator Neutron REM Meter***Olson, Jeffrey (MPA)***Tapered Pulse Tube for Pulse Tube Refrigerators***Ott, Kevin (MPA-MC)***Hybrid Catalyst for Selective Catalytic Reduction of NO<sub>x</sub>***Park, Jaeyoung (P-24)***Processing Materials Inside an Atmospheric-Pressure Radiofrequency Nonthermal Plasma Discharge***Parker, Robert (N-1)***MiniGrand Family of Software***Pautz, Shawn (CCS-4)***ATILA***Pelowitz, David (N-1)***Falcon, Version 2***Perkins, Simon (ISR-2)***Genie Pro, Version 0.6***Porter, Reid (ISR-3)***Genie Pro, Version 0.6***Powers, Tamara (B-3)***Method for Measuring Changes in Light Absorption of Highly Scattering Media***Prime, Michael (WT-2)***System and Method for Measuring Residual Stress***Reagor, William (MPA-STC)***Underground Radio***Reass, Pamela (N-1)***MiniGrand Family of Software***Ren, Xiaoming (MST-11)***Air Breathing Direct Methanol Fuel Cell Catalyst Inks and Method of Application for Direct Methanol Fuel Cells*

*Flow Channel Device for Electrochemical Cells*

*Methanol Sensor Operated in Driven Mode*

*Methanol Sensor Operated in Passive Mode*

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

*Water-Soluble Polymers and Compositions Thereof*

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

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

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

*Alpha-Environmental Continuous Air Monitor Inlet*

*Apparatus Having Reduced Background for Measuring Radiation Activity in Aerosol Particles*

*Elbow Mass Flow Meter*

*Quick-Change Filter Cartridge*

**Romero, Amos (LANSCE)**

*MiniGrand Family of Software*

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

*Field Enhanced Electrodes for Additive Injection Non-Thermal Plasma (NTP) Processor*

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

*Fast-Pulse Nonthermal Plasma Processor*

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

*Work Package Generator (WPG), Version 1.0*

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

*MiniGrand Family of Software*

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

*PC/FRAM, Version 2.3*

*PC/FRAM, Version 3.3*

*PC/FRAM, Version 3.4*

*PC/FRAM, Version 4.3*

**Sauer, Nancy (INST-OFF, previously at C)**

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

**Schmidt, Jurgen (B-3)**

*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 Processing Reactor*

*Atmospheric-Pressure Plasma Decontamination/Sterilization Chamber*

*Atmospheric-Pressure Plasma Jet Combined Plasma/Liquid Cleaning of Substrates*

*Deposition of Coatings Using an Atmospheric Pressure Plasma Jet*

*Large Area Atmospheric-Pressure Plasma Jet*

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

**Shera, Books. (P-21)**

*Ordered Transport and Identification of Particles*

**Shimada, Tsutomu (P-24)**

*Method for Quantifying Optical Properties of the Human Lens*

**Silks, Louis (B-3)**

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

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

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

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

*Apparatus and Method for Remote, Non-invasive Characterization of Structures and Fluids Inside Containers*  
*Cylindrical Acoustic Levitator/Concentrator Having Non-Circular Cross-Section*

*Noninvasive Characterization of a Flow-*

*ing Multiphase Fluid Using Ultrasonic Interferometry*

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

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

*Ultrasonic Characterization of Single Drops of Liquids*

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

*Water-Soluble Polymers and Compositions Thereof*

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

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

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

*Lead-Free Glovebox Glove*

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

*Lead-Free Electric Match Compositions*

**Strobl, Karlheinz (C)**

*Apparatus and Method for Spectroscopic Analysis of Scattering Media*

*Method and Quantifying Optical Properties of the Human Lens*

**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)**

*Cascaded Thermoacoustic Devices*

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

*Tapered Pulse Tube for Pulse Tube Refrigerators*

*Pulse Tube Refrigerator with Variable Phase Shift*

*Traveling-Wave Device with Mass Flux Suppression*

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

**Terwilliger, Thomas (B-2)***Heavy 4.0**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**RESOLVE, Version 1.0**RESOLVE, Version 2.0**SOLVE, Version 1.0**SOLVE, Version 2.0***Theiler, James (ISR-2)***Genie Pro, Version 0.6***Thomas, Sharon (MPA-11)***Catalyst Inks and Method of Application for Direct Methanol Fuel Cells***Unkefer, Clifford (B-3)***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 [ $^2\text{H}_1$ ,  $^{13}\text{C}$ ], [ $^2\text{H}_2$ ,  $^{13}\text{C}$ ] and [ $^2\text{H}_3$ ,  $^{13}\text{C}$ ] Methylaryl Sulfones and Sulfoxides**Synthesis of  $^2\text{H}$ - and  $^{13}\text{C}$ - Substituted Dithanes**Synthesis of Isotopically Labeled D or L [ $^{13}\text{C}$ ,  $^2\text{H}$ ] Glycerols**Synthesis of Labelled Oxalic Acid Derivatives***Vacarro, Henry (N)***WISDOM & SENSE (W&S)***Van Riper, Kenneth (X)***SABRINA***Vasilik, Dennis (HSR)***Neutron Dose Equivalent Meter***Vasquez- Dominguez, Jose (MPA-STC)***Underground Radio***Vo, Duc T. (N-1)***New Low Voltage Power Supply Schematic 68Y-155924, Version 2.0***Wang, Haiyan (MPA-STC)***Improved Buffer Layer Compound for Coated Conductors***Wang, Hsing-Lin (C-PCS)***Method for Detecting Biological Agents***Wareing, Todd (CCS)***ATTILA***Warner, Benjamin (C)***Electrochromic Salts, Solutions, and Devices**Electrolytes for Electrooptic Devices Comprising Ionic Liquids**Extension to MIXRF IP Portfolio**Flow Method and Apparatus for Screening Chemicals Using Micro X-Ray Fluorescence**Fluorescent Beryllium Detection**Method and Apparatus for Measuring Binding Constants**Method for Detecting Binding Events Using Micro-X-Ray Fluorescence Spectrometry**Radiofrequency Attenuator and Method Reversible Electrooptic Device Employing Aprotic Molten Salts and Method***Wells, Cindi (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***White, Paul (B-1)***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)***Ambient Pressure Fuel Cell System**Annular Feed Air Breathing Fuel Cell Stack**Composite Bipolar Plate for Electrochemical Cells**Fuel Cell Membrane Humidification**Fuel Cell with Interdigitated Porous Flow-Fields**Fuel Cell with Metal Screen Flow-Field***Young, Lloyd (ISR)***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***Zheng, Lianxi (MPA-STC)***Preparation of Single-Walled Carbon Nanotubes**Preparation of Pile Carbon Nanotubes and Fiber Therefrom***Zhu, Yuntian (MPA-STC)***Preparation of Single-Walled Carbon Nanotubes**Preparation of Fibers from a Supported Array of Nanotubes**Preparation of Pile of Carbon Nanotubes and Fiber Therefrom**Arrays of Long Carbon Nanotubes for Fiber Spinning*

## **Fiscal Year 2006 Executed Cooperative Research and Development Agreements (CRADAs)**

### **Phase Stability Modeling**

Alan Graham (INST-OFF)

Consumer products such as fabric softeners, toothpastes, and detergents are complex mixtures of non-equilibrium phases. During storage and shipment, these phases may separate, rendering the product unsuitable for its originally intended use. Because these mixtures involve a very large number of parameters, experimental determination of mixtures with sufficient stability to survive the time from manufacture to use (typically one to three years) is extremely time consuming and expensive. This project seeks to employ molecular scale modeling to predict the phase separation kinetics of consumer products, allowing reduced experimental costs, faster qualification time of new formulations, higher confidence in shelf-life predictions, and increased flexibility in formulation.

### **Oil Shale and Heavy Oil Recovery**

Robert Hermes (TT-DO)

Develop uses for DOE and DoD technology for exploring and developing new energy resources in enhancing the energy independence of the United States.

### **Hybrid Channelized Activity DEtector (CADET) System**

Scott Robinson (ISR-4)

As part of the ongoing requirement to upgrade these radio frequency (RF) collection systems, Los Alamos National Laboratory will provide the engineering solution for high sensitivity detection of RF signal activity. This technology will be incorporated into the Digital Data Recorder (DDR) being developed by the CRADA Participant. The existing CADET algorithm developed by LANL will be modified and integrated with CRADA Participant's Parameter Encoder to capture Pulse Descriptor Words and Burst Digitized data.

### **Electron Cloud Diagnostic for Use in Quadrupole Magnets**

Lawrence Rybarcyk (AOT-ABS)

Beam instabilities induced by electron clouds are a major factor limiting the performance of high intensity proton and positron accelerators such as the Los Alamos Proton Storage Ring (PSR), the positron rings at the B-factories, and the Large Hadron Collider project at CERN. Experimental studies of the causes and cures for these instabilities require suitable electron cloud diagnostics. A prototype of a novel electron cloud diagnostic for use in quadrupole magnets will be designed, built, and tested with the beam at the Los Alamos PSR. It will be designed to measure the generation and trapping of electron clouds

created in quadrupole magnets and thereby provide valuable data for better understanding of the electron cloud dynamics in these accelerators.

### **High Temperature Superconductor (HTS) Coated Conductor Samples in Tape Form**

Vladimir Matias (MPA-STC)

The parties will study the feasibility of using Los Alamos National Laboratory's ion-beam assisted deposition (IBAD) technology in conjunction with Participant's proprietary metal organic chemical vapor deposition (MOCVD) process for depositing oxide buffer layers and high temperature superconductors (HTS) on metal substrates, to produce HTS coated conductor samples in tape form. LANL will train Participant in the use of its IBAD technology and will provide Participant with 1–10-meter long IBAD template tapes, which Participant will convert into HTS coated conductor samples using its proprietary MOCVD process. LANL will then perform electron microscopy and/or other tests on these samples and the Parties will characterize these samples for electrical measurements of critical currents, magnetic field dependence thereof, and AC losses.

### **Plasma-Assisted Tornado Combustion Using Biofuels**

Louis Rosocha (P-24)

The Participants and Los Alamos National Laboratory will test a novel, high-efficiency, low-emissions combustion technology, developed by the Participants, for electricity and heat production from biofuels (biodiesel and bioethanol) in contemporary gas turbines. LANL will work with the Participants to develop scaling criteria, and carry out economic projections for industrially relevant prototypes of the new combustion technology. This project is carried out under the auspices of the DOE's Initiative for Proliferation Prevention program and the United States Industry Coalition.

### **EnergyFit**

Chung-Hsing Hsu (CCS-1)

LANL and Participant will jointly evaluate the effectiveness of EnergyFit™ in a representative corporate data center. The parties will jointly identify an appropriate center and deploy a suitable version of EnergyFit. The parties will quantify the energy savings and performance reduction due to EnergyFit. A report will be jointly prepared that characterizes performance in sufficient detail to enable Participant to determine the marketability of the technology and LANL to evaluate the attainable programmatic benefit for data center and performance computing facilities.

### **Natural Gas Pipeline Detection of Defect Characterization**

Dipen Sinha (MPA-11)

The purpose of this project is to verify that the acoustic technique developed by Los Alamos National Laboratory can indeed quantify the depth and size of defects on the surface of a natural gas pipeline.

### **Synthesis and Characterization of Four New Compounds**

David Chavez (DE-1)

Synthesize and characterize new solid propellant ingredients. The material will contain very high nitrogen content within the chemical structure, thereby ensuring a large energy release. Energy densities from these ionic salt propellant ingredients will be higher than those obtained from purely covalent compounds. Thermo-chemical analysis, modeling, and computer simulations will be performed to predict gas products, adiabatic flame temperatures, and specific impulses due to thermal decomposition/combustion. The decomposition/combustion temperatures, heats of formation, heats of combustion, and pressure responses will also be obtained experimentally in nitrogen, air, and oxygen gas environments. Impact, friction, and shock sensitivity tests will also be performed.



## Center for HIV/AIDS Vaccine Immunology (CHAVI)

Bette Korber (T-10)

The Los Alamos National Laboratory and the CRADA Participant will collaborate to perform the critical studies in HIV vaccine development that will break bottlenecks in vaccine development and speed the design and testing of novel vaccines.

## The Meteorological Context of Strong VHF Lighting Pulses

David Suszcynsky (ISR-2)

The CRADA covers joint scientific research for the purpose of understanding the meteorological context of a type of very high frequency (VHF) lightning emission that is important for future space-based VHF lightning mapping missions. LANL is currently developing a concept definition for a future space-based VHF global lightning mapper. This development includes a technology feasibility study using existing LANL ground and satellite assets and a basic scientific study aimed at better understanding the meteorological context of the dominant form of VHF lightning emissions seen from space. This lightning type is characterized by intense, impulsive, in-cloud VHF and accompanying low frequency (LF) emissions that have been observed over the last several years by various means including the Participant's ground-based LF and VHF detectors and LANL space-based VHF receivers. An excellent way to evaluate the meteorological

context of these lightning types is to simultaneously relate available Participant ground measurements and LANL satellite measurements of the lightning to local meteorological conditions.

## Ultrahigh Strength Fibers from Carbon Nanotube Arrays

Yuntian Zhu (MPA-STC)

Participant and LANL will be completing development of carbon nanotube based materials for commercialization. LANL has succeeded in producing long carbon nanotubes and taken the first steps to incorporating them in useful macroscopic structural materials. The Participant will be working with LANL to fully develop this technology, design machinery to produce the carbon nanotubes in bulk, and implement them in a commercially viable form. The unique work that has been done to date and will continue to be conducted under this CRADA is key to commercializing this technology and producing the next major advancement in structural materials.

## Development of Bi-2212 Superconducting Tapes and Coated Conductors

Terry Holesinger (MPA-STC)

Significant advances have been achieved in the development of high performance Bi-2212 round multifilament wires. Transport properties of Bi-2212 wires have been elevated

to a level that makes them attractive for high field magnets. For magnet applications, round wire is preferred over tape. Bi-2212 is the only high temperature superconductor (HTS), to date, that can be manufactured as a round wire. For example, critical currents greater than 420 A at 15 T and corresponding  $J_c$ 's greater than 3,000 A/mm<sup>2</sup> have been demonstrated in Bi-2212 strand. However, further improvements in the intrinsic critical current density (quality of the Bi-2212 filaments), engineering current density (design of the conductor), and manufacturing cost are required for Bi-2212. This work will combine the Bi-2212 materials synthesis and characterization expertise of LANL personnel with the Bi-2212 wire development expertise of Supra-Magnetics to develop a more cost-effective, high-performance HTS round wire.

## Development of New Biophotonic Technology

Peter Stark (C-ADI)

Los Alamos National Laboratory and the CRADA Participant will develop a new biophotonic technology based on the interpretation of the interaction of light with cells and other particles contained in bodily fluids for the quantitative analysis and diagnosis of the presence of viral, bacterial, and/or parasitic pathogens.

## Fiscal Year 2006 Work for Others – Non-Federal Agreements Executed

### 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. ISD staff will curate these data to the highest level applied to public data in the ISD. ISD staff will make available all analysis tools that have been designed for public use. ISD will develop custom features for data management and analysis to meet individual sponsor's needs, as determined by analysis of required performance.

### Equipment and Training

Gregory Kaduchak (B-2)

Provide four training classes for chemical detection on the DSA 620 Acoustic Sensor.

### Infrasound Rocket Grenade Experiment

Rodney W. Whitaker (EES-2)

Infrasound measurements will be made of rocket grenade experiments done at White Sands Missile Range as well as analysis of results.

### Water Resource Management Tools and Evaluation for Environmentally Sustainable Oil Shale Development

Cathy Wilson (EES-2)

This project is an analysis of water resource requirements and impacts from *in situ* retorting of oil shale in the Piceance Basin Colorado. The project includes analysis of water resource availability for complex oil shale development and reclamation processes under a range of current and projected climate conditions including extended drought. The Watershed Analysis Risk Management Framework (WARMF) model and systems dynamics models will be parameterized and applied to assess water rights requirements and reservoir sizing to ensure uninterrupted supply of peak water flows to the Oil Shale reclamation process under a range of oil shale operation scenarios. The WARMF model will additionally be used to determine surface environmental impacts of the company processes.

### Safeguards Study for the Korea Advanced Pyroprocess Facility

Susan E. Pickett (N-4)

Because the Korea Advanced Pyroprocess Facility will be 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.

### **Structural Genomics of Persistence Targets from M Tuberculosis**

Thomas Terwilliger (B-2)

LANL will carry out protein expression and purification as part of the TB Structural Genomics Consortium pipeline.

### **A Low Cost National Radiation Sensor Network**

Angela Mielke (ISR-3)

The development of an application scenario and test scenario description for a wireless radiation detection network.

### **Residual Stress Anisotropy in Automotive Diesel Particulate Filters**

Donald Brown (MST-8)

Under this agreement spatially resolved measurements of the lattice parameter of cordierite filters and reference powders will be completed. To aid in understanding of this data, measurements of the lattice response to temperature and applied stress will also be completed.

### **Visualization and User Interface for Chemical Biological Defense Multivariate Decision Support Tools**

Steven A. Smith (D-4)

LANL will address the difficult and complex issue of applying decision science to research Chemical/Biological related decisions at the Defense Threat Reduction Agency. We will focus on the application of Visualization and User Interface methods for Hierarchical Risk Analysis and on the application of LANL's Logic Evolved Design methodology.

### **High-Frequency Broadband Acoustic Scattering from Temperature and Salinity Microstructure: from Nonlinear Internal Waves to Estuarine Plumes**

Karen Fisher (IT)

High frequency acoustic backscatter will be analyzed at multiple frequencies to map the dynamics of turbulent microstructure in internal waves. This five-ship survey is a major effort supported by Office of Naval Research to investigate the dynamics of internal waves in the continental shelf waters of the Northeastern United States. The deployment of the state-of-the-art instrumentation developed by Sponsor will enable new understanding of turbulent fields of interest to LANL. By providing

state-of-the-art signal processing techniques, LANL's participation will consist of characterizing the turbulent fields on the fly, to guide deployment of *in situ* validation equipment in critical locations.

### **Rochester Center for Bio Defense Modeling**

Alan Perelson (T-10)

This project will develop new immune system models relevant to our body's ability to fight infectious diseases such as influenza.

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

George E. Busch (C-ADI)

Design acoustic optically tuned heterodyne laser system for remote chemical and biological detection and identification of aerosols. Model performance expected for designed system.

### **Protein Synthesis**

Andrew M. Bradbury (B-1)

LANL's unique work involves the expression and purification of recombinant proteins using a protein fermentation and purification robot. Sponsor's objective is to engage in development of new medical therapies.

## Feasibility of Cost Effective, Long-Length, BSCCO 2212 Round Wires

Terry G. Holesinger (MPA-STC)

Bi-2212 wires are of interest for use in high field magnets for NMR or high energy physics applications. To investigate the potential benefits of dopants on improving the properties of BSCCO-2212/Ag composite wires, the proposed effort will determine which type of dopant(s), dopant amount(s) and dopant addition(s) techniques yield the greatest enhancement for engineering critical current density ( $J_c$ ) in BSCCO-2212/Ag composite round wires.

## Next Generation Specification of the Earth's Radiation Environment

Josef Koller (ISR-1)

The primary objective of the project is to upgrade the currently used and inadequate radiation belt models to improve the quality of the specification by incorporating the enormous volume of radiation measurements obtained since the release of the current model. The end result will be a next-generation specification model for the Earth's radiation belt environment. The model will be used for pre-flight risk assessment, real-time data assimilation, and scientific investigations.

## ECAM Testing

Murray Moore (RP-2)

LANL proposes to use the LANL HSR-4 aerosol laboratory facilities for a series of tests. The first of these tests would test the ability of the automatic filter changer to respond to the reduction of air flow in the ECAM caused by a significant amount of dust loading on the test filter. LANL proposes to run the ECAM in an enclosed chamber and establish steady state flow conditions. At a determined time, Arizona Road Dust, or other equivalent test material, will be introduced into the chamber as a test challenge for the ECAM air sampler.

## Homeland Security Strategic Integration

Edward Van Eeckhout (D-4)

The purpose of this task is to assist Homeland Security Institute in planning and conducting a prototype process for strategic integration of homeland security programming.

## Underground Radio

David W. Reagor (MPA-STC)

The underground radio (unique to LANL) is a device that sends audio communications through the earth, fresh water, and other media that are unfavorable for electro-magnetic propagation. It can be used in interconnected tunnel networks (e.g., mines, both underground and under fresh water; and subway stations), underground construction

sites, caverns, boreholes, collapsed buildings, basements, and sub-basements of large buildings. As part of that commercialization process the vendor wishes to do demonstrations for potential customers. We will cooperate and assist with those demonstrations under this agreement.

## Detection of Category A Pathogens by Gold Nanoparticles

Thomas K. Leitner (T-10)

LANL will investigate the application of the bio-barcode amplification (BCA) method to pathogen detection with emphasis on pathogens in which LANL has considerable expertise, particularly influenza. LANL's primary effort will be on computational design of sequence probes. This will be done at both the base and amino acid level: the base level probes will be optimized for detection of pathogen sequence with good discrimination ability. In a complementary effort, the amino acid level design will serve to suggest peptides and DNA expressed sequence tags against which highly specific monoclonal and polyclonal antibodies can be raised, respectively. In a related third component, LANL will also design optimized BCA "bar codes" by considering both artificially constructed sequence probes, as well as probes selected from plant sequence databases.

### **Improved Plutonium Canister Assay System (IPCAS) Phase V**

Martin Swinhoe (N-1)

This work continues the design, supply and installation of NDA monitoring systems for the Sponsor.

### **Hydrothermal Models of the Coso Geothermal Area**

Carl W. Gable (EES-6)

Develop the three-dimensional tetrahedral finite element grids for the project using LANL LaGriT software. LANL will assist the Sponsor in constructing geologically realistic tetrahedral finite element grids that honor the local geology and fault zone architecture for the Coso Region.

### **X-Ray Fluoresces Analysis**

George Havrilla (C-CSE)

Materials characterization will be done on samples provided by Sponsor.

### **Pathways**

Herbert Van de Sompel (STBPO-RL)

The Pathways project aims to investigate and prototype new infrastructure for the dissemination of scholarly results. A loosely coupled, highly-distributed, interoperable system for scholarly communication is envisioned that allows a unit of communication to proceed simultaneously through different scholarly

value chains, each of which we name a pathway. Our research is motivated by a number of requirements: 1) The unit of scholarly communication must be redefined; 2) The scholarly communication process is as important as the product; and 3) The dynamics of scholarship must be recorded and exposed.

### **Fabrication and Delivery of Membrane Electrode Assemblies (MEA)**

John C. Ramsey (P-25)

LANL will fabricate 12 direct methanol fuel cell membrane electrode assemblies (MEAs) for the Sponsor. Two of these MEAs will be set aside for testing to insure proper performance. These MEAs will then be delivered to the Sponsor for their own testing and evaluation.

### **IMR-MIP: Concept and Engineering Design of a Free Electron Laser Light source for High Magnetic Field Research**

John Singleton (MPA-NHMFL)

A high-magnetic-field plus free-electron-laser facility is being developed in response to emerging needs and desires of the scientific community, identified at a series of workshops and conferences in the past two years. It will be dedicated to new types of experiments in physics, chemistry, and biophysics that utilize a magnetic field's ability to manipulate the electrons

within matter, plus the free-electron laser's ability to probe the resulting changes as a function of time, laser power, and wavelength. Such techniques promise to provide important information about materials ranging from semiconductors to DNA, and from superconductors to nanoparticles, and processes from quantum computation to photosynthesis. The provision of this unique facility will help to maintain U.S. competitiveness in fundamental science and its spinoff emergent technologies.

### **Detector Evaluation**

John Blackadar (N-2)

Various gamma radiation detection/identification technologies are being evaluated using a variety of medical, industrial, and nuclear radioisotopes.

### **Spatiotemporal Imaging of Human Visual System Processing**

John S. George (P-21)

Apply advanced techniques for imaging of dynamic neural function (combining multiple measurement technologies using computational modeling techniques) for the study of information processing by the human visual system. LANL will develop, validate and apply geometrically realistic numerical models of the conductivity of the head to allow calculation of observed patterns of electric potential and mag-

netic fields associated with simple neural sources, and apply powerful methods for neural electromagnetic source reconstruction, including multiple dipole spatiotemporal optimization and Bayesian Inference.

### **MINISENS Project**

Thomas C. Hale (ISR-2)

LANL will assist the sponsor with a technical survey of remote sensing technologies in relation to their implementation of Unmanned Aerial Vehicles (UAVs). The survey will be focused on determining which remote sensing technologies are best suited for UAV applications. We will evaluate both existing and emerging technologies.

### **Radiological Decontamination**

Mark Smith (C-ADI)

This project will advance the materials and methods for use in decontaminating building exteriors following a dirty bomb event. Specifically, the research and development supports the goal of a fieldable system for decontamination. The subtasks are directed to understanding and improving the binding of radionuclides and controlling the transport of water in porous substrates to increase removal efficiencies.

### **External Peer Review of WAG 7 Comprehensive RI/FS**

Robert C. Roback (EES-6)

Perform an external peer review of the Sponsor's WAG 7 Comprehensive RI/FS. This will be conducted in two separate phases, one for each major document. LANL will review the RI/BR Assessment and Feasibility Study and write review reports of these documents.

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

Fred Shelley (AOT-IC)

The work entails the design of an extremely fast, reprogrammable, computational engine for real-time data analysis. This requires the application of multiple, very large field programmable gate arrays (FPGAs) on a single, small, circuit board. Designs of this power density are unique to LANL and have been successfully done at LANL by the same team that will be involved in the scope of work. These large FPGAs require hundreds of high-frequency signal lines that must be sufficiently isolated from each other to prevent cross-talk, multiple, high-current, low-noise, POL power supplies, high-speed, optical data links and a very small form-factor circuit board. The individual parts of the design are not unique unto themselves, but the use of the unique LANL technologies together on a very small circuit board without

unwanted interaction is extremely difficult. LANL just completed two designs very similar to this, for internal use, within the last year.

### **Hydrogen Detonation Scenarios**

Edward Rodriquez (WT-DO)

Provide a peer review of (1) structural analysis calculations and (2) assessment design criteria. Hydrogen gas concentrations in piping, vessels, and equipment from radiolytic decay of waste products can become volatile and cause deflagrations or detonations under certain conditions. The piping, vessels, and equipment must be able to withstand these potential dynamic pressure transients. As such, the structural analysis and acceptance criteria are based on best-practices, industry standards, and ongoing research at LANL.

## **User Facility Agreements Executed in Fiscal Year 2006**

User Facility Agreements permit outside users, including scientists and engineers from industry, universities, and other governmental 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 using the facility.

### **Weapons Neutron Research Facility**

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

SPAESRANE (Solutions for the Preservation of Aerospace Electronic Systems Reliability in the Atmospheric Neutron Environment)

Single Event Effects (SEE) Testing of Cisco Products

Neutron Soft Error Sensitivity of Advanced FPGA

The NESU Sensitivity of Static Latch Based Programmable Logic

Neutron SEU and SEL testing of commercial SRAM and Logic

Neutron Soft Error Time-to-Fail and Data Corruption Rate Measurements State of the Art Servers

Neutron SEU Testing of Commercial Memories and Logic Devices  
SEU in DRAM, SRAM, and Logic

Investigation of the Effects of NSEU on Avionics Equipment

SER and SEL Characterization of 90- and 65-nm Technologies

## Distinguished Awards

### Distinguished Patent Award

The Distinguished Patent Award honors inventors whose patented invention exhibits outstanding innovation. The award is selected by the Laboratory Fellows 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.

#### *2006 Award Winner*

The 2006 Distinguished Patent Award goes to the patent titled "Through-the-Earth Radio" submitted by Dr. David Reagor of MPA-STC (Superconductivity Technology Center) and Jose Vasquez-Dominquez (formerly of MPA-STC). This patent, along with several other pieces of intellectual property, has been exclusively licensed to Vital Alert Technologies, Inc. Dr. Reagor has played a critical role in the development of the Underground Radio technology and currently serves as the Laboratory's lead for the R&D effort sponsored by Vital Alert, an emergency wireless communications company specializing in mine and urban safety.

The Through-the Earth Radio patent significantly improves wireless communication capabilities by using very low frequency

electromagnetic radiation in the range of 2000 to 6000 Hz; a superconducting quantum interference device (SQUID) for signal reception; and digital audio compression to transmit voice and data signals. The transmitter operates at a predetermined frequency sufficiently low to effectively penetrate useful distances through earth, water, and other materials that would otherwise block higher frequency radio waves. Once the technology is incorporated into practical devices, this invention will allow two-way text and voice communication capabilities in traditionally harsh environments in which current technologies are easily rendered useless.

The Through-the-Earth Radio technology is currently positioned to solve major communication problems in mining and urban settings during both normal operations and emergency events. The portable technology sends and receives very low frequency radio waves that penetrate solid, dense material up to distances of more than 500 feet. Through-the-Earth technology accomplishes a degree of reliability unavailable in other forms of communication systems because it doesn't require easily compromised hard wired systems or line-of-site signal transmission. This seminal patent will undoubtedly generate new, patented technologies that will be used by first responders, rescue teams, and underground miners in emergency situations to help save lives.

Through-the-Earth Radio will be integrated within existing network



solutions to provide comprehensive communication capabilities within every aspect of mine, urban, underwater, and tunnel operations.

## Distinguished Copyright Award

The Distinguished Copyright Award honors the authors of disclosed copyrighted materials that are considered extraordinary creations. Nominated copyrights for this distinguished 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.

### 2006 Award Winner

The 2006 Distinguished Copyright Award goes to the Copyright titled "EnergyFit™" by Dr. Chung-Hsing Hsu of the Computer, Computational, and Statistical Sciences (CCS) Division and Dr. Wu-Chun Feng (formerly of CCS Division, now at Virginia Polytechnic Institute). EnergyFit was originally created to enhance energy efficiency and reliability (by virtue of heat reductions) associated with high perfor-

mance computing systems. The LANL inventors determined that by reducing CPU (central processing unit) voltage, they could effectively reduce energy consumption and thus heat, while having minimal impact on workload performance (e.g., CPU peak voltage was not always necessary for dynamic workloads). EnergyFit is a system software solution that tunes CPUs for optimal performance by adjusting CPU speed in correlation with workload requirements, resulting in significant reductions in heat output and electrical costs. EnergyFit software monitors processing requirements and dynamically modifies CPU voltage in real-time to minimize energy expenditures.

EnergyFit software can be applied to personal, corporate, and government venues to help mitigate very serious data center heat and power consumption problems. The software can also be applied to laptop computers, which can prolong battery life and provide a significant benefit for the average user. Thus far, the software has been demonstrated to provide power use reductions on the order of 4% to 39%, depending on the type and intensity of the application load.

LANL entered into an Exclusive License Option Agreement, as well as a CRADA with AES Corporation to initiate the commercial deployment of EnergyFit™ into U.S. and international markets. After completing beta validation testing procedures with four large U.S. corporations, it was determined

that "Initial performance and test results for EnergyFit are exceptional, showing savings in power consumption ranging from 15% to more than 35%," noted Bill Lyons, Managing Director of AES's Climate Change and Technology Group. This software will present a significant benefit for companies...by reducing data center power consumption and cooling costs—two of the fastest growing components of a typical data center budget. The reduction in heat generation will also prolong the life and reliability of the hardware utilizing the software."

EnergyFit is expected to enter the market and to be leveraged for commercial, non-commercial, and government use within the year, moving LANL a step closer toward worldwide recognition as a source of energy saving technologies.

## Distinguished Licensing Award

The Distinguished Licensing Award recognizes innovators who proactively engage in commercialization activities at Los Alamos National Laboratory and who have had a positive impact on the Laboratory's Licensing Program. These individuals, by example, demonstrate outstanding success in transferring Laboratory-developed technologies to the public and private sectors. In addition, the Laboratory's reputation is enhanced by the commercialization track record of current and former recipients of this distinguished honor.

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

#### *2006 Award Winner*

The 2006 recipient of the Distinguished Licensing Award is Kevin Ott of the Laboratory's Materials Physics and Applications (MPA) Division, inventor of a novel selective catalytic reduction (SCR) catalyst that can be used to reduce levels of nitrogen oxides (NOx) inherent in exhaust systems in a variety of applications. The NOx HyCat (hybrid catalyst) technology has been exclusively licensed by Santa Fe-based CleanAIR Systems Inc. in all fields of use except automotive. CleanAIR is marketing it under the name ENDURE™ SCR. This breakthrough SCR catalyst operates over a broad range of temperatures (from 150 degrees Celsius to more than 500 degrees Celsius) and can effectively reduce up to 98 percent of NOx emissions, depending upon temperatures.

The technology was originally developed for use in vehicles under Department of Energy funding and in collaboration with the Low Emissions Technologies Research and Development Partnership (LEP), which was formed under the United States Council for Automotive Research (USCAR). CleanAIR is developing the technology for use in a variety of applications,

including large diesel vehicles, power plants (fossil-fuel-, gas-, and wood-fired), and lean burn engines (e.g., stationary generators, pipeline compressors, and pumps).

Ott's work is widely recognized by industry and other researchers throughout the world. In addition to his development of novel technologies for the catalytic removal of NOx, Ott has made important contributions in several areas of catalysis, including heterogeneous catalysts, zeolite structures, and nano-structured catalysis. Ott's research emphasis is primarily directed at providing technical solutions for the nation's energy security problems. His research has resulted in 19 new invention disclosures, from which 13 patent applications have been filed. To date, the Laboratory has received six issued patents from these patent applications.

Ott has been effective in educating companies about the commercial applications of his work, which laid the groundwork for attracting a commercial licensee. His exemplary work sets a standard of excellence in support of the Laboratory's technology transfer program and reflects his strong passion for high quality science with a purpose—to impact the world in a positive way.

## **Programmatic Impact Award**

The Programmatic Impact Award honors individuals or groups who have made significant 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 (CRADA, WFO, 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.

#### *2006 Award Winner*

The LANL Muon Tomography Team, which has developed an advanced 3-D tomography technology and associated detectors and algorithms that allow large objects to be investigated in detail without an artificial radiation source, is the recipient of the 2006 Programmatic Impact Award. Their technique uses muons, which are produced naturally by the interaction of solar and cosmic rays within the atmosphere. Muons, high energy sub-atomic particles with high penetrating power (through up to 6 feet of lead), can be used like x-rays to produce detailed 3-D images of complex objects.

However, unlike x-rays, muons are readily available over an infinite area without concern of increased radiation exposure to operators or objects. This technology was originally funded through internal LDRD funding obtained by Chris Morris and the Muon Tomography Team. The project later received funding from the Department of Homeland Security's Domestic Nuclear Detection Office, as well as the DOE's NA-22 program.

Muon tomography was created to provide homeland security organizations with a tool to identify high-density objects (such as nuclear material), without using an active radiation source. An additional benefit of muon tomography technology is the detection not only of nuclear material, but also other high-density materials, e.g., shielding that can be used to disguise the radiation signal for fissile material. Muon tomography scanners can also detect radioactive materials such as dirty bomb components.

In September 2006, LANL and a private company called Decision Sciences Corporation (DSC) entered into a CRADA for the development of a full-scale prototype muon tomography scanner. DSC hopes to develop a suite of sensors for a variety of chemical, biological, radiation, and nuclear threats. DSC recognizes the importance of muon tomography as a tool for detecting potential threat objects and has made a serious commitment to the Laboratory to complete the development of this

critical technology.

The Laboratory's Muon Tomography project is supported by a distinguished group of scientists, representing numerous divisions within LANL. The work performed by this team is widely recognized by industry and other researchers throughout the world. The team members are as follows:

Jeffrey Bacon (P-25)  
 Konstantin Borozdin (ISR-1)  
 Deborah J. Clark (P-25)  
 Rick Chartrand (T-7)  
 Camilo Espinoza (P-25)  
 Andrew Fraser (ISR-2)  
 Mark Galassi (ISR-1)  
 John Gomez (P-21)  
 Andrew Green (P-25)  
 Nick Hengartner (CCS-3)  
 Gary Hogan (P-25)  
 Alexei Klimenko  
 Mark Makela (P-25)  
 Jason Medina (P-25)  
 Christopher Morris (P-25)  
 Fawn Pazuchanics (P-25)  
 William Priedhorsky (LDRD-PO)  
 John Ramsey (P-25)  
 Alexander Saunders (P-25)  
 Richard Schirato (P-25)  
 Larry Schultz (P-21)  
 Michael Sossong (X-1-TA)

Additional support is provided by the Technology Transfer Division and Laboratory Legal Counsel in administering the program, managing the project, and protecting resultant intellectual property. This extraordinary collaborative effort, both across the laboratory and with engineers and software developers at the company, has resulted in a

large program with the promise of delivering a functional, optimized tool to improve homeland and national security. This program encourages continued interaction among the contributing divisions at the laboratory and provides funding for homeland security research at LANL, which will undoubtedly play a critical role in protecting the nation and its national security interests in the future.

### 2006 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 Laboratory technology, personnel, or expertise. (Per Appendix N of the LANS LLC Prime contract to manage Los Alamos, 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 Laboratory-affiliated venture(s), creation of new jobs or new products, or implementation of a unique resource for entrepreneurs. In addition, the individual, organization, or program must reflect the spirit of entrepreneurship through personal risk taking, strong personal commitment, ingenuity, and as a role model for regional innovation.

2006 Award Winners

The 2006 Regional Impact Award goes to CleanAIR Systems Inc. of Santa Fe, New Mexico, and to Kevin Ott of the Materials Physics and Applications Division. The award-ees are well on their way to demonstrating strong regional as well as national impact from a Los Alamos clean energy technology solution being successfully commercialized by a tenacious regional partner.

Developed by Ott, the NO<sub>x</sub> HyCat technology could enable the U.S. to switch from inefficient gasoline vehicles to more efficient diesel cars, trucks and SUVs. Diesel engines deliver up to 35 percent higher fuel economy than gasoline engines, however, they are also a major source of particulate and smog-forming pollution, particularly nitrogen oxides (NO<sub>x</sub>). Ott developed NO<sub>x</sub> HyCat to clean the exhaust stream from diesel engines, dramatically reducing air pollution from diesel exhaust.

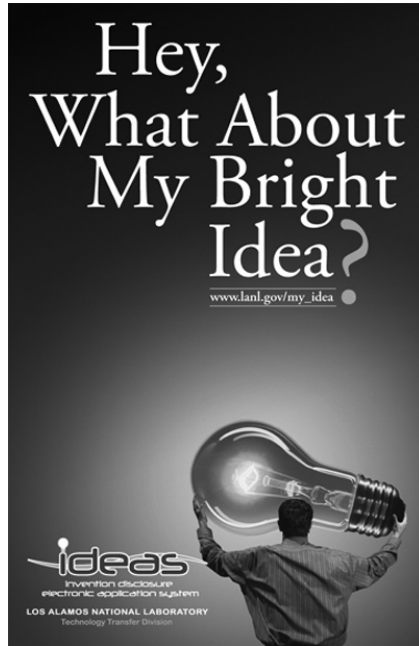
The new hybrid catalyst cleans between 90 percent and 98 percent of NO<sub>x</sub> at low temperatures—where the pollution is most problematic—and demonstrates between 96 percent and 98 percent efficiency at higher temperatures. Unlike competing solutions, the NO<sub>x</sub> HyCat system does not consume additional fuel, retaining diesel's inherent efficiency. Ott's technology is the first catalytic system to span the temperature range—from 150 degrees Celsius

to more than 500 degrees Celsius—found in vehicle exhaust.

In 2006, CleanAIR Systems executed an Exclusive License Option Agreement for the NO<sub>x</sub> HyCat technology and is marketing it under the name ENDURE™ SCR Catalyst. CleanAIR designs and produces emissions control systems for on- and off-road vehicles, machinery, and stationary generators. CEO Michael Roach formed the company in 1993 to create ceramic-based filters with a proprietary catalytic process that uses platinum to convert particulate matter and gases into nearly harmless emissions. Endure™ SCR and other new product lines are enabling significant growth for the small local technology company.

While Ott and his team invented the technology for vehicles, CleanAIR is developing it for use in a variety of applications, including large diesel vehicles, power plants and lean-burn engines (such as stationary generators, pipeline compressors, and pumps).

CleanAIR is one of a few companies that manufactures its products locally with high-paying jobs and good benefits—in an industry that is also clean. CleanAIR expected to make \$5 million in revenues in 2006—30 percent more than in 2005 and more than double its reported revenue in 2000. CleanAIR intends to double its staff of 25 employees by mid to late 2008.



## IDEAS

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

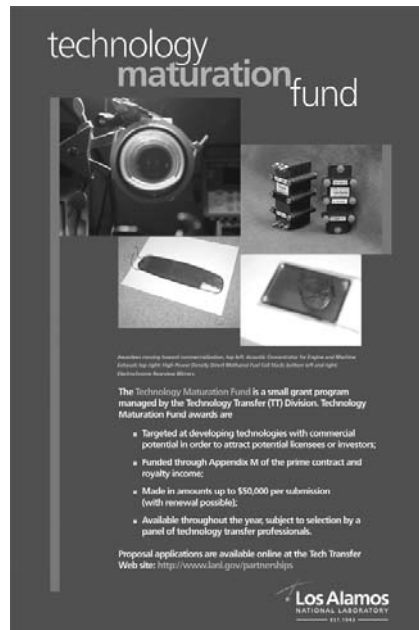
The disclosure process provides Laboratory Legal Counsel with the information necessary to file a patent application and the TT Division with the vital information needed for successful, commercial, noncommercial, and academic licensing and transfer of an invention to the public/private sector.

After submission, invention disclosures are routed electronically for approvals, archiving, and entry into TT Division's Opportunity Module. Launched in November 2005, 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 increased by 41 percent since the launch of IDEAS.

To process a disclosure visit:

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

## 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. Since 2002, we have funded over 30 awards with an average award size of \$45K.

***LANS Venture Acceleration Fund***—The Los Alamos National Security (LANS) LLC Venture Acceleration Fund (VAF) supports projects that facilitate the creation and growth of regional businesses based on LANL technology or expertise. Each year, the LANS VAF will provide investments of up to \$100K to facilitate three to five projects with regional entrepreneurs, companies, investors, or strategic partners. Proposals submitted to the LANS VAF 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.

***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 using 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, 31 employees have taken ELOA. In 2006, four LANL employees took ELOA.

### ***Entrepreneurial Training and Networking Programs***

- ***Commercialization Training***—Inventors learn how to evaluate the commercial potential of their ideas as well as the process for getting their innovations to market. Since 2003, over 150 technical staff evaluated over 80 technologies; 40 percent of participants

continue to work with TT to commercialize a technology. Six commercialization sessions were held during 2005 and 2006.

- *Intellectual Property Management Training*—This internal training course teaches Laboratory staff about the process for protecting intellectual property and why it is an asset for the Laboratory. Since 2005, over 80 LANL staff members have participated in this training.
- *SBIR Training*—Regional businesses and Laboratory entrepreneurs learn how to access funds available through these federally sponsored programs. During 2005 through 2006, 92 participants attended six events. In conjunction with Sandia National Laboratories and Technology Ventures Corporation (TVC), Los Alamos co-sponsors an annual New Mexico SBIR/STTR Conferences that brings in agency representatives to discuss their specific SBIR/STTR programs.
- *Center for Commercialization and Entrepreneurial Training (CCET)*: The education/training arm of TVC offers a broad array of training topics, which TT Division helps promote, including Marketing Research, Financial Management, Preparing and Presenting the Business Plan, and The Term Sheet and Lessons Learned. The monthly series attracted over 300 participants during 2005 through 2006.

***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, 81 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.

## 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.

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