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Proceedings of the LLNL

Technical Women's Symposium

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October 27-28, 1994

San Ramon Marriott Hotel
at Bishop Ranch
San Ramon, California

Lawrence Livermore National Laboratory

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Erica von Holtz, Scientific Editor

Sponsored by the Women's Issues Program
Lawrence Livermore National Laboratory
Livermore, California

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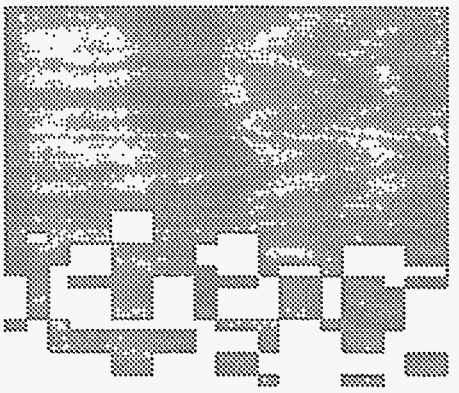

Welcome to the second Technical Women's Symposium sponsored by Lawrence Livermore National Laboratory. You are all to be commended for your involvement in this event: organizers, presenters, and attendees. In particular, I wish to recognize the members of the symposium's organizing committees.

Those of you who attended the first symposium know that in the next two days you will be exposed to a variety of presentations by women researchers and those who provide essential support for institutional research and development activities. This year's symposium has an added feature: it provides an opportunity to showcase the contributions of women not only from Livermore Laboratory, but from other scientific institutions as well. Women are here from organizations such as Lawrence Berkeley Laboratory, Sandia National Laboratories, and Stanford Linear Accelerator Center. Expanding participation to include women from other laboratories reflects the Laboratory's increasing attention to partnering. Partnering through collaborations with other laboratories, industry and academia has always been important and has become an essential way of doing business in the 1990s.

The symposium is also an excellent way to display the enormous variety of work that is carried out at Livermore and elsewhere. You'll find presentations dealing with many aspects of global security, global ecology and bioscience. There are also presentations reflecting the challenges we face in improving our business practices, communicating effectively, and expanding collaborations in the industrial world. The symposium is designed to take on all these challenges and more, challenges you and others like you face and conquer every day.

As women deeply involved in framing the future of science, you are an important part of the present and future workforce, no matter where you are employed. For those who work here at LLNL, your contributions are vital to the future of the Laboratory. I hope you will find the information presented in the next two days both exciting and useful.

C. Bruce Tarter
Acting Director
Lawrence Livermore National Laboratory

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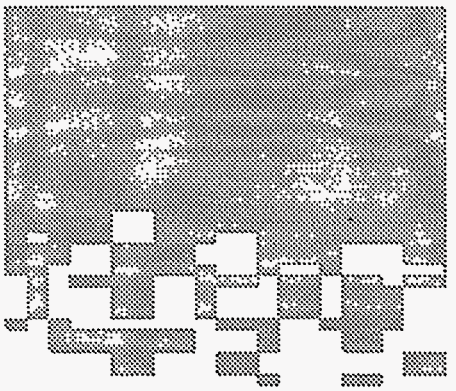
All authors and session chairs are LLNL employees unless otherwise noted.

The 1994 LLNL Technical Women's Symposium



Welcome to Lawrence Livermore National Laboratory's second Technical Women's Symposium at the San Ramon Marriott! The theme for this year's event, "Professional Women Framing the Future of Science," is intended to build upon LLNL's vision, as articulated in the June 1994 document "Framing the Laboratory's Future." In this vision, the Laboratory focuses on three areas of long-term importance: global security, global ecology, and bioscience. This vision depends upon maintaining an excellent and diverse staff and building new forms of cooperation among the national laboratories, universities, and industry. Overall, this vision for the future of LLNL is one of sustained, results-oriented excellence. This symposium reflects not only LLNL's areas of focus, but celebrates the diversity of technical and professional women working at the Laboratory and the results of their work.

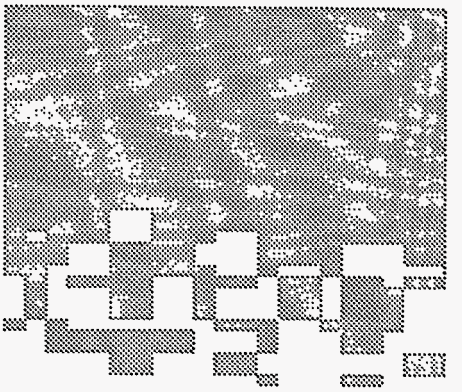
The goals of this symposium are threefold: to highlight the achievements of LLNL women; to give participants an opportunity to meet with colleagues from LLNL, other laboratories, and local DOE facilities; and to stimulate professional growth. This year, women from Sandia National Laboratories, Lawrence Berkeley Laboratory, Stanford Linear Accelerator Center, and Department of Energy (Headquarters and Oakland Operations Office) will be participating, enhancing the perspective of work presented. Our featured speakers will address issues relating to survival of the national laboratories in an ever-changing environment, how women are contributing to success during transition, and building leadership skills to enable DOE and the national laboratories to embark into the 21st century.

The first Technical Women's Symposium was held May 6–7, 1993, and was a great success. Over 225 LLNL employees attended 66 technical presentations and six professional development workshops. The attendees rated the overall symposium, technical sessions, poster session, and the professional development workshops on a scale of 1 to 10, with 10 being outstanding. The average ratings for these four areas were 9.1, 8.5, 7.0, and 8.7, respectively. The proceedings were videotaped and distributed nationwide, providing encouragement to women who could not attend and sending the message that LLNL is committed to a role for women in its technical work.

The Women's Issues Program of LLNL's Affirmative Action & Diversity Program is again sponsoring this symposium with support from numerous other sources. Full thanks to the organizing committee, which was once again composed of a multi-discinplinary team of dedicated women who organized this event on a volunteer basis.

Featured Speakers

All addresses take place in the Grand Ballroom.



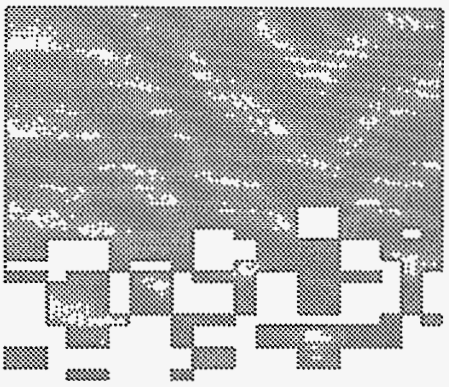
Keynote Address

The Evolution and Future Role of Computing in Our Work and in Our Lives

Dona Crawford, Director of National Information Infrastructure (NII) Research and Development, Sandia National Laboratories

As Director of NII Research and Development, Ms. Crawford's responsibilities encompass high-speed networking, collaborative worktools, distributed systems, and technology integration. Her organization pursues a smooth transition from research to development to application across Sandia's distributed base. She holds a B.S. degree in Mathematics from Redlands University and a master's degree in Operations Research from Stanford University. Ms. Crawford is a member of the Association for Computing Machinery, the Institute of Electrical and Electronics Engineers and was one of the founders of the National Information Infrastructure Testbed. She is active in community outreach to promote math and science.

Computing has evolved over time from centrally located big machines to the client/server model of today and will transition to an intelligence-based model in the next 10 years. The DOE laboratories' mission has been a key driver in the innovation of component computing technologies and their evolution. Ms. Crawford's keynote address will focus on DOE's role in this arena, the associated computing technologies along the way, and a potential future which will affect not only how we do business but how we live our lives.



Luncheon Address, Day I

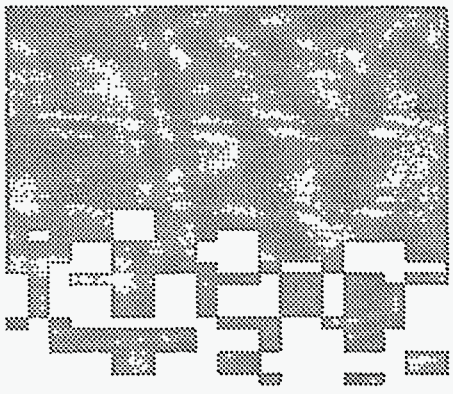
Diversity in Today's Workforce

Corlis Moody, Director of the Department of Energy's Office of Economic Impact and Diversity

Mrs. Moody heads the newly formed Office of Economic Impact and Diversity, which was established to provide greater focus and visibility to small and disadvantaged businesses. The Office also works to assure consideration of all views in DOE's decisionmaking and to ensure a diversified workforce. Before her appointment to this position, she was Director of Workforce Effectiveness and Diversity at Northern States Power Company in Minneapolis, Minnesota, where she led the company's diversity, employee relations and recruiting offices. She was also a consultant with Smith, Moody, Smith Company where she was responsible for assisting companies in the development of their Affirmative Action plans and training in Des Moines, Iowa. Mrs. Moody received a B.A. in Political Science from Southern University, Baton Rouge, Louisiana, and an M.A. in Public Administration and Personnel from Drake University

In her address at the symposium, Mrs. Moody will focus on diversity in today's workforce. She will interweave her personal experiences from 18 years in private enterprise and education with the current situation in Department of Energy. Mrs. Moody will also share her thoughts on the future direction of workforce diversity within DOE.

Luncheon Address, Day II

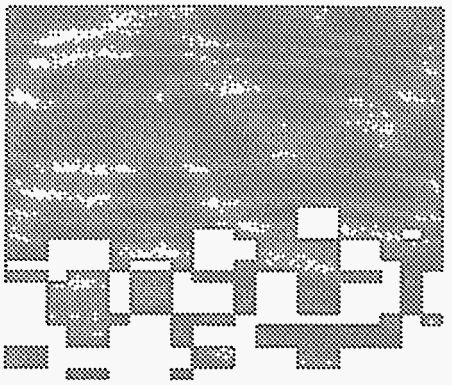


Reflections from the Glass Ceiling or How to Achieve Your Career Goals

Barbara Jean, President, The Competitive Edge

Ms. Jean is President of The Competitive Edge, an executive consulting and training company located in Santa Monica, California. She formed The Competitive Edge in 1991 after a 28-year career with the Eastman Kodak Company where she broke the glass ceiling seven times and was the first woman in all her management positions. Her undergraduate work was at Ohio State University and the University of Rochester. She completed the Executive Education Program at the USC Graduate School of Business in 1985. For 25 years, Ms. Jean has worked with women and corporate management on women's issues. She also teaches management, leadership, and diversity courses for the American Management Association, New York, and does customized curriculum development and course leadership for Fortune 500 companies and government organizations including ITT and the U.S. Navy.

In her talk, Ms. Jean will discuss how she broke glass ceilings at Eastman Kodak and what she learned from the process that will help other women successfully manage their careers. Among the topics she will cover are how to believe in your dream and make it reality, the importance of a mentor, how to manage your manager, learning from role models, asking for and accepting constructive criticism, and keeping life in balance while pursuing a challenging career. She will also discuss specific leadership skills that successful leaders demonstrate and how to develop them.



Endnote Addresses

The Jupiter-Comet Impact: What Happened, and What Made It So Exciting?

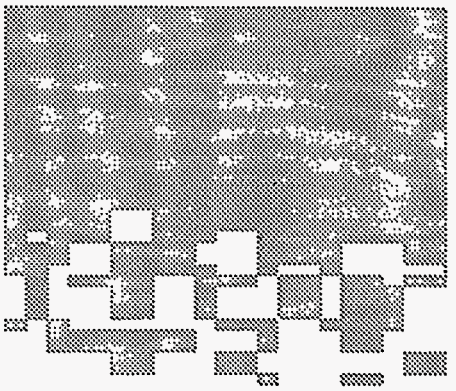
Claire Max, Institutes Director, LLNL

Dr. Max is Institutes Director at LLNL. She supervises five joint institutes which are devoted to enhanced research collaborations between Laboratory and University scientists and students. In addition, she is the leader of LLNL's Laser Guide Star Project, whose goal is to demonstrate the feasibility of laser guide stars for improving the resolution of large astronomical telescopes. After graduating from Radcliffe College and Princeton University in Astrophysical Sciences, Dr. Max was a post-doctoral fellow in Physics at the University of California, Berkeley, before joining LLNL. Dr. Max's research interests have included laser plasma interactions, astrophysical plasmas, and most recently, adaptive optics and laser guide stars. She has served on many national committees, including the National Academy of Sciences Committee on International Security and Arms Control, and the National Research Council's Commission on the Physical Sciences, Mathematics, and Applications.

Her endnote address will focus on the recent crash of Comet Shoemaker-Levy into Jupiter's atmosphere, which was observed by hundreds of astronomers all over the world. A group from LLNL spent a week at Lick Observatory on Mt. Hamilton, using LLNL's speckle imaging camera to take high-resolution images of the impacts. Dr. Max will describe both the science and the excitement of that week, and show some of the remarkable data obtained by the LLNL group, by the Hubble Space Telescope, and the Keck Observatory in Hawaii.

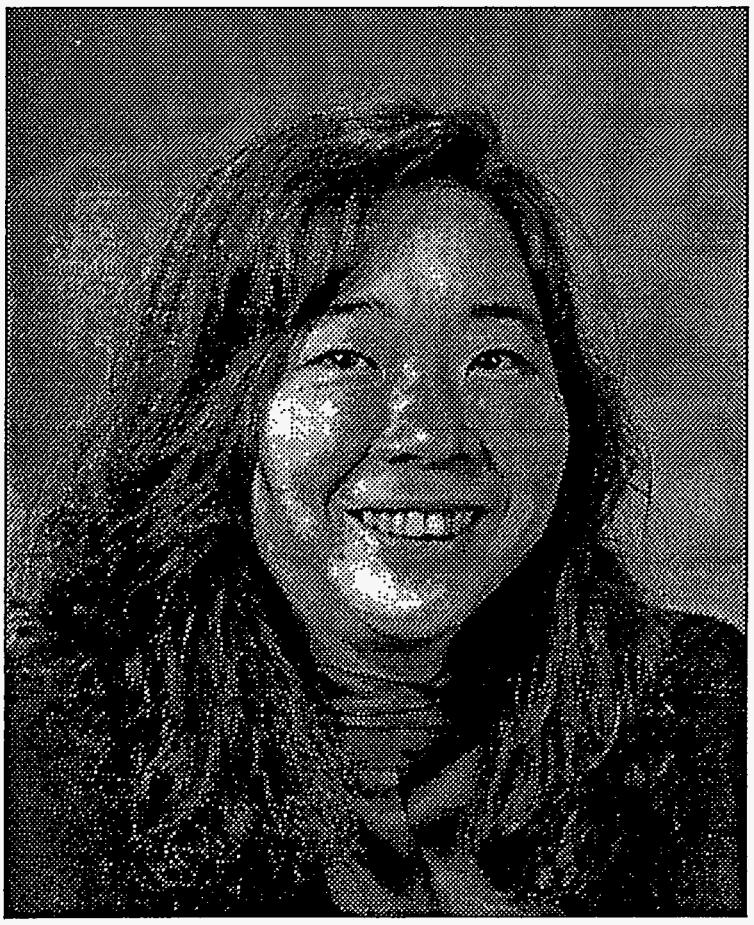
Clementine in Cyberspace: A New Look at the Moon 25 Years After Apollo 11

Muriel Y. Ishikawa, Project Leader for Clementine in Cyberspace, LLNL

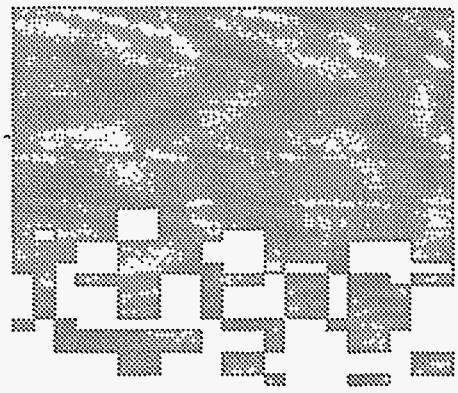


Dr. Muriel Y. "Yuki" Ishikawa is presently Project Leader for Clementine in Cyberspace and Project Leader for New Concepts in the Special Studies "O"/AT Program at LLNL. She is also a senior staff physicist on the Physics and Space Technology Associate Directorate Staff. Dr. Ishikawa holds a Ph.D. in Aeronautics and Astronautics and a M.S. in Aeronautical Science from Stanford University, as well as the first B.A. in Physics from Mills College.

Dr. Ishikawa will take us on a journey to the moon, in the 25th year of the Apollo 11 landing, as she discusses the Deep Space Program Science Experiment (DSPSE), nicknamed "Clementine." On January 25, 1994, Clementine was launched out of Vandenberg Air Force Base on a two-month mission in lunar orbit. This spacecraft carried a scientific instrument payload of lightweight sensors built by LLNL's "O"/AT Program. These sensors transmitted back over 1.7 million high-resolution images of the lunar surface and environment. The Clementine image-set represented the first complete high-resolution multispectral mapping of a planet. While the mission was still in progress, Clementine was also launched into cyberspace, the designation usually given to the worldwide data-space on the Internet. The Clementine in Cyberspace project constitutes an early demonstration of massive scale scientific data transport, archiving and retrieval-on-demand for general public assimilation. Review of the Clementine images has already led to fundamental new insights on the lunar environment.



Session I



Versatile Communication Expands Our Sphere of Influence

Rita Y. Myers (Salons A and B)

Understanding communication styles of co-workers, managers, family, and friends will help to frame the future of science. As professional women, we have achieved career success because of our ability to effectively communicate our thoughts, ideas, talents, and skills. We may expand our sphere of influence by being versatile in the way we communicate.

Being versatile doesn't mean giving up our own identities and unique styles, it means having the skill to get to the bottom line instead of our usual step-by-step approach when we're communicating with a senser; it means using language that communicates visual cues instead of auditory cues if our receiver forms mental pictures; it means recognizing that the attack you received was anindicator that the communicator is under stress and that addressing the source of stress is a more appropriate response than criticizing the behavior or fending off that unwarranted attack. Understanding these principles of communication can help us to more effectively frame the future of science.

Opportunities to Enhance Your Technical Career—Technology Transfer, Washington Assignments, Education Activities

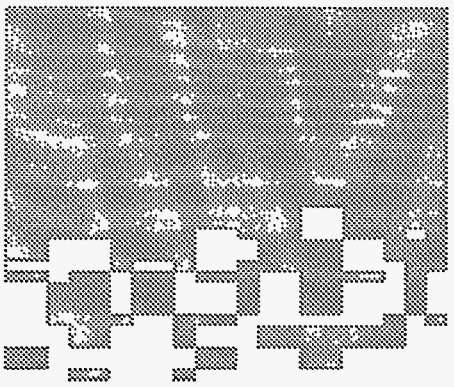
Chair: Arden Dougan (Salon C)

Technology Transfer: A New Culture

Kathy Kaufman, Ann Freudendahl, and Ruby Tebelak

When the U.S. Congress decided in 1989 that the national laboratories should participate in technology transfer to industry, Laboratory scientists were faced with the challenge of marketing their technologies to industry. Historically, laboratory scientists working in unclassified areas had been encouraged to freely share their work with peers both inside and outside the laboratories, but their mission did not extend beyond the government. Today, government scientists are no longer as free to share their work; for the first time their organizations must market their technologies and to a much broader audience—American industry. They now must recognize that successful technology transfer requires a completely new culture and a marketing approach to communication.

To be effective, technology transfer must also occur internally. While of equal importance, internal technology transfer has been slow to develop and requires cultural change. In the past, national laboratories were completely inaccessible to the public for security reasons. Their scientists could not even discuss their work with their families. Consequently, today the public has little notion of the way in which weapons-related technologies can touch them and improve their lives. By continually educating the entire workforce—internal tech transfer—employees can, in turn, inform their neighbors, relatives, and



friends, and begin to educate their communities about the resources that national laboratories hold for industry.

Successful technology transfer also requires motivated employees to make the transition successful. Everyone, even those not directly involved, must understand the organization's mission and their place in it. Internal technology transfer has a different audience than external technology transfer and requires a whole new style—with emphasis on why the culture has changed, what that means for the institution, what their role will be, and how this change will benefit the individual, the institution, and the nation.

The CRADA Process—A Principal Investigator's Perspective

Arden Dougan and Lucy Hair

Many work plans now include working with an industrial partner to transfer technology to the private sector. The process requires much advance preparation to find an industrial partner, understand the partner's and your sponsor's needs, and build a working relationship before any project work begins. All this can happen in a Cooperative Research and Development Agreement (CRADA) or in a procurement. We will discuss differences between these two mechanisms.

We will discuss and compare our experiences in obtaining a CRADA with an industrial partner, using the Technology Transfer Initiative method and as a part of a Field Work Proposal. We will explain the process involved, how long it takes, the difficulties we encountered, and the successes we've had.

Washington, D.C., Change of Station Assignments

Cynthia Nitta

LLNL change-of-station assignments—temporary offsite assignments available to scientific, engineering and administrative staff—will be described, with emphasis on assignments to sponsoring organizations in Washington, D.C.

Sample jobs and responsibilities will be discussed, along with the costs and benefits to the sponsoring organizations, the Laboratory, and the employee and his or her family. LLNL Domestic Transfer Policy covering offsite job placement, expenses and reimbursements, and job placement upon return will be discussed.

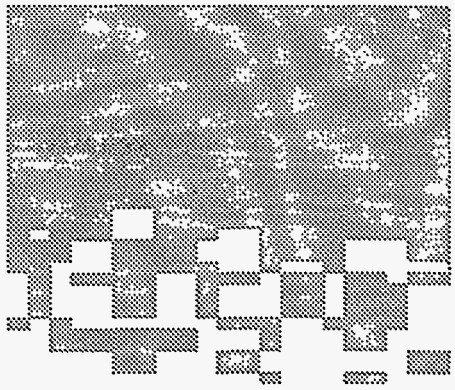
Teaching the Teachers: Tips, Times, Talents, and Thrills

Carol Velsko

Teachers participating in LLNL Summer employment programs work on projects under the guidance of Laboratory staff members. Careful planning and appropriate supervision on the part of the researcher can provide a valuable high-tech, hands-on laboratory experience for the teachers and result in a high quality product for the research project. Some of the factors promoting favorable outcomes are: management support/buy-in; a developed, but flexible, research plan; teacher interest and abilities; Laboratory staff motivation and time commitment; enrichment and curriculum development activities for teachers; and general helpful attitudes by Laboratory employees. I shall present a description of the available summer employment options for teachers, a history of the program, my experiences as a mentor, and some of the benefits I've enjoyed by participating.

Lasers

Chair: Gail Glendinning (Salon F)



A Novel Beam Smoothing Technique For Laser Fusion

D.M. Pennington, M.A. Henesian, R. Wilcox, D. Eimerl, and H.T. Powell

We will report on the development of a novel four-frequency beam smoothing scheme for laser fusion experiments on the Nova laser, with a capability similar to that planned for the proposed National Ignition Facility. Wavefront aberrations in high-power laser systems produce nonuniformities in the energy distribution of the focal spot that can significantly degrade the coupling of energy into a fusion target, driving various plasma instabilities. The introduction of temporal and spatial incoherence over the face of the beam using techniques such as smoothing by spectral dispersion (SSD) reduces variations in the focal irradiance when averaged over a finite time interval.

In SSD, broadband light is spectrally dispersed by a grating, amplified, frequency converted, and focused through a random phase plate on to a target. Each distinct frequency component produces a speckle pattern, resulting in the superposition of many patterns that are spatially shifted as a function of frequency. The rapidly fluctuating interference of the displaced speckle fields causes the irradiance to appear smooth on a time-averaged basis.

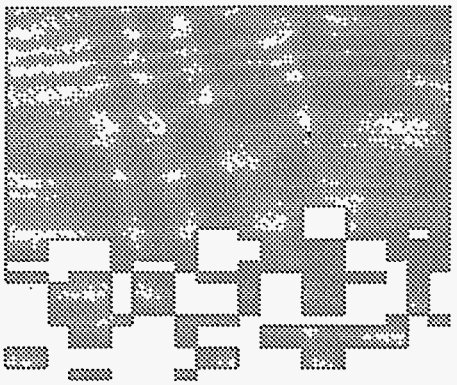
One of the limitations of beam smoothing techniques used with solid state laser systems has been the inability to efficiently frequency convert broadband pulses to the third harmonic (351 nm). To obtain high conversion efficiency, we developed a multiple frequency source that can be spatially separated into four quadrants, each containing a different central frequency. Each quadrant is independently converted to the third harmonic in a four-segment Type I/Type II KDP crystal array with independent phase-matching for efficient frequency conversion. SSD is implemented by adding limited frequency modulated bandwidth to each frequency component. This improves smoothing without significant impact on the frequency conversion process. The development and performance of this advanced beam smoothing technique will be described in detail.

Control System Integration: A New Approach for CNC

Kimberly Cupps

The Computers, Networks and Controls (CNC) Associate Program has provided front-end and supervisory system controls for the Atomic Vapor Laser Isotope Separation (AVLIS) program for the past eight years. The AVLIS program is nearing the end of its research and development phase and is positioning itself to prove plant production capabilities. The current AVLIS supervisory control system must be significantly modified to provide functional capabilities necessary to support an AVLIS plant. These functions include enhanced alarm capabilities, the need to support additional lasers and separator vessels while maintaining current or better supervisory system performance as the AVLIS system scales up, and much increased automation of laser and separator systems.

With fundamental redesign, the current supervisory control system could meet most of the needs described above. However, such a redesign would require a large amount of software rewriting and would be very time consuming. Fur-



thermore, high software maintenance costs would continue for the life of the program. An alternative to rewriting the existing system is to use a commercial product and allow developers to concentrate on unique control areas that require customization. Toward this end, CNC has evaluated many commercial control systems for possible use in the AVLIS Facility in B490 and/or in an AVLIS production plant. Based on these evaluations, Hewlett Packard's Real Time Application Program (RTAP) was chosen for an in-depth evaluation prototype.

This talk will discuss the factors that led CNC to adopt a strategy of providing system integration expertise and abandoning the previous "it's all invented here" philosophy. The features of the RTAP system which allow its integration with existing specialized software and hardware systems will also be discussed.

Automation and Intelligent Systems

Chair: Erna Grasz (Salons G and H)

Advanced Robotics Technology Applied to Mixed Waste Characterization, Sorting, and Treatment

Erna Grasz, Loretta Huber, and Karl Wilhelmsen

There are over one million cubic meters of radioactively contaminated hazardous waste, known as mixed waste, stored at DOE facilities. Researchers at LLNL are developing methods to safely and efficiently treat this type of waste. LLNL has automated and demonstrated a means of segregating items in a mixed waste stream. This capability incorporates robotics and automation with advanced multi-sensor information for autonomous and teleoperational handling of mixed waste items with previously unknown characteristics. The first phase of remote waste stream handling was item singulation: the ability to remove individual items of heterogeneous waste directly from a drum, box, bin, or pile. Once objects were singulated, additional multi-sensory information was used for object classification and segregation. In addition, autonomous and teleoperational surface cleaning and decontamination of homogeneous metals have been demonstrated in processing mixed waste streams.

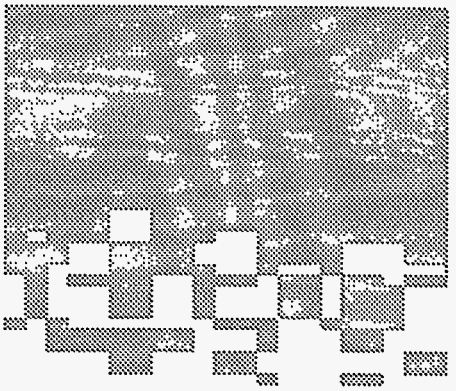
The LLNL waste stream demonstration includes advanced technology such as object classification algorithms, identification of various metal types using active and passive gamma scans and RF signatures, and improved teleoperational and autonomous grasping of waste objects. The workcell control program used an off-line programming system as a server to perform both simulation control as well as actual hardware control of the workcell. This presentation will discuss the motivation for remote mixed waste stream handling, the overall workcell layout, sensor specifications, workcell supervisory control, 3D vision based automated grasp planning, and object classification algorithms.

Depth-from-Focus 3D Microscopic Imaging

Shin-yee Lu

Depth calculation of an object allows computer reconstruction of the surface of the object in three dimensions. Such information provides human operators 3D measurements for visualization, diagnostics, and manipulation. It can also provide the necessary coordinates for semi- or fully automated operations. This paper describes a microscopic imaging system with computer vision algorithms that can obtain the depth information by making use of the shallow depth of field of microscopic lenses.

Design of an Automated Glove Box Line
Katherine Fritz



In an effort to reduce radioactive waste, Los Alamos National Laboratory (LANL) recycles plutonium beryllium neutron sources. Currently this process is executed manually. This manual process exposes personnel to extremely high radiation doses when operated at the required frequency. A significant reduction in operator radiation exposure is required to meet the DOE requirements of .5 mrem/year. One potential solution is the integration of automated systems to minimize the level of human involvement required to carry out the recycling process. An automated system would physically remove or distance the operator from the radiation source, thus reducing radiation exposure, improving productivity, increasing yields, and improving ergonomics.

A team of engineers and designers from LANL and LLNL was established to develop innovative solutions to this problem. Personal contributions included development of several of the six 3D conceptual layouts of intelligent and automated systems proposed for evaluation. Particular design attention was given to my concept of an automated transport system for the neutron source delivery. This automated method for transporting the neutron sources from the vault where they are stored, to the room, and into the glove box would minimize and in some cases delete the radiation exposure to the operator. In the manual handling process, 75% of the total radiation exposure is obtained during transport and delivery. The design of an automated transport and delivery system would provide at least two levels of containment at all times.

During this design process many viable design options were considered with various levels of automation incorporated into the designs. The concept selected incorporated the automated delivery system coupled with an IBM gantry robot in the glove box for the recycling process. The customer considered this project a success.

In this presentation, I will discuss the automated delivery system and hardware designs, and show a video animation of the process.

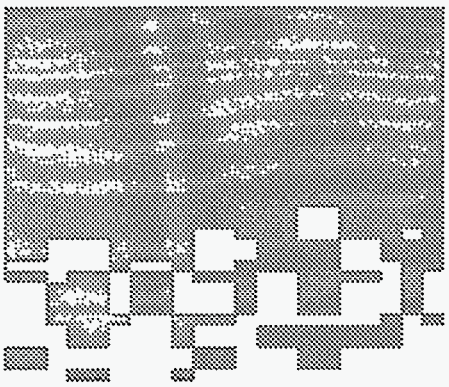
Laser Guide Star
Chair: Jong R. An (Pleasanton and Danville Rooms)

Laser Guide Star Project—Control System
Jong R. An

The main factor limiting the performance of ground based telescopes is atmospheric turbulence. The goal of the Laser Guide Star project is to reduce the deleterious effects of the atmosphere so that even modest telescopes can produce very high quality astronomical images. This talk will focus primarily on the control system and also will provide a short overview of the project and brief descriptions of the various subsystems. Experimental results from the Lick Observatory will also be presented.

The Laser Guide Star Project (LAGOS): An Optical Designer's View
J. Nan Wong

The Laser Guide Star project has been a source of technical design challenges. The project's main goal is atmospheric correction for astronomy. Since this is leading-edge technology, creative problem-solving and good technical



skills are essential. This talk will overview some of the interesting and challenging optical design tasks and skills associated with the project.

We will examine the role of an optical designer in a project such as LAGOS, using three of the project's optical design tasks as examples:

- Laser pulse broadening
- Sodium guide star laser system
- Adaptive-optics system (sensing and correction of atmospheric turbulences)

Projects like LAGOS not only benefit the technical community, but also the individuals involved. The work is both interesting and challenging, providing a wealth of opportunities for technical growth.

Finite Element Analysis of the Lick Observatory Three-Meter Telescope

Johanna Swan

A laser guide star system is being added to the three-meter telescope at the Lick Observatory. This requires mounting of alignment-sensitive optics and a laser system directly on the telescope, as well as an understanding of truss deflections and misalignment of optical components. A finite element model was generated for the telescope tube, which employs an unequal-armed Serrurier parallelogram truss. The model employs both solid and shell elements to define the tube and main optical elements. Mass elements are used to define the laser system and counter weights on the telescope. Both the calculated deflections and resulting alignment errors are presented.

Deformable Mirror Design for Laser Guide Star

Carolyn Weinzapfel, John Bergum, Charlie Swift, J. Thaddeus Salmon, and Johanna Swan

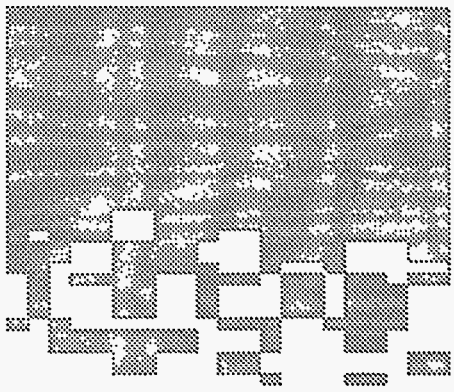
A deformable mirror with actuators in a close-packed, hexagonal geometry is being designed for the Laser Guide Star project. A scaled design will be used to control light from astronomical sources at the Lick Observatory on Mt. Hamiliton. The design employs lead magnesium niobate (PMN) actuators to deform the substrate to the correct conjugate shape. The actuators are preloaded, field replaceable, and cooled for moderate bandwidth operations. A prototype mirror with nineteen actuators attached to a five-centimeter hexagonal substrate has been built and tested. Details of the mirror's design and performance will be presented.

Laser Guide Star Adaptive Optics for the Keck Observatory

Claire Max

Laser guide stars and adaptive optics systems can remedy the deleterious effects of atmospheric turbulence and improve the resolution of ground-based astronomical telescopes. Design is currently under way for a laser guide star adaptive optics system at the Keck Observatory, to serve the 10-meter telescope (the largest in the world). The major design issues will be discussed, and performance predictions for adaptive optics and laser guide star systems at Keck will be presented. Expected performance of the astronomical instruments that will take advantage of adaptive optics will be described.

Session II



Bioscience at LLNL: Genes, Genetic Damage, and Genomics

Chair: Cindy Thomas (Salons A and B)

Spectrum of Somatic Mutation at the Hypoxanthine Phosphoribosyltransferase (Hprt) Gene of Healthy People

K. Burkhart-Schultz, C. B. Thomas, B. Tucker, J. C. Fuscoe (Integrated Laboratory Systems, NC), C. L. Thompson (National Institute of Environmental Health Sciences), C. L. Strout, R. B. Whitelock, and I. M. Jones

Somatic mutations (changes in the DNA in cells other than ova or sperm) have been found in tumor cells and are believed to be at least part of the reason that cells become cancerous. Understanding the significance of mutations in human populations that are exposed to toxins requires knowledge of the mutations that occur in normal unexposed populations.

We have been studying the spectrum of mutations in a healthy, unexposed population of 200 healthy, male and female, smoking and non-smoking individuals. Data have been collected on the mutant frequency (MF, the number of mutant cells per million cells) and the molecular character of individual mutations at the hypoxanthine phosphoribosyltransferase (HPRT) gene in lymphocytes. Lymphocytes from a donor's blood sample were grown in culture under conditions that selected for the growth of mutant cells possessing a non-functional HPRT enzyme (the protein product of the HPRT gene). Each selected mutant cell was grown in culture to produce a clone (a large number of identical cells) that was analysed to determine the molecular basis for the mutant character. Polymerase chain reaction amplified cDNA (produced from messenger RNA) and genomic DNA were sequenced to define the mutation in 1 or 2 mutants per person. We have analysed 180 mutant clones from: 87 smokers (average of 1 pack per day for 10 years) and 49 non-smokers. We found 171 mutations that included 101 base substitutions, 27 deletions of 3 to 200 base pairs, 21 larger deletions (ranging to >1 megabase), 16 frameshifts of 1 to 2 bp, 2 duplications, and 4 complex changes. Forty-five percent of the base substitutions were identical mutations, 2 to 3 at each of 14 "hotspots". Type of mutation, age of donor, and MF were not correlated. The mutation spectrum in this control population reveals the richness of mechanisms by which cells misprocess DNA and misrepair damaged DNA. (Work performed under the auspices of U.S. DOE by LLNL under contract W-7405-ENG-48 with support from IA Y01-ES-80171 from NIEHS.)

Characterization of Genes Involved in Repair of Damaged DNA

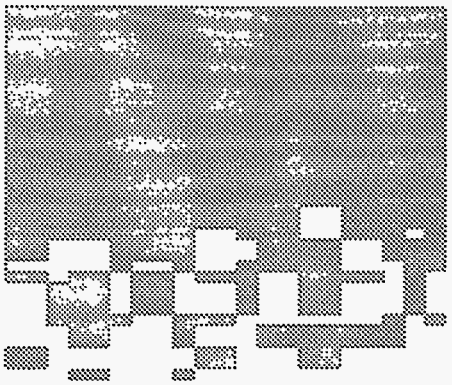
Kerry Brookman

See addendum.

Sequencing the Human Genome: A Beginning

Jane Lamerdin

See addendum.



Chromosome Painting as a Tool in Radiation and Chemical Dosimetry

Francesca S. Hill, Cheryl Burk, and Joe N. Lucas

Fluorescent in situ hybridization (FISH) with whole-chromosome probes (chromosome painting) is a useful tool for the measurement of translocation frequencies found in the peripheral blood of individuals exposed to ionizing radiation and various clastogenic chemicals. DNA from several kilobase pairs (kb) to whole chromosomes can be labeled and visualized in several fluorescent colors. Comparisons with conventional cytogenetics, which is labor intensive and requires highly trained technicians, show that translocations detected by chromosome paints are stable and can be more easily used to determine exposure (dosimetry) immediately following or decades after an accident. Because translocations are involved in both carcinogenesis and inherited genetic diseases, accurate measurement of their persistence is important for risk estimation. FISH can efficiently detect translocations and other chromosomal aberrations involving targeted portions of chromosomes or whole chromosomes, making it an ideal screening tool for dosimetry, prenatal diagnosis, sperm aneuploidy, gene mapping and tumor studies.

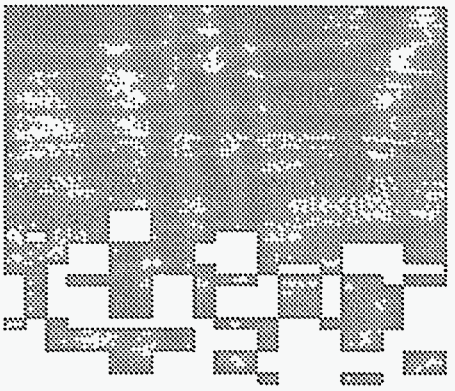
Molecular Detection of a Paternal Age Effect on Chromosomal Abnormalities in the Germ Cells of Mice

Xiu Lowe

A new method has been developed to identify individual chromosomes in mouse sperm and to detect sperm carrying chromosomal abnormalities (aneuploidy). This method, which uses fluorescent DNA probes, was applied to eight B6C3F1 male mice aged 22.5 - 30.5 months to determine if advanced age is associated with an elevated production of chromosomally defective germinal cells. Mice aged 2.4 months served as controls. Sperm aneuploidy was measured by multi-color fluorescence in situ co-hybridization with DNA probes specific for chromosomes X, Y, and 8, scoring 10,000 cells per animal (8 aged and 4 control). The aged group showed significant (1.5 - 2.0 fold) increases in the hyperhaploidy phenotypes X-X-8, Y-Y-8, 8-8-X, and 8-8-Y with the greatest effects appearing in animals aged greater than 28 months. The frequencies of total hyperhyploidy and sex chromosome hyperhaploidy were also significantly increased in aged group ($p=0.005$ and 0.001, respectively). The aneuploidy frequencies of the control animals were consistence with those of previously published data. In conclusion, our findings suggest that advanced paternal age is a risk factor for chromosomal abnormalities of reproductive importance. Therefore, this novel technique is promising for future studies of the induction of aneuploidy following exposure to potential germinal mutagen.

Looking into the Future: Major Environmental Issues of Today

Chair: Florida M. Matthews (Salon C)



Pollution Prevention Opportunity Assessments

Florida M. Matthews, Phil Armatis, John Celeste, Doug Dobie, and Al Harrison

The Waste Minimization Project (WMP) is offering to perform Pollution Prevention Opportunity Assessments (PPOAs) for waste of pollution generators throughout LLNL in order to evaluate existing processes that generate pollution or waste and identify prevention options.

Processes will be reviewed and evaluated by WMP staff engineers who will work with process operators to:

- Define the material and energy flows for a given process.
- Define technical or operational options to reduce pollution at the source or make the process more energy-efficient.
- Evaluate various options based on cost effectiveness and technical feasibility.
- Provide a final recommendation and implementation report to the process operator.

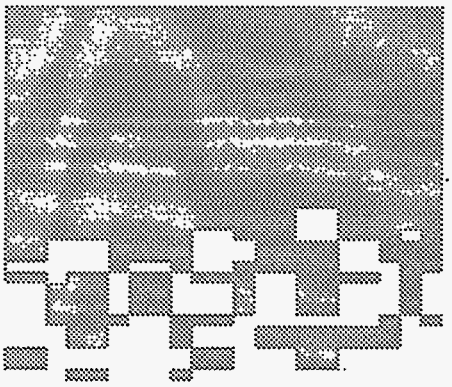
More than 30 PPOAs will have been provided funding between June - September 1, 1994.

Integrating Pollution Prevention/Waste Minimization into the National Environmental Policy Act Process

Sheryl L. Buck (Sandia National Laboratories)

Since Spring 1993, Sandia National Laboratories has formalized the integration of the Pollution Prevention/Waste Minimization Program (PP/WMin) criteria into the National Environmental Policy Act (NEPA) review process. Federal agencies are bound by NEPA, which became law in 1970. Sandia, a DOE contractor, is a research and development laboratory expanding its mission toward Technology Transfer and Work for Others. Because all projects, regardless of size or budget, are reviewed by NEPA, it is the logical existing process to integrate environmental, safety, and health program criteria, including the PP/WMin Program. We now include PP/WMin in the development of a project plan. By making environmentally safe materials and process choices, we identify chemicals by type and quantity, and document research and maintenance activities.

Integration results have been positive. NEPA uses the interdisciplinary team approach to evaluate proposed projects to existing environmental conditions, to guide the project leader to regulations, and to offer alternatives. Our on- and off-site customers benefit from their increased understanding of laws governing their project. Staff awareness of the PP/WMin regulations has increased. Staff members are conscious of ozone depleting chemicals, as directed by Executive Order 12843. They purchase smaller quantities of chemicals regulated by the Toxic Substance Control Act, and comply with regulations, such as the Clean



Air Act, Clean Water Act, and Resource Conservation and Recovery Act. This enables Sandia to meet its 50 percent reduction goal by end-of-year 1995, using 1990 as a baseline.

The public and current Administration insist that government, industry, municipalities, and the private sector pay more attention to how they use, reuse, reduce, and recycle. We find NEPA to be the best tool to integrate programs. Integrating pollution prevention and waste minimization into the NEPA process makes good sense.

Environmental Monitoring and Analysis Division

Evelyn M. Ryan

In this presentation, we will discuss the role of Quality Assurance (QA) in Environmental Project Management by examining:

- Which QA definitions pertain to environmental project management—including the difference between quality assurance and quality control and the importance of the quality management concepts of work planning, implementation and assessment, and customer satisfaction.
- The best sources of QA information—including a brief discussion of the DOE Orders and national consensus standards that provide quality system requirements applicable to EPA, DOE, and nuclear or commercial projects.
- The need to integrate applicable QA requirements to plan, implement, assess, and document projects—including guidance on how to integrate QA requirements into a practical format and how to incorporate them into project plans while applying quality to a level commensurate with project needs.
- The minimum elements that should be addressed in a Quality Assurance Project Plan (QAPP).

The session will end with time for questions and answers.

Managing ES&H Issues and Documentation for the Mixed Waste Management Facility

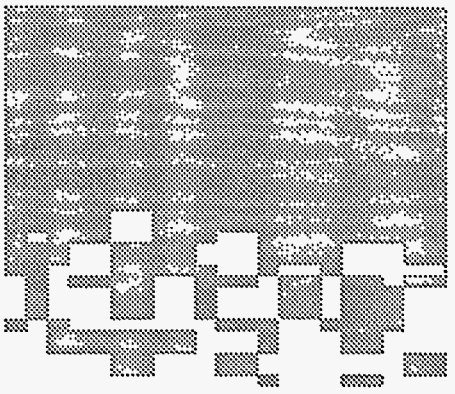
Judy Steenhoven

LLNL recently received approval from DOE to proceed with design of the Mixed Waste Management Facility. The project has been established under the Environmental Programs Directorate to demonstrate integrated technologies for the treatment of low-level organic mixed waste on a pilot scale. In particular, the project will focus on demonstrating a variety of competing technologies that are environmentally acceptable alternatives to conventional incineration, and will evaluate these technologies relative to federal and state standards that call for incineration.

What are the ES&H issues and regulatory requirements for turning this concept into a reality? This talk will cover the goals of the project from an ES&H perspective and how the basic DOE and regulatory requirements are being met. It will also include a general discussion of what my role as the Assurance Manager for this project is in terms of accomplishing these tasks.

Physics: Research and Applications

Chair: Linda Powers (Salon F)



Large Scale Computer Simulation of Complex Physical Systems—Applied to Inertial Confinement Fusion Targets

Judith Harte, Sharon Wilson, Kelly Barrett, Linda Powers, and Barbara Lasinski

We have developed a tool to simulate the evolution of the complex systems which occur in ICF target design and related work. In this work, a laser (or some kind of high energy beam) is used to heat and compress small "targets" to temperatures and densities that will initiate and sustain thermonuclear fusion. The nuclear energy released by the fusion process will be captured and used as an energy source.

There are many challenges involved in creating such a tool. First, we have to derive a consistent set of mathematical equations to model the actual physical systems. Next we must decide how to solve these equations on a computer. For practical reasons, the different physical processes are modeled separately, so we must combine the various solutions in a consistent way at each time step. Then we advance time by a specific amount and combine them all over again and so on. This code must be built in an orderly and modular way to allow our team of scientists to work on it simultaneously and efficiently. Creating the user interface is another challenge. We must create a system in which our users can generate their particular experiment on the computer in a straightforward way. Also the user interface helps the users examine and interpret their results. The final challenge is validating the code results. We test the code on simple problems for which we can solve the equations analytically. We compare code results with experiments to see that they produce what happens in the laboratory. This gives us confidence that we can use the code to predict and design future experiments.

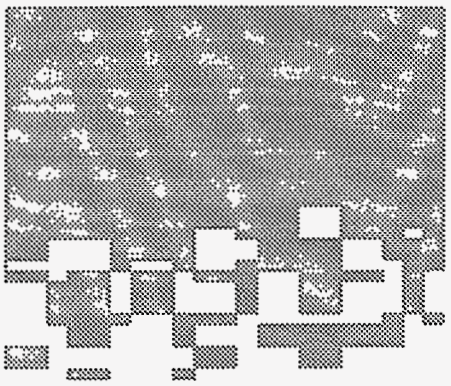
We will describe these challenges, review the basic physics that can be modeled by our code, and describe the code development process. Example calculations will be shown.

The Evolution of Novel Physical Concepts to Useful Applications: Traveling Potential Hills to Isotope Separation and Mass Spectroscopy

Lou Ann Tung

Novel ideas usually arise by small leaps of creativity from existing, well-understood concepts. Novel ideas also evolve from the observation of unexpected phenomenon by paying attention to the "data point that doesn't fit" and understanding why the unusual event occurred. Useful applications of these novel ideas come from always being open to that possibility.

For example, Dr. Richard Post (LLNL) discovered the mass selectivity of a traveling potential wave while working on computer simulations for a new linear accelerator for heavy ions. In his simulations, he observed that some ions were accelerated and some not, depending on their mass. After understanding what was observed, he patented this concept of the mass selectivity of a travel-



ing potential hill.† Consequently, this project became funded to build an experiment to prove this principle for separating specialty stable isotopes. During this successful experiment, my colleagues and I observed two separate, unexpected events.

The first was a result of a vacuum leak that caused nitrogen rather than neon ions to be accelerated. Almost two months later, I realized that we had used our isotope separator as a mass separator. Since then, I have presented this new application at mass spectrometer conferences and have received favorable reviews. The search for a collaborator to build a prototype is now underway.

In the second event, I observed an unusually high ion current before turning on the power supplies to the focusing electrodes. After investigating further, I found that I had unintentionally configured beam-focusing electrodes to provide a self-focusing channel for the ion beam, without an active power supply. Immediately seeing that this could be useful, I filed a record of invention, and am now seeking a useful application for this physics phenomena while awaiting the possibility of a patent.

†*"A Method for Discriminative Particle Selection," R. F. Post, Patent #5140158 issued Aug. 18, 1992.*

Resonant Dissociative Recombination of H_3^+

A. E. Orel

Recent experiments by Larsson *et al** have confirmed the prediction** of a high energy (~9eV) peak in the cross section for dissociative recombination of H_3^+. This peak is caused by four resonant states of H_3. Electron scattering calculations using the complex Kohn method provide the resonance positions and widths as a function of internuclear separation. This information was used as input to a wave packet calculation for the dissociation dynamics. Substantial autoionization occurs during dissociation due to the large widths of the resonant states. The shape and magnitude of the calculated resonance cross sections agrees with experiment.

(This work was supported by NSF PHY-90-14845 and performed under the auspices of the U. S. Department of Energy by LLNL under contract W-7405-ENG-48. Computer time was provided by the San Diego Supercomputing Center.)

* *M. Larsson, H. Danared, J. R. Mowat, P. Sigray, G. Sundstrom, L. Brostrom, A. Filevich, A. Kallberg, S. Mannervik, K. G. Rensfelt and S. Datz, Phys. Rev. Lett, 70, 430 (1993).*

** *K. C. Kulander and M. F. Guest, J. Phys. B, 12, L501 (1979)*

Gamma Ray Burst Optical Counterpart Search Experiment

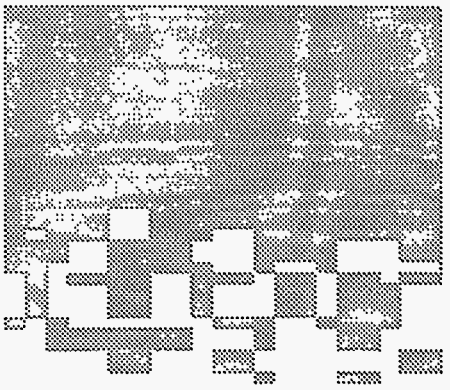
Hye-Sook Park

The Burst And Transient Science Experiment (BATSE) detectors implemented on NASA's Gamma Ray Observatory are detecting ~1 Gamma Ray Burst (GRB) event per day. The origin of GRB is one of the leading puzzles of modern astronomy. These phenomena have been known for many decades but their near isotropic distribution in space defies explanation. There are intense efforts to determine the origin of these events. However, the poor angular resolution of BATSE's gamma ray detector and their short duration (1~1000 seconds) prevents astronomers from associating the bursts with known objects.

Our experiment attempts to observe simultaneous visible counterparts to gamma ray burst events. We use a wide-field-of-view camera system originally

designed for the SDI program which maintains contact with BATSE so it can rapidly slew to any burst location upon notification. The WFOV camera system has been operating every night since January 1994, weather permitting.

This paper will describe the experimental approach, the hardware setup, the on-line algorithms, and recent results.



Maximize Your Leadership Potential: An Exploration of Leadership Skills

Joy Hirabayashi (Salons G and H)

What makes a leader? What skills and qualities distinguish a leader? Can those attributes be learned? In a 1-1/2-hour session participants will have the opportunity to explore these questions through:

- A discussion of key concepts of leadership and team building.
- A guest speaker who will present her personal leadership experiences.
- An individual assessment inventory of leadership skills.

Cutting Edge Computer Technology

Chair: Tory Bobo (Pleasanton and Danville Rooms)

Workflow and Business Process Reengineering

Tory Bobo

In order to maintain a competive edge, businesses are forced to examine, streamline, and improve their business processes. Workflow, the automation of processes used to run our everyday businesses, is a technology that can facilitate this improvement. A workflow infrastructure can easily be established by integrating computer technology such as Electronic Forms, Digital Signatures, Electronic Mail, Internet, Document Managing Systems, and Databases. This session will focus on implementing workflow to help make LLNL business processes more cost effective and efficient. A case study of workflow in action at the Laboratory will be presented.

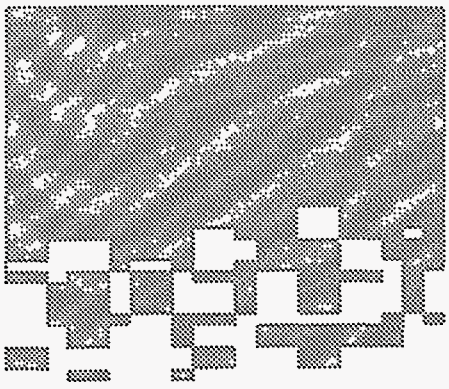
Automation—The Future of Computer Operations is Now

Nancy V. (Ginny) Bedsole

I work in a large data center where new systems seem to come through the door on a daily basis, giving the operators increasingly more responsibilities and systems to monitor. Finally, there were more computer systems to monitor than operators available; it was clear that the operators needed assistance. As a result, the system Comensa was selected to assist in the automation of our data center.

The Comensa system alerts the operator to things that are necessary to perform the job. It monitors for such things as tape mounts, printer problems, memory errors, job status, security alerts, communication/network problems, and system outages. The system alerts the operator by audio announcement and graphics. It can notify other pertinent personnel via the telephone and also leave messages on voice mail or pagers.

One script of Comensa computer code alone has saved the Administrative Information Systems (AIS) department approximately $50,000 in overtime since we first started using it about two years ago.



Session III

Framing the Future of Science Through Mentoring

Rita Y. Myers (Salons A and B)

Professional women may frame the future of science both as mentors and mentees in the workplace, in schools, and in our communities. Mentoring fosters career growth, broadens perspectives, and increases personal and organizational effectiveness.

The results of a one-year pilot program at LLNL will be presented. Based on this pilot program and other research, this session will highlight the:

- Desirable qualities of a mentor and a mentee.
- Benefits to both mentor and mentee.
- Roles of the mentee, mentor, parent, teacher, supervisor in the mentoring process.

The Women of All Dimensions

Chair: Anne Sunwoo (Salon C)

Concurrent Diffusion Bonding and Superplastic Forming of Aluminum Alloys

Anne Sunwoo

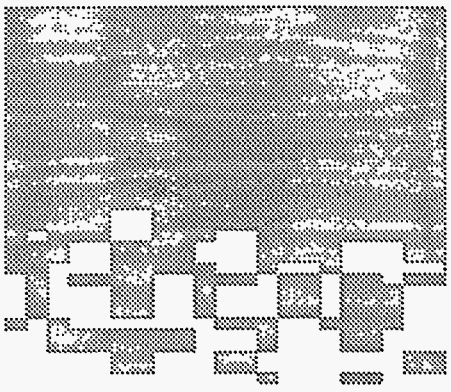
Many alloys we use today have been engineered to exhibit desired properties. One aspect of metallurgy we are studying at LLNL is superplasticity. Superplastic materials exhibit large plastic elongation with a low flow stress at high homologous temperatures (≥ 0.5 Tm). This enables the alloys to be easily formed with gas pressure into complex shaped parts in a reasonable amount of time. Near-net- shape forming of parts enables manufacturing to be economical by reducing material costs and eliminating many post-formed fabrication procedures.

Several commercial applications in both aerospace and automotive industries select aluminum (Al) alloys for their low density and high strength-weight ratio. There would be greater use of superplastic Al alloys if the alloys could be concurrently diffusion bonded. However, this constitutes an enormous challenge due to the stability of the oxide layer. The oxide layer is an excellent diffusion barrier, successfully guarding the bonding interface, even in vacuum. We addressed this challenge first by studying the effects of surface composition on the bond integrity and second by applying theoretical superplastic deformation mechanisms to enhance bonding. The results of this first approach demonstrate the feasibility of diffusion bonding Al alloys using a transient liquid phase (TLP) bonding technique. The results also show the greater importance of compositional compatibility between the TLP and base alloy than the temperature of the TLP.

The second approach uses the superplastic deformation mechanisms of grain boundary sliding and grain rotation. A unique device has been designed and built to study concurrent superplastic forming and diffusion bonding processes. During bonding, the specimens are superplastically deformed to create new oxide-free surfaces, while lateral pressure on the bonding surfaces enhances surface contact. The bonded surfaces are free of high temperature oxides. The results of this study will be presented.

Theoretical Study of Clean and Cl-covered Ta(100) and (110) Surfaces

Christine J. Wu



Tantalum (Ta) materials have widespread applications in microelectronic devices, such as serving corrosive protective layers in thermal ink jet printheads. To achieve optimum Ta etching process, it is essential to understand the Ta surface structures as well as their chemical reactivities.

Here, we present first-principles total energy calculations of both atomic and electronic structures of clean and Cl-covered Ta(110) and (100) surfaces. Ta surfaces were modeled by supercell geometries and their multilayer atomic relaxations were studied as a function of the number of layers in the supercell. The contraction, relative to bulk, of the first interlayer spacing for the Ta(100) surface is found to be large, approximately 12%, in excellent agreement with available experimental observations. The corresponding contraction for the more close-packed Ta(110) surface is predicted to be much smaller (about 2%). Relative stabilities of different adsorption sites on Ta(110) and (100) surfaces upon Cl exposures were determined to provide insights into experimentally observed progressive streaking LEED patterns over a range of Cl coverages. The nature of the Ta-Cl bonding was analyzed via calculations of the adsorbate-induced surface states and work function variations.

The Dynamic "Punch-Thru" Shear Test Technique

Mary LeBlanc and David Lassila

Explosive metal forming operations similar to deep drawing involve a combination of tensile and shear loading at strain rates between 103 s^{-1} and 105 s^{-1}. Deformation of the material can be limited by the formation of localized plastic instabilities; which can be either a symmetric necking type, usually seen under tensile loading, or a shear instability, typical of torsional loading.

The most widely used method for measuring material behavior at strain rates from 103 s^{-1} to 104 s^{-1} is the split Hopkinson pressure bar (SHPB) or Kolsky bar technique. We have developed a "punch-thru" test based on the SHPB technique which creates a combination of tensile and shear loading in the gage section of a thin disc. The sample load is measured with a transmitter bar. A high-speed framing camera is used to record the motion of seven tiny boron fibers attached to the gage section of the sample, and the displacements are correlated with the sample load record.

In this session, we will present a complete set of test data for copper. We will also discuss changes in behavior associated with grain size (copper), material (tantalum and copper) and geometry of the gage section.

Electron Microscopy Investigation of a New Generation of Thermoelectric Materials

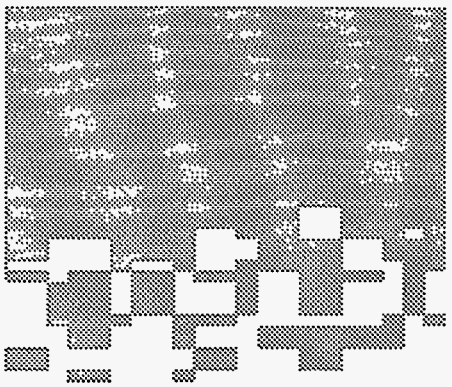
Peggy Olsen

See addendum.

Fabrication of GaAs-Based Wavelength Division Multiplexers (WDM) and Channel Dropping Filters

Lan Thi Nguyen

GaAs-based materials have been on the leading edge of research and development in the optoelectronics field. Increasing interest in WDM systems is creating a significant demand for wavelength demultiplexers. An example of an efficient demultiplexer is a "channel dropping filter" (CDF) that extracts a



single wavelength channel from a stream of multi-wavelength data.

These WDM devices are being designed and built in cooperation with LLNL's L Division and Electronics Engineering Department.

Aside from the initial designs, calculations, and simulations, the physical aspects of building these devices will be discussed, including the use of MOCVD epitaxial growth, thick and thin film photolithography, and selective dry and wet chemical etching. The chemistry of the solutions used in the processes will also be emphasized.

This presentation will discuss the main processes used in fabricating of the CDF, including the problems encountered and the solutions developed to correct those problems.

LLNL Support to Nonproliferation

Chair: Mary Beth Ward (Salon F)

LLNL Support to U.S. Nonproliferation and Arms Control Efforts

Panel Members: Mary Beth Ward, Arden Dougan, Amelia Hagen, and Melanie Elder

Threats to U.S. national security have changed dramatically, creating new demands on the expertise and technology in LLNL's Nonproliferation, Arms Control, and International Security (NAI) program. From the outset of the nearly simultaneous Iraq crisis and the new U.S. Former Soviet Union (FSU) cooperation, experts from NAI and other LLNL programs strengthened their efforts to work with the U.S. government to develop detection technology, improve intelligence analysis and collection, develop new inspection procedures and safeguards, prevent accidents and the theft of Soviet nuclear weapons, cooperate with the new FSU republics, and provide advice on furthering arms control. In 1992 and 1993, NAI integrated and focused the many separate elements at LLNL into a single major program clearly identified with U.S. goals to stop the spread of weapons of mass destruction. Numerous new technology developments have been undertaken to address this important problem. Now, approximately three-fourths of NAI's nearly four hundred people are working on nonproliferation.

Pipes, Wires, and Walls: The World of Conventional Facilities Engineering

Chair: Valerie Morrow (Salons G and H)

An Overview of the History and Future of Land Use, Existing Facilities, and Infrastructure at Lawrence Livermore National Laboratory

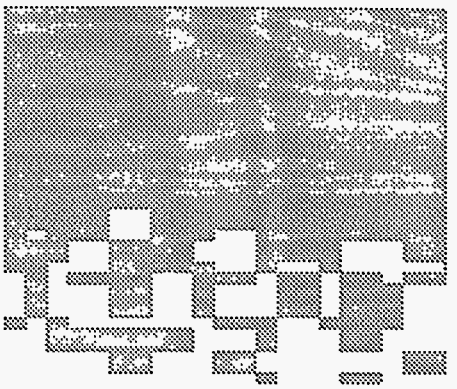
Valerie Morrow

Land use at the Livermore site is the result of 50 years of physical development, determined first by the requirements of a Naval Air Station and later guided by the Atomic Energy Commission, the Energy Research and Development Administration and now by the Department of Energy.

Conventional facility planning, design, operation, and maintenance must consider such factors as: codes and regulations, security, environmental constraints, infrastructure requirements, and costs, as well as a myriad of special programmatic operational needs.

Mechanical Engineering in Plant Engineering: Water, Water Everywhere. . .or the Central LCW Cooling Tower Upgrade Project

Barbara Quivey



The Laboratory's Central Cooling Tower Upgrade Project is a Line Item project to replace the 30-year-old cooling tower water system providing programmatic and utility low-conductivity water to south and central Laboratory facilities. Key features of the project included replacing aged equipment in place without interruption of service to users, improving capacity of the overall system while minimizing land consumption, improving temperature and pressure control and monitoring of the system, operating new equipment as each piece was installed in parallel with existing remaining equipment, and significant capital cost savings in use of new types of heat-transfer equipment and materials. The project was completed in June 1994, on time and on budget, with a construction value of approximately $4.4 million dollars.

Sanitary Sewer Rehabilitation Project and Sewer Diversion Facility: Infrastructure, Compliance, and Research

Sheree Siemiatkoski

The comprehensive rehabilitation of LLNL's Sanitary Sewer System centers around a cured-in-place pipe project. Driven by regulatory requirements to eliminate the potential for exfiltration, a careful condition assessment of the existing infrastructure was conducted. Under programmatic constraints to maintain continuous operations, the INLINER USA cured-in-place pipe system was selected as the appropriate technology, and the project is currently under contract.

LLNL's Sewer Diversion Facility

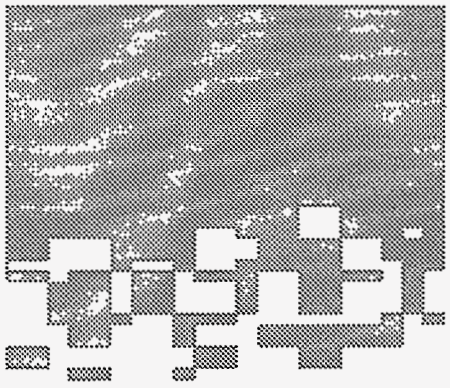
Jill Farrell

The Plant Engineering Maintenance and Operations Department operates a Sewer Diversion Facility (SDF) as part of LLNL's waste water discharge control program. The SDF provides a diversion capability to prevent the significant release of sewage containing contaminants above alarm levels to the City of Livermore's sewage collection system. In the event of an inadvertent release, potentially contaminated sewage is automatically diverted into holding tanks until it can be analyzed and appropriately handled. The SDF has a 200,000-gallon capacity, enough to contain 4 to 6 hours of average peak flow of effluent from LLNL and Sandia National Laboratory. This presentation will describe the environmental reasons for building the facility, the engineering design, the operating capabilities, and the historical usage of this one-of-a-kind facility.

Electrical Engineering at LLNL: Custom Power Systems and the Electrical Power System Upgrade Project

Anna Lidgey and Anita Gursahani

This presentation includes an overview of the Laboratory's Electrical Power System Upgrade Project, a $7-million Line Item project to upgrade and replace portions of the Lab's 40-year-old electrical system. Key features of the project include providing two sources of 13.8KV electrical power to each new load grid switchgear through a tie breaker between the two sources with a fast transfer of less than 6 cycles. This upgrade will provide an overall system reliability at the



13.8KV level. The project also includes replacing aged 480V electrical panelboards and feeders in place without major interruption of service to users, improving system capacity and reliability.

We will also give an overview of the Laboratory's Electrical Custom Power Systems. The Laboratory has various means of emergency backup power, such as emergency generators and uninterruptible power supplies, to meet necessary facility requirements in the event of loss of normal utility power. Each requirement for emergency backup is clearly analyzed so that the appropriate form of backup power can be incorporated into the electrical system for each facility.

Technical Communication: The Touch, Sound, and Feel of the Future

Chair: Miriam Alford (Pleasanton and Danville Rooms)

Using Video as a Scientific Tool

Miriam Alford

If a picture is worth a thousand words, then video can be worth millions. Video is unmatched in its flexibility and broad appeal, and is the preferred method for communicating complex scientific and engineering concepts, projects, and reports. There is no more powerful communication medium. In this session, various video productions will be shown that demonstrate scientific visualization, marketing, and project reports. Participants' questions and involvement are encouraged.

Quality Process in Technical Writing

Karinne W. Gordon (Sandia National Laboratories)

As the roles of the national laboratories have been changing in the post-Cold War era, my work as a technical writer has taken on a different flavor. Publications expounding the Laboratories' capabilities have become more important. One such publication at Sandia is our Capabilities Portfolio. It is a folder designed to hold one-page descriptions of the technical capabilities, resources, and accomplishments of Sandia's various programs. The portfolio inserts can be pulled together so that they give visitors or customers the specific information that would be of most interest to them. The Portfolio has a cohesive look and feel, even though the topics vary widely.

Because the process for producing an insert for the Portfolio involves many people around the Labs with different backgrounds, it needed clear guidelines. I developed a style guide and process flow diagram, which have evolved over the last year into useful tools for anyone on site who wants to contribute an insert to the Portfolio. The project is ongoing in a spirit of continuous quality improvement. We are also looking to take advantage of the information we have already gathered for other uses, such as the World Wide Web.

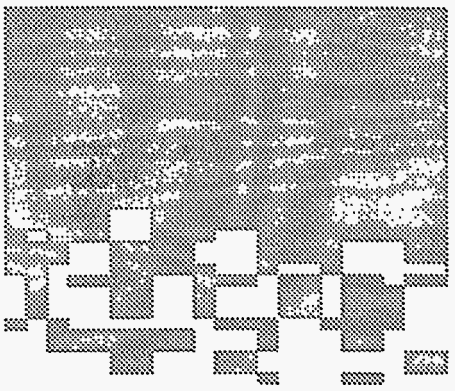
Steps to Writing Well

Cynthia Richards (Sandia National Laboratories)

The old axiom "Your ideas are only as good as they are communicated to others" still rings true in the age of the information highway. At some time or another, everyone must write. The need for well-written communication is clear whether you are procuring grant money for future work, or seeking continued fiscal support for research in process; whether you are teaching colleagues, or informing the public; whether you are reporting to your manager the progress you've made on an assignment, or writing an absence excuse for your child.

Ideas, requirements, findings, or questions expressed clearly and concisely are of great value corporately and personally.

As a writer/editor at Sandia National Laboratories/California, I have assisted in writing SAND reports; prepared text for viewgraph presentations; written educational and informational video scripts and brochures; edited annual reports, ES&H safe operating procedures, and proposals for funding. While these documents have diverse purposes and audiences, they all require clear and organized writing. In my presentation, I will discuss steps authors should take and the role the writer/editor plays in producing successfully written documents.



Environmental Video Script: A Tool for Explaining LLNL to the Public

Mary Beth Acuff

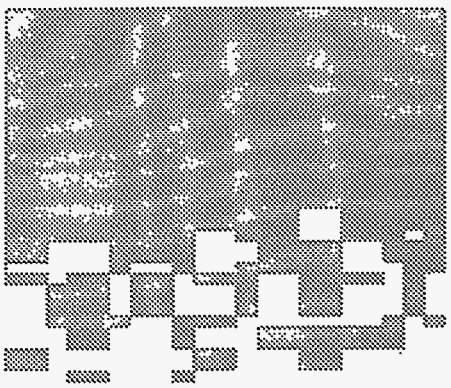
Explaining what LLNL does to a curious, marginally knowledgeable and sometimes skeptical public requires a number of approaches. One of the most successful tools we have, now that the Laboratory is moving into more open research, is the public tour of the site. A key part of this tour is a script explaining the environmental restoration work at the Laboratory and the environmental contributions from other LLNL research. A tour guide uses this script to explain the work at the Laboratory to bus loads of people several times a month. From this script, the Area Relations group of the Public Affairs Department is developing a series of videotapes which can be more widely distributed. The organization of the script, therefore, has moved away from a location specific to an activity specific presentation.

Personal Telepresence: An Interactive Multimedia Workstation

Renee E. Farrell and Mike Pihlman

Affordable, fully interactive, multimedia desktop communications have the power to revolutionize the way we communicate and learn. "Seamless," real-time exchange of information between geographically dispersed individuals and/or groups can—among other things—reduce costs, enhance the education experience, and increase worker productivity.

Personal Telepresence is an interactive multimedia tool that allows individuals or groups to affordably meet with remotely located individuals or groups—from their desktop—as if they were all in the same location. A Personal Telepresence workstation would include telephony, computer, desktop videoconferencing, groupware, and graphics capability on a single platform. The user interface presented will allow natural, face-to-face interaction between all those involved in "virtual" meeting, classroom, office, or manufacturing problem-solving sessions. Files could be opened and placed on a virtual "conference table" where changes could be made interactively by any or all the "meeting" participants. "Copies" of the files can be made, "stapled" together, and given to each of the attendees. The desktop would include a "whiteboard" for brainstorming sessions and a "projector screen" to display movies, video mail, and/or the results of a simulation program.



Session IV

Poster Session

All poster presentations take place in the Grand Ballroom.

ARAC's Site Workstation Final Design and Deployment

Rosemary O. Abriam and R. Miki Moore

The Atmospheric Release Advisory Capability (ARAC) Center located at LLNL, provides real-time estimates of the environmental consequences of accidental releases of radioactivity or other hazardous materials into the atmosphere anywhere in the world. ARAC's expertise includes integrating a suite of local, regional, and global dispersion models into a highly automated system.

Since 1979, on-site computers have provided the link between DOE and DOD facilities around the U.S. and the ARAC Center. Beginning in 1993, these facilities have been replacing their personal computers with UNIX workstations running ARAC's Site Workstation Systems (SWS) software. The SWS is a collection of applications that help sites prepare for and respond to incidents involving an atmospheric release. The SWS can be used either as a real-time emergency-response tool or to make historical or hypothetical assessments of releases.

Creating Dynamic Viewgraph Presentations

Lyn C. Ahboltin

The role of administrators at LLNL has changed dramatically in the last few years. We are now required to use powerful computer programs and create multiple documents, presentations, spreadsheets, and databases that were unheard of in the typewriter days. The engineers, scientists, and physicists we support have learned that first impressions are vitally important in the new post-Cold War era. The competition is fierce among national laboratories and numerous defense contractors. All are vying for the same dollars to keep their programs operating. Since a viewgraph presentation is often the first glimpse an outside party may have of the Laboratory, it is imperative that the "first impression" be the one that is remembered at the end of the day. The ability to stand out and be remembered is vital for our survival as a national laboratory.

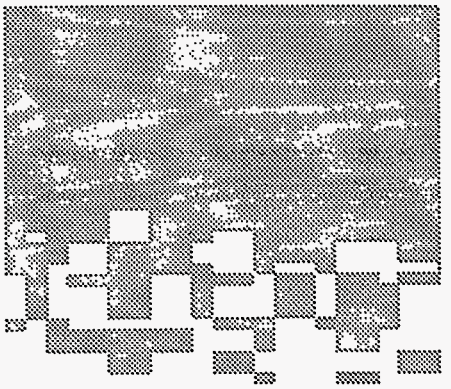
Viewgraph presentations are such an important part of the clerical role, I have made the preparation and planning of viewgraphs my area of expertise in the division I support. I use the applications Aldus Persuasion and Adobe Photoshop, among others, to create dynamic, colorful, and interesting presentations that grab and hold the attention of any audience. In this active poster presentation, I use a computer to demonstrate how to create such viewgraphs.

Using Video as a Scientific Tool

Miriam Alford

If a picture is worth a thousand words, then video can be worth millions. Video is unmatched in its flexibility and broad appeal, and is the preferred method for communicating complex scientific and engineering concepts, projects, and reports. There is no more powerful communication medium. In

this poster session, various video productions will be shown that demonstrate scientific visualization, marketing, and project reports. Participants' questions and involvement are encouraged.



Direct Measurements of the Terminal Laser Level Lifetime in Neodymium-Doped Crystals and Glasses

Camille Bibeau, Stephen A. Payne, and Howard T. Powell

We have measured the terminal level lifetime ($t_{11/2}$) for the 1 mm neodymium transition in several laser media using a novel pump (2.41 mm) and probe (1.06 mm) technique. This method allows us to monitor the terminal level $^4I_{11/2}$ population as a function of time by observing the change in integrated fluorescence of the 0.88 mm emission for each time delay between the pump and probe pulses. We developed a computer model to analyze the data and determined the upper and lower limits for the $t_{11/2}$ lifetime. The results for some of the materials investigated are: 115–225 ps for Nd:$Y_3Al_5O_{12}$, 250–450 ps for Nd:LG-750 (phosphate glass), 535–740 ps for Nd:LG-660 (silicate glass), 896–1900 ps for Nd:$YAlO_3$, and 10.5–20 ns for Nd:$YLiF_4$. In addition, we found the lifetimes to be independent of the neodymium doping concentration for the phosphate and silicate glass samples investigated.

The Effect of Standing Litter and Bird Predation on the Germination of a Rare Forb, *Amsinckia grandiflora*

Tina M. Carlsen and Steven D. Gregory

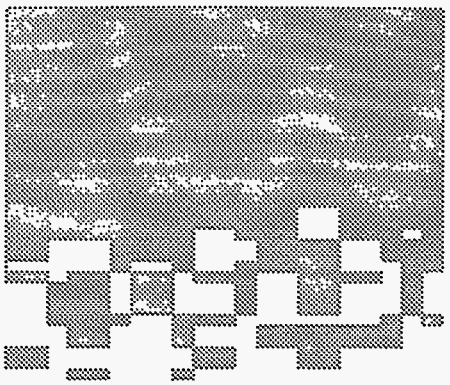
In the fall of 1993, we investigated the effect of litter on the germination of the federally listed endangered plant, *Amsinckia grandiflora*. Nutlets were sown into plots established in an area that had been manually cleared of all litter, as well as in an uncleared area. Within the uncleared area, three plots contained standing litter, and three plots had the litter clipped and left lying on the plot. Within the cleared area, three plots were covered with aviary netting, and three plots were left bare. All plots except those covered with aviary netting were instrumented with thermocouples.

Percent germination and diurnal surface soil temperatures were obtained between November 19 and November 30, 1993. There was a significant difference between cleared and uncleared plots, with plots containing litter averaging more than five times the germination of cleared plots. There was no significant difference between the germination of the plots with standing or clipped litter, or between the bare and aviary netting treatments. Temperature data showed that, compared to plots with litter, cleared plots were warmer during the day and cooler at night. Little is known about the seed bank dynamics of *Amsinckia grandiflora*, and such a difference in germination success could have implications on restoration strategies for this rare annual forb.

LLLWA Activities and Achievements

Pat Chance and Pat Campbell

The Women's Association is an educational discussion and action group concerned with issues of interest to women at Lawrence Livermore National Laboratory. Six goals support this charter: facilitate educational opportunities for women; emphasize the contributions that women have made to the Laboratory;



help further the contributions of women today and tomorrow; collaborate with management to address issues of concern to women; work with others to facilitate diversity in the workplace; and provide an organizational structure for networking. The Association is governed by a Board of Directors elected annually, consisting of President, Vice President, Secretary, and Treasurer. All Laboratory employees are eligible to become members by paying $5.00 annual dues.

We will show the 1993-1994 accomplishments of the LLLWA and plans for the future. Summaries will be presented by the Advancement of Women Committee, Dependent Care Committee, Job Sharing Committee, Membership Committee, Salary Study Committee, Scholarship Committee, Take Our Daughters To Work Committee, and Women's History Month Committee.

Operation of the Fabry-Perot Interferometry System Within H.E.A.F.'s 1 kg Firing Tanks

Chelle Clements

There are many diagnostics available within the High Explosives Application Facility (H.E.A.F.) to aid experimenters in determining the behavior dynamics and properties of both inert and energetic materials that are reacted upon inside the 1 kg Firing Tanks. The Fabry-Perot Velocimeter (F-P) is one such mechanism utilized in the H.E.A.F. It is used primarily to measure the speed of a free surface after reaction (such as hypervelocity impact experiments with the electric gun). The F-P can efficiently and accurately record the acceleration of a rapidly moving surface by measuring the Doppler shift of the reflection of an incident beam of a single-mode laser light. By measuring the positional changes of interference fringes recorded on an electronic streaking camera, the energy transfer in a shock accelerated surface can be inferred. Once this information is obtained the experimenter can directly calculate the detonation velocity of materials ranging from fractions of a kilometer per second to several kilometers per second with an accuracy of 1 to 2%. Although not as fast and sensitive to light as some systems, the F-P output is more easily recorded and much simpler to analyze, and the velocity can be determined within minutes of the conclusion of the experiment. The F-P also has the advantage in that it does not directly contact the surface of the experiment and it is immune to electromagnetic interference. All in all, a very versatile tool.

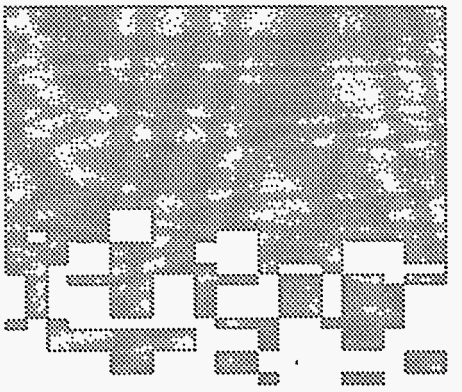
The Marshall Islands Radioecology and Dose Assessment Program

Cynthia L. Conrado and A. Carol Stoker

Two sites in the Northern Marshall Islands, Bikini and Enewetak Atolls, were used by the United States as the testing grounds for the nuclear weapons program. Twenty-three nuclear tests were conducted from 1946 to 1958. On March 1, 1954, a nuclear weapon test, code named BRAVO, conducted at Bikini Atoll in the northern Marshall Islands had an explosive yield that greatly exceeded expectations, with the results that heavy fallout was experienced at Bikini Island. The Bikini people have had a continuing desire to return to their homeland. There has been a continuing effort since 1977 to refine dose assessments for resettlement options at Bikini Atoll.

We have provided radiological dose assessments for the main island of Bikini. The most significant potential pathway to the contaminated atoll was the terrestrial food chain. Nearly 95% of the estimated effective dose at Bikini

Island results from cesium-137(^{137}Cs). We have developed an extensive data base for ^{137}Cs, strontium-90(^{90}Sr), plutonium-239+240($^{239+240}$Pu) and americium-241(^{241}Am) derived from analysis of food crops, ground water, cistern water, fish and other marine species, animals, air, and soil collected at Bikini Island as part of our continuing research and monitoring program that began in 1975. In addition, we have also been to 12 atolls and two islands that were east of Bikini Atoll and that received fallout from the BRAVO test. We documented external gamma exposures and obtained terrestrial and marine samples for radiological dose assessments for current or potential atoll inhabitants. We have evaluated various countermeasures to reduce ^{137}Cs in food crops in the northern Marshall Islands. Treatment with potassium reduces uptake of ^{137}Cs into food crops, and therefore the ingestion dose.



Comparison of Methods for the Analysis of Heterocyclic Amine Mutagens/Carcinogens in Cooked Muscle Meats

K. P. Dewhirst, M. G. Knize, D. M. Eades, and J. S. Felton

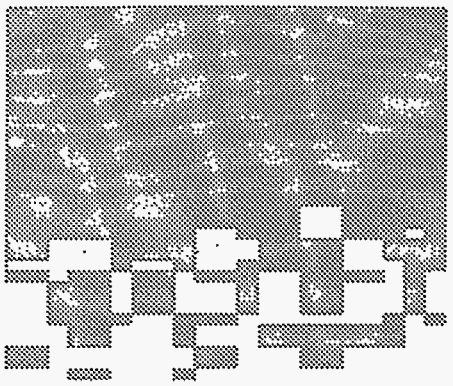
Heterocyclic aromatic amine chemicals are sometimes formed during the cooking of meats. This is of great concern because all of the heterocyclic aromatic amines tested to date are carcinogenic in rodents and may contribute to the cancer incidence in humans. Four of these compounds are: AaC=2-amino-9H-pyrido[2,3-b]indole, DiMeIQx=2-amino-3,4,8-trimethylimidazo[4,5-f]quinoxaline, IQ=2-amino-3-methylimidazo[4,5-f]quinoline, MeIQx=2-amino-3,8-dimethylimidazo[4,5-f]quinoxaline, and PhIP=2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine. The analysis of foods for heterocyclic amines is difficult because they are present at very low, part-per-billion levels (ppb). We examined two recently published methods for heterocyclic amine analysis in foods that differ in sample preparation and instrumentation required. We repeatedly analyzed two cooked meat samples for MeIQx, PhIP, DiMeIQx, and AaC, the heterocyclic amines commonly found in cooked meats. We compared the precision and sensitivity of the two methods to establish the advantages and disadvantages of each.

Customer Satisfaction Survey Shows Confidence in SNL-CA Wellness Program

Khabira Hartwig (Sandia National Laboratories) and Wendy Friesner (Sandia National Laboratories)

The TLC (Total Life Concept) Program is a health promotion program at Sandia National Laboratories (SNL). It is designed to assist employees in achieving and maintaining optimal well-being and to create an environment that supports positive health practices. A program coordinator was hired in February 1994 to adapt the pattern of the successful program at SNL-NM to the California site. An employee interest survey indicated that preferred features of the program would be fitness testing and classes, a wellness newsletter, and classes in personal wellness. Topics of interest included exercise, nutrition and food, and stress management.

In June 1994, a 12-question survey was mailed to all employees to evaluate customer satisfaction after one year; 167 (12.8%) surveys were returned. Survey questions focused on program utilization and non-utilization, program effectiveness, and customer-preferred ways to deliver wellness information. Responses



regarding non-utilization showed that 20% agree or somewhat agree that they don't want interruptions in their work day. Another 7% felt that they were not interested in the topics. Responses regarding effectiveness showed that 67% felt the TLC program has increased their awareness of health issues; 54% agreed that as a result of TLC they had changed at least one health habit. Regarding customer preferred delivery of health information, 64% of those responding utilize *The Healthlines Newsletter*, 56% participate in TLC courses; and 44% attend Brown Bag Lectures. To publicize events and courses, 54% prefer flyers and the *TLC Update Newsletter*, while 42% prefer *cc:Mail*, Sandia's computer bulletin board.

Results of the survey indicate that a worksite wellness program is supported by employee interest. Written materials as well as lectures and classes are effective methods of disseminating health information.

Mapping Hydroacoustic Blockage Across the Tasman Sea

Teresa F. Hauk, David B. Harris, and Eric F. Breitfeller

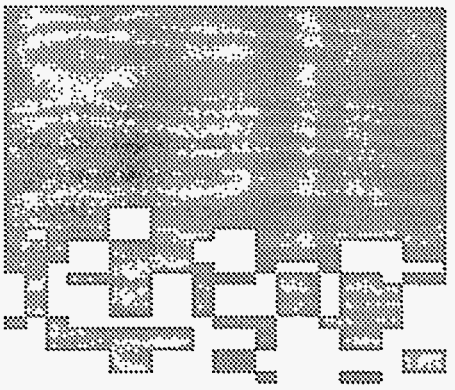
As part of examining the role of hydroacoustic monitoring of the world's oceans in a nonproliferation or nuclear test ban treaty verification setting, it is helpful to determine the potential gaps in existing coverage in order to evaluate the current hydroacoustic systems' capabilities. We attempt to demonstrate the feasibility of empirical studies of single hydrophone arrays, small parts of the existing systems, to define such gaps in coverage and assist in longer term theoretical studies and modeling.

In 1991, the Heard Island Feasibility Test was conducted by the Acoustic Thermometry of Ocean Climate (ATOC) program. It revealed that the Tasman Sea acted as a barrier to acoustic signals. We used one of the U.S. Navy's SOund SUrveillance System (SOSUS) hydrophone arrays, a part of the existing systems, to record acoustic signals (T phases) from undersea earthquakes. The acoustic T phase, generated by conversion of seismic waves at the ocean floor/water interface, travels along the SOFAR (SOund Fixing and Ranging) channel in the water. The SOFAR channel is a minimum velocity zone that averages 1 km in depth worldwide in the oceans and acts as a very efficient acoustic waveguide. We selected a number of earthquakes from the southwest Pacific Ocean region using the U.S. Geological Survey's National Earthquake Information Center's catalog, some of whose acoustic propagation paths traverse the Tasman Sea. We found that recordings of the earthquakes whose paths traverse the Tasman Sea do not exhibit the typical acoustic T phase. T phases are, however, observed from all other earthquakes. The SOFAR channel is evidently blocked by the shallow Tasman Sea bathymetry (300-500 m in some places) where significant bottom interaction rapidly attenuates acoustic energy.

We characterize the T phases observed from the undersea earthquakes and examine amplitude and complexity effects of magnitude, distance, focal mechanism, orientation of fault to receiver, depth of water column, and bottom topography at the source. A gap in coverage from this particular receiver (a single hydrophone array) can be defined and information gained can potentially be included in models and studies of other such areas of the oceans.

Maximize Your Leadership Potential

Joy Hirabayashi



In May 1994, the Association of Women in Science (AWIS) sponsored a National Women's Leadership Conference. Over 200 women from throughout the Department of Energy (DOE), National Aeronautics and Space Administration (NASA), academia, and private industry attended. Leadership, the participants learned, is a process that produces effective change and is distinct from the management process that focuses on order and consistency. Conference activities provided the attendees with a framework for sharing information with others about the leadership process and how it can be applied to the workplace. At the conclusion of the conference, DOE participants formed teams for the purpose of disseminating information from the conference and continuing its mission. Team 11 has eight members drawn from Bay Area DOE facilities.

This session introduces the Team 11 members and the team's objectives. They intend to be catalysts for developing the leadership potential of DOE women in the Bay Area by sharing information, providing tools, and inspiring action. Through a poster display, they plan to communicate their objectives to:

- Establish a network among DOE women and women in other organizations.
- Encourage development of organizational and leadership building skills among DOE women.
- Identify the tools required to develop leadership skills.

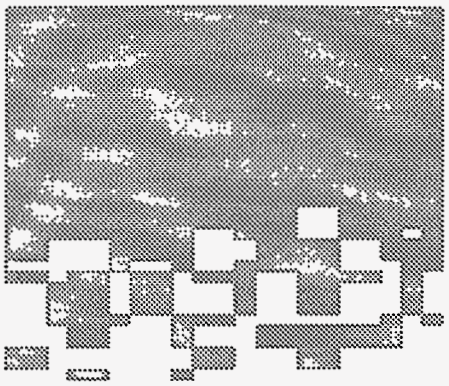
Assessing Data Quality for a Federal Environmental Restoration Project: Rationalizing the Requirements of Multiple Clients

Valerie R. Kiszka and Tina M. Carlsen

Most environmental restoration projects at federal facilities face the difficult task of melding the quality assurance (QA) requirements of multiple clients, as well as dealing with historical data that are often of unknown quality. At Lawrence Livermore National Laboratory (LLNL), we have successfully integrated the requirements of our multiple clients by carefully developing a QA program that efficiently meets our clients' needs. LLNL is operated by the University of California for the Department of Energy (DOE).

The Laboratory's Site 300 Experimental Test Site is operated in support of LLNL's national defense program. The responsibility for conducting environmental contaminant investigations and restoration at Site 300 is vested in the Site 300 Environmental Restoration Project (Site 300 ERP), which is part of LLNL's Environmental Restoration Division (ERD). LLNL Site 300 ERP must comply with the QA requirements of several clients, which include: the LLNL Environmental Protection Department, the DOE, the U.S. Environmental Protection Agency-Region IX (EPA), the California Regional Water Quality Control Board-Central Valley Region, and the California Department of Toxic Substances Control.

We will present a hierarchy of QA documents prepared for the various clients, how they interact, and how they are implemented within the LLNL Site 300 ERP. This comprehensive QA program was used to determine the acceptability of historical data. The Site 300 ERP began soil and ground water investigations in 1982. However, we did not begin receiving analytical quality assurance/quality control (QA/QC) data until 1989; therefore, the pre-1989



data that were collected are of unknown quality. The U.S. EPA QAMS-005/80 defines data quality as the totality of features and characteristics of data that bears on its ability to satisfy a given purpose. In the current context, the characteristics of major importance are accuracy, precision, completeness, representativeness, and comparability. Using our established QA program, we determined the quality (as defined by EPA QAMS) of this historical data based on its comparability to the post-1989 data. By accepting this historical data, we were able to save a considerable amount of money in recharacterization costs.

Site Planning Improvement Team

Valerie Morrow

See addendum.

Effects of Steam Injection and Electrical Heating on Soil Physical Properties at a Gasoline Spill Site

J. C. Nelson-Lee

Lawrence Livermore National Laboratory is a research and development facility owned by the Department of Energy and operated by the University of California. In 1979, approximately 17,500 gallons of leaded gasoline were reported to have leaked from four underground fuel storage tanks at the LLNL facility. Prior to the cleanup effort, a site characterization study was done to estimate the distribution of gasoline hydrocarbons in the subsurface. Remediation efforts involved dynamic stripping, which includes steam injection and electrical heating. This paper presents unique sampling methods for handling the hot core and evaluates soil properties measured prior to and following the steam injection and electrical heating processes.

During the post-steaming (site characterization) drilling phase, sampling methods were developed to ensure data integrity of the hot (80 to 90°C) sediments. Core temperatures were measured immediately upon core removal from the borehole. Temperature measurements at various depths helped to validate other temperature measurement techniques used during the steam injection phase to estimate temperature distribution within the study area. Core material retrieved during the drilling operation was analyzed for various physical properties to determine the effectiveness of the remediation effort. The study focuses on contaminant concentration and soil properties, including soil permeability, water content, porosity, particle size distribution, bulk density, pH, cation exchange capacity (CEC), and partition coefficient (Kd). Because steam injection methods work best in soils with high permeabilities, lithology should be carefully characterized for proper placement of well screens.

Soil properties measured prior to steaming and electrical heating will be compared with values measured following the heating process. In general, it is expected that the steam will reduce contaminant concentration and alter contaminant distribution in the subsurface.

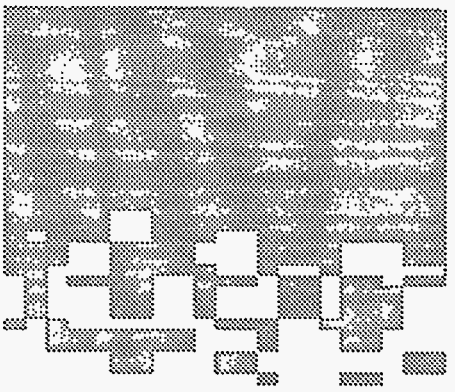
Teleconferencing at LLNL

Lisa Parker and David Dirks

LLNL's state-of-the-art Video Teleconference Center can electronically connect DOE, DOD, UC, and private firm sites for direct video meetings. Sophisticated cameras, electronic equipment, and large viewing screens create an environment that is remarkably close to a face-to-face meeting—at a substantial savings of travel time and expense.

The Video Teleconference Center can connect to more than 100 DOD sites,

30 DOE sites, and 7 UC sites, as well as any facility (national or international) connected to the U.S. Sprint Meeting Channel. The facility can accommodate seating for 18 participants and can transmit and receive documents, viewgraphs, slides, computer graphics, and videotape—with trained technical staff always on hand to facilitate the teleconference.



LLNL's Protocol Office: Your Resource for High-Level Visits

Sheryl E. Rikard

The Laboratory's Protocol Office was established by the Director in 1990 to coordinate VIP visits for the Director and the Laboratory's associate directors. Protocol representatives design the agenda for each visit, and arrange transportation, hotel, meals, badging, clearances, media coverage, and special security arrangements. We are also available as a resource for information about any aspect of high-level visits. For instance, we can help with questions regarding the proper etiquette when entertaining CEOs, military and congressional VIPs, and foreign dignitaries.

Wellness Partnership Project

Cynthia Rose

The Health Services Department (HSD) conducted a pilot Wellness Partnership Project (WPP) to help design and test an efficient vehicle for compliance to DOE Order 5480.8A. Supported by a Process Action Team and CQI tools, the project included the development of sixteen new services, a marketing plan and supporting materials, a Health Action Team (HAT) program, project metrics, pilot partner selection (Hazards Control), budget details and management agreement.

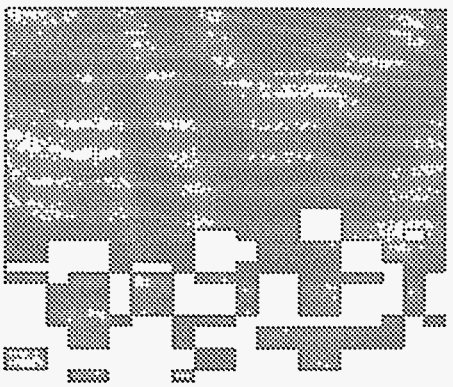
The project ran from April to August 1994, with maintenance activities continuing to educate and motivate participants. Program impact will be measured annually, using baseline values established for more than 315 individual services. Health education included personal wellness mailers, 23 custom wellness newsletters, and 16 rotating bulletin boards.

Participant satisfaction was high. Of the fifty project evaluation surveys that were returned (20%), 83% rated the project overall as "good"/"very good." Forty percent indicated they had made healthy lifestyle changes because of the WPP. Seventy one percent rated the value of the project to themselves as "good"/"very good." The primary reason for lack of greater participation was: "not enough time in my schedule" (50%). Two institutional issues—flex-time options and recharge methods—were identified as unresolved obstacles to participation.

The partnership format proved successful. It improved communications, marketing efforts, visibility, cost efficiency, and organizational impact. It also facilitated access to management and opportunities for sharing responsibilities. WPP services were placed on HSD's public server.

Lessons learned from this pilot effort include the need to resolve certain institutional obstacles and to make management support more visible. Also, subgroups should be identified for tailoring services, with more services delivered in partner's work areas. And, the HAT program could be used more effectively.

In conclusion, the WPP demonstrated a viable means to meet DOE compliance requirements to apply preventive medical measures toward ensuring optimal employee health. A Wellness Partnership Program should be pursued.



Comparison of Heterocyclic Aromatic Amine Carcinogens in Muscle Meats Cooked to Varying Degrees of Doneness

Cynthia P. Salmon, Mark G. Knize, and James S. Felton

Heterocyclic aromatic amines have been shown to be potent carcinogens in rodents and are suspected to be human carcinogens. They are formed during the cooking of many foods, especially those from the muscle meat group. As part of a large study to determine the levels of heterocyclic amines formed during cooking, a number of meats commonly consumed were analyzed. Meats were cooked to varying degrees of doneness, from medium to very well done. Portions were then homogenized and extracted using solid-phase techniques and analyzed by high-performance liquid chromatography (HPLC). Three heterocyclic amines, MeIQx, DiMeIQx, and PhIP, were found in amounts ranging from undetectable levels (< 0.1 ng/g) to 46 ng/g in very well done bacon. The levels of heterocyclic amines correlated with the degree of doneness, indicating that cooking technique has a significant effect on human exposure to these compounds.

Negotiating the Procurement Maze

Sandy Vinson

Sandy Vinson of the Contracting and Materiel Management Department will present poster information regarding navigating the procurement maze and a decision tree for determining what purchase method to use in which situations (e.g., Petty Cash, A Orders, ProCard, Purchase Order).

A Software Tool to Determine Overlaps Between Clones and Existing Restriction Fragment Maps

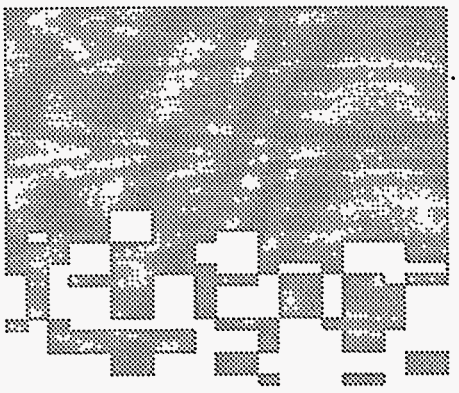
T. Mimi Yeh and Tom Slezak

The LLNL Human Genome Center currently has more than 50% of chromosome 19 covered with high-resolution EcoRI restriction fragment maps. As the number of the restriction fragment maps in our database nears 200, an automatic clone matching software tool is needed to help the chromosome 19 closure effort. Such a tool would have two functions:

- Given a clone (or a list of clones), it could find the "best" matches against all the restriction fragment maps within our database.
- It could find pairs of restriction maps that possibly overlap on their ends.

This would assist in the gap closing process by freeing map builders from tedious task of manual clone matching and by minimizing human errors as much as possible. With such a large amount of chromosonal real estate covered, it is quite likely that there may be multiple candidate "fits" for any given clone.

Session V



Diversity in the Work Place: Working With Your Whole Team

Rita Y. Myers (Salons A and B)

Studies show that diversity creates higher quality ideas and products. We don't need studies to show that diversity also creates problems in communication and relationships; we experience them at home, at work and at school. If we manage ourselves, we can foster the positive benefits of diversity in our work environments.

How we respond to that cute, but negative, remark by our co-worker can be an opportunity to educate and heighten awareness rather than alienate. Expecting that older or younger employee to really understand our values and where "we're coming from" may be expecting far more than is humanly possible, but we can identify common ground within the total human experience.

Using our listening skills, and responding appropriately to ideas and feelings fosters open communication necessary for achieving mutual respect and a WHOLE team attitude.

Overcoming barriers of different perspectives and a tendency toward exclusion versus inclusion will maximize the positive benefits of diversity in the work place.

High Tech Health Care

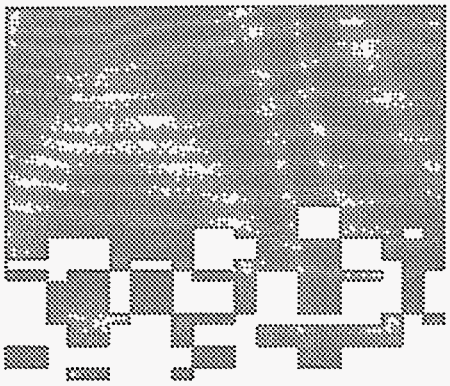
Chair: Karin Hollerbach (Salon C)

Clinical and Ergonomic Evaluations of Alternative Keyboards

Pat Tittiranonda, Steve Burastero, Karin Hollerbach, et al

In recent years, there has been a dramatic increase in the occurrence of cumulative trauma disorders (CTDs) which now account for more than 60% of occupational illnesses (Bureau of Labor Statistics, 1993). Specific ergonomic risk factors for CTDs involving keyboard use include repetitive motion, forceful exertions, awkward joint postures, direct mechanical pressure, and prolonged static postures (Armstrong, 1986). Moreover, repetitive key entry (~ 50,000 to 200,000 keystrokes per day) can lead to cumulative high fingertip force, which may contribute to CTD development (Rempel, 1991). Because studies (Burt, 1990) have associated CTD's with flat computer keyboards, there has been recent interest in alternative ergonomic keyboard designs that will potentially minimize CTD risk factors such as awkward wrist postures and forceful exertions on the keyboard.

These new keyboards, however, have not been subjected to extensive biomechanical or epidemiological studies where users' health effects are examined in the workplace setting. Comprehensive biomechanical and clinical interventional studies are currently being conducted at LLNL's Ergonomics Testing Center to address these issues. A state-of-the-art three-dimensional motion analysis system (MacReflex) composed of three high-resolution, charge-



coupled-device, infrared flash cameras and a sensor-based hand-motion tracking system (Dataglove) have been adapted to measure deviation patterns of the wrists and forearms during use of the new ergonomic keyboards. Results will be compared to those for a traditional flat keyboard. An instrumented keyboard has been fitted with quarter-bridge strain-gauge circuits to measure fingertip impact force during typing. A clinical interventional study is being conducted to examine the effects of these keyboards on the recovery rate of patients suffering from CTDs. Their clinical progress will be monitored using the physical exam findings, subjective reporting of pain, digital vibrogram scores, and nerve conduction study results.

The PEREGRINE Project: Monte Carlo Transport for Radiation Therapy

C. L. Hartmann Siantar, M. M. Svatos, W. P. Chandler, and R. M. White

Radiotherapy is used to treat about 60% of all cancer patients. The effect of radiation is predicted from the amount of energy deposited in the patient per unit mass, or dose. Because malignant tumors and radiation-sensitive structures are often located in close proximity, accuracy in calculation of dose distributions is critically important. Until now, clinical centers have used simple empirical schemes to predict absorbed dose in the body. Sophisticated Monte Carlo transport methods have the potential to provide more accurate prediction of dose distributions than currently used methods.

We have written a new, all-particle Monte Carlo radiation transport code, PEREGRINE, to predict radiation dose distributions in the human body following radiation therapy. In this talk, I will discuss the importance of accurate dose calculations for radiation therapy calculations, give an overview of the PEREGRINE Project, and show some of the most recent results calculated with the PEREGRINE code.

A Virtual Clinical Trial to Evaluate Monte Carlo Simulation in Electron Radiotherapy

M.M. Svatos, T. R. Mackie, and J. O. Deasy (University of Wisconsin Department of Medical Physics)

See addendum.

Defense Technology: The Changing Face of Defense Spawns Future Technologies

Chair: Donna Chato (Salon F)

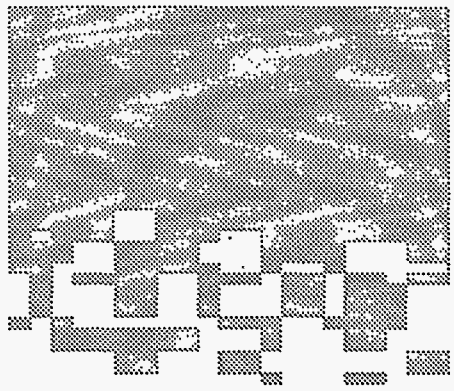
Her Majesty's PROMIS: MathGraf to the Rescue

Donna Chato

PROMIS (Probability of Miss) is a computer program that simulates militarily-interesting battlefield systems interactions. A United Kingdom sponsor for this project needed to compute the effectiveness of an anti-missile defensive system when applied on the armored battlefield. The British government

required rapid response problem-solving with simple, understandable, and illuminating graphical results. The United Kingdom had already spent a huge effort and a lot of money in search of other ways to solve this problem, which did not produce satisfactory results. My challenge was to provide a product that was easier to use and to understand, and far cheaper to develop and to modify.

Using MathGraf, a math-graphics analysis/simulation language, I developed a prototype for Advanced PROMIS to model the behavior of missiles in flight from a source to a target. The missiles were given random directions and barriers which altered their behavior. I modeled various modes of flight, including self-correcting behavior, showing them graphically in realtime simulation.



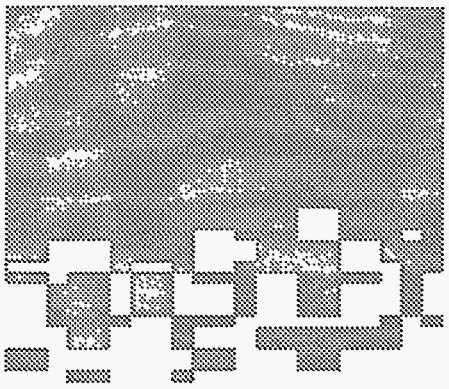
MathGraf was uniquely capable of meeting the requirements, where other methods would have taken a lot longer. Due to the self-debugging nature of MathGraf, the Advanced PROMIS prototype was fast to develop, fast to correct, and fast to refine, based on our growing understanding of the problem and of the objectives. Models such as PROMIS need to deal with a large variety of missile guidance systems. Modeling such systems in MathGraf made sense partly because other systems were so cumbersome to use. A presentation of the MathGraf version of the prototype of PROMIS in England resulted in a formal proposal by us and its acceptance by the British.

In this presentation we discuss the creation of the first phase of the Advanced PROMIS computer program. The computer language, MathGraf, is discussed, some of the models are outlined, and some of the preliminary graphical output is shown. (This project is a collaboration between LLNL, DOD, and the DRA, UK.)

Operation of the Fabry-Perot Interferometry System Within H.E.A.F.'s 1 kg Firing Tanks

Chelle Clements

There are many diagnostics available within the High Explosives Application Facility (H.E.A.F.) to aid experimenters in determining the behavior dynamics and properties of both inert and energetic materials that are reacted upon inside the 1 kg Firing Tanks. The Fabry-Perot Velocimeter (F-P) is one such mechanism utilized in the H.E.A.F. It is used primarily to measure the speed of a free surface after reaction (such as hypervelocity impact experiments with the electric gun). The F-P can efficiently and accurately record the acceleration of a rapidly moving surface by measuring the Doppler shift of the reflection of an incident beam of a single-mode laser light. By measuring the positional changes of interference fringes recorded on an electronic streaking camera, the energy transfer in a shock accelerated surface can be inferred. Once this information is obtained the experimenter can directly calculate the detonation velocity of materials ranging from fractions of a kilometer per second to several kilometers per second with an accuracy of 1 to 2%. Although not as fast and sensitive to light as some systems, the F-P output is more easily recorded and much simpler to analyze, and the velocity can be determined within minutes of the conclusion of the experiment. The F-P also has the advantage in that it does not directly contact the surface of the experiment and it is immune to electromagnetic interference. All in all, a very versatile tool.



Pressure Dependence on the Reaction Propagation Rate of PETN at High Pressure

M. Frances Foltz

The reaction propagation rate (RPR), or burn rate, of the sensitive high explosive pentaerythritol tetranitrate (PETN) was measured in a diamond anvil cell (DAC) over the pressure range of 2-20 GPa. The experimental technique used is the same as that previously reported. The data shows that it burns one to two orders of magnitude faster in the DAC than 1,3,5-triamino-2,4,6-trinitrobenzene (TATB) and nitromethane (CH3NO2) respectively. The PETN RPR curve did not show simple pressure-dependent behavior like that of nitromethane, but instead varied abruptly like the RPR curve of TATB. In order to interpret these changes, static-pressure DAC mid-IR FTIR spectra were taken of micro-pellets of PETN embedded in KBr. The relationship between changes in the spectra, the RPR curve, and published single crystal PETN wedge test data are discussed.

The Earth: Inside and Out

Chair: Annie Kersting (Salons G and H)

Crustal Influences in Island Arc Magmas: Geochemical Evidence from Northern Honshu, Japan

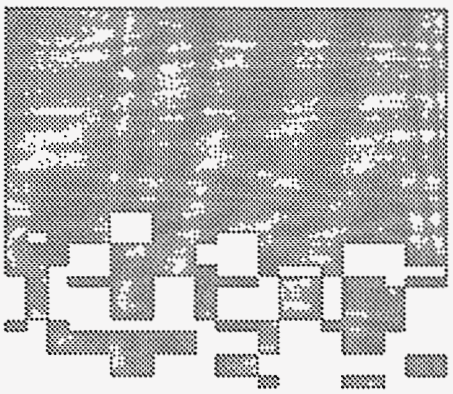
Annie Kersting

More than 75% of the volcanoes that erupt above sea level occur parallel to deep ocean trenches where oceanic material descends into the Earth's interior (called subduction zones). These chains of volcanoes (e.g. Japan, Aleutians, Indonesia) are called island arcs and are the locus of continuous and dynamic chemical transfer between the Earth's crust and mantle. Understanding the chemical interaction between subduction of the oceanic crust, melting, magma ascent, and eruption in island arc environments is essential to understanding the chemical evolution of the crust and mantle. Despite current recognition that island arcs result from the complex interaction between the subducted oceanic crust, mantle, and overlying arc crust, there is still no consensus on the extent or mechanisms by which these different reservoirs contribute to the genesis of island arcs.

This study was undertaken to examine the contribution of the overlying crust in the generation of arc magmas. The approach was to identify the crustal influences in a transect of volcanoes that cross-cuts two chemically distinct crusts. The influence of other parameters on volcanism (e.g. depth to the subducting crust, distance to the trench axis, composition of the subducting sediments, oceanic crust, and mantle) are similar for the entire group of volcanoes. Therefore, chemical distinctions from the volcanoes coincident with the change in crustal types must reflect differences in the contribution from the crust.

A direct test of crustal influence to arc magmatism is possible in northern Honshu, Japan, where a suite of 10 volcanoes, resulting from the subduction of the Pacific plate, cross-cuts two juxtaposed crustal terranes. The volcanoes show

geochemical differences coincident with a change in crustal types. Volcanoes in the south have elevated Pb, Sr, and lower Nd isotope ratios compared to volcanoes in the north. The different geochemical signatures between the volcanoes results from crustal contamination as the magmas traverse through chemically distinct crusts.



Physical Properties and Microstructure of Rocks

Patricia A. Berge

Many problems in exploration geophysics, geotechnical engineering, and environmental geology center on evaluating physical properties of rocks and sediments. Rocks are inhomogeneous combinations of solid mineral grains and fluids. The physical properties of a rock depend strongly on the details of the microstructure, which include relative volumes and arrangements of pores, cracks, and grains.

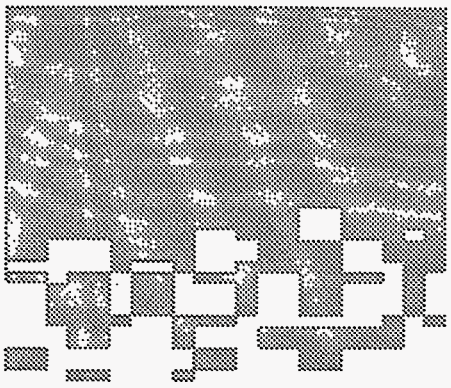
Rock physics theories use the properties of the components making up a rock to estimate the properties of the rock as a whole. The fact that these theories contain assumptions about the microstructure has two important consequences. The first consequence is that a theory can only be applied to model a particular rock if the microstructure assumptions in the theory are compatible with the actual microstructure of the rock. The second consequence is that rock property values predicted by a particular theory are physically realizable if a rock with the appropriate microstructure exists. The first point is illustrated by comparisons of ultrasonic velocity data and theoretical predictions for porous glass foams and fused glass-bead packs. The second point is illustrated by considering microgeometries that allow unlikely but physically possible property values such as expanding under pressure (negative pore compressibility or negative Poisson's ratio).

Environmental Applications of EXAFS: Zinc Structure in Acid Mine Drainage Sediments

Susan Carroll, Brian Phillips, Peggy O'Day, and Glenn Waychunas

This work addresses the specific need to accurately characterize toxic metal coordination in complex natural sediments and soils. Metals may be mobilized or retarded depending on their mode of incorporation in the solid. X-ray absorption spectroscopy (XAS; including x-ray absorption near-edge structure, XANES, and extended x-ray absorption fine structure, EXAFS) is ideally suited to provide quantitative detailed structural and redox information on the incorporation of environmentally important elements common in contaminated soils and sediments. Conventional analytical techniques, such as x-ray diffraction, cannot determine the geochemical environment of metals in the solid phase of most sediments and soils, because the metals occur in trace concentration, the phases in which they occur are often poorly crystalline and heterogeneous, and metal uptake may occur in one or more phases in the sample.

We use extended x-ray adsorption fine structure (EXAFS) spectroscopy to examine the chemical environment of zinc (1-2 wt. %) in complex acid mine drainage sediments from the Tri-State Mining District (KS, MO, OK). EXAFS spectra of the sediment samples, taken at SSRL with a fluorescence detector at low temperature (~10 K), show that, with increased weathering, Zn coordination changes from a sulfide phase in its host mineral, sphalerite (ZNS), to coordination indicative of hydroxide phases. In samples with silica, carbonate, and iron-hydroxide phases, the local atomic Zn environment varies with the



total amount of bulk iron hydroxide, but Zn is not incorporated into carbonate or silica phases. The sediments in streams draining tailings piles and open mine shafts are dominated by quartz or amorphous iron hydroxides. Accessory minerals include calcite and amorphous iron hydroxide in quartz-rich sediments, and calcite in amorphous iron hydroxide-rich sediments.

Water-Rock Interactions in New Zealand Geothermal Systems

Carol J. Bruton, Agnes G. Reyes (Institute of Geological and Nuclear Sciences, Wairakei Research Centre, New Zealand), and Bruce W. Christenson (Institute of Geological and Nuclear Sciences, Wairakei Research Centre, New Zealand)

Many physical and chemical processes hypothesized to occur in the potential Yucca Mountain, Nevada, nuclear waste repository are occurring in geothermal systems such as those in the Taupo Volcanic Zone of New Zealand. These processes include mineral dissolution/precipitation, changes in fluid chemistry, boiling, condensation, fluid flow, glass alteration and degradation of manufactured materials. The extent to which computer codes can be used to simulate the processes that may occur in a nuclear waste repository is being tested by comparing computer simulations of fluid-solid interactions with data from New Zealand geothermal systems. Comparisons of the observed state and evolution of the geothermal systems with predictions of fluid-solid equilibria made using geochemical modeling codes will determine how the codes can be used to predict the chemical and mineralogical response of the environment to nuclear waste emplacement. Field-based exercises allow us to test the models on time scales unattainable in the laboratory.

Analysis of the state of equilibrium among subsurface fluids and secondary minerals in the Wairakei geothermal system suggests that vein minerals are presently in equilibrium with subsurface fluids when temperatures exceed 200°C. Matrix replacement minerals, although of much greater variety and number than vein minerals owing to initial rock mineralogy, are consistent with calculated mineral stabilities at downhole temperatures. However, caution must be used when trying to predict the identity and sequence of silicate minerals that precipitate in response to changes in the chemical and physical environment.

Making Sense Out of Change

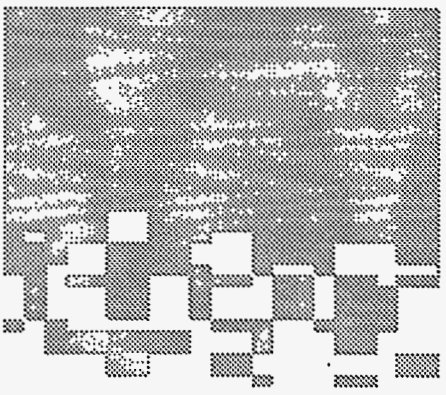
Michelene Ottery (Pleasanton and Danville Rooms)

Many people view change as an enemy—resistance is normal. To see change as an opportunity presents a challenge. *Making Sense Out of Change* will be an interactive seminar to provide information, introduce skills, and generate strategies on the subject of CHANGE. The goals of this workshop are to help participants:

- Understand the transition process and the personal response to change.
- Learn and apply four practical skills to work through change.
- Increase personal power when faced with change.

To achieve these goals, the session will include small- and large-group excercises with the presentation and ample time for questions and answers.

Session VI



Environmental Restoration: Remediating Past Contamination to Protect the Future

Chair: Kathy Angleberger (Department of Energy) (Salons A and B)

Contaminant Investigations and Remediation at Lawrence Livermore National Laboratory

Tina Carlsen, Dorothy Bishop, and Maureen Ridley

LLNL has been actively investigating soil and ground water contamination at both the Livermore site and Site 300 since 1982. Contaminants found in the ground water beneath the two sites consist primarily of volatile organic compounds (VOCs), gasoline resulting from a leaking underground storage tank, and small amounts of tritium. In addition, small amounts of high explosive compounds are present at Site 300. As chemists and biologists in the Environmental Restoration Division, we actively participate in the contaminant investigations, human health and environmental risk assessments, and subsequent remediation efforts at both sites and involve project hydrogeologists, engineers, and other scientists.

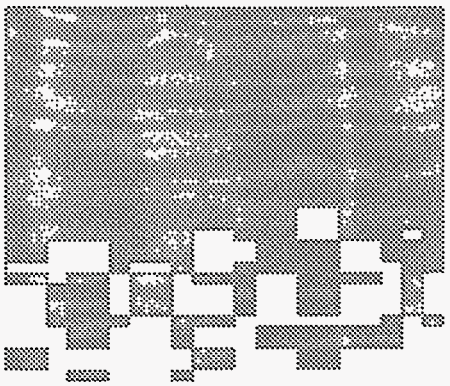
Using strict regulatory protocols, involving detailed quality assurance/quality control measures, more than 400 monitor wells and exploratory boreholes have been drilled at each of the sites to better characterize the contamination. Soil and water samples are collected and chemically analyzed to identify the type and concentration of contaminants. Physical characteristics are also determined for selected soil cores. These measurements are used with geologic and hydrogeologic data to determine risk to human health and the environment, and to design the most effective and economical treatment processes. Ground water treatment facilities are in operation at both sites. These facilities pump ground water to the surface for treatment using techniques such as air sparging and ultraviolet light oxidation. The treated ground water is then used to recharge the aquifer or supplement the site's non-potable water. The gasoline spill at the Livermore site has also been used as a test area for the dynamic underground stripping demonstration experiment which used electrical heating and steam injection to dramatically mobilize the contaminates for removal. Treatment options which may be applicable in some situations include soil vapor extraction, *in situ* bioremediation and *in situ* barrier or filter technologies.

Environmental Restoration Activities at Sandia National Laboratories, California

Leslee Gardizi (Sandia National Laboratories)

Sandia National Laboratories/California (SNL) currently has two environmental remediation sites: the Fuel Oil Spill Site and the Navy Landfill. A third previously listed site, the Trudell Auto Repair Shop site, was remediated and officially closed during 1990. In addition, five other miscellaneous sites were identified by DOE, but required no further action.

In 1975, as the result of an accidental puncture of an underground transfer line, 59,500 gallons of diesel fuel were released into the vadose zone from an above-ground fuel tank. The groundwater has been monitored in this area since



1985 and shows occasional low-level contamination of fuel oil components. Several bench-scale tests have indicated bioremediation to be the most effective means of cleanup. The Fuel Oil Spill Pilot Study is currently in the initial stages of start up. In the meantime however, the Regional Water Quality Control Board (RWQCB) has directed SNL to implement an Interim Remedial Measure (IRM). SNL has designed and implemented the IRM groundwater treatment system which consists of carbon filtration beds and a free product separator.

The Navy Landfill is an inactive landfill used intermittently from 1940 to 1960 for disposal of general construction debris and machine turnings. It is located at the southern end of SNL. The results of several investigations have shown no evidence that hazardous material was buried at the landfill. Currently, the RWQCB is reviewing the results of the investigations and SNL's request for No Further Action.

In 1987, DOE expanded the SNL security buffer zone by purchasing land adjacent to East Avenue, which was the site of the Trudell Auto Repair Service Station. DOE agreed to remediate the site as part of the purchase agreement. During 1989 and 1990, the contaminated materials containing oil, lead, and low levels of chlorinated solvents were shipped for disposal to a landfill permitted according to the Resource Conservation and Recovery Act (RCRA). The RWQCB officially closed the site in December 1990, requiring SNL to continue groundwater monitoring at the site.

Five miscellaneous sites were identified by DOE in 1988 as potentially having contamination due to past operations. Soil samples from these sites analyzed in 1991 were found to be below the RCRA action levels. The RWQCB has informed SNL that they have closed the miscellaneous sites with no further action required.

Groundwater Flow and Contaminant Transport at the Stanford Linear Accelerator Center

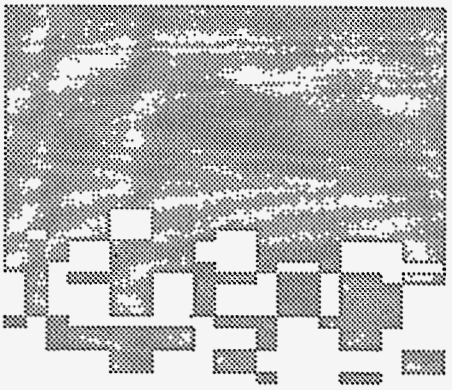
Helen Nuckolls (Stanford Linear Accelerator Center)

Evidence from geology, hydrogeology, and groundwater geochemistry at the Stanford Linear Accelerator Center (SLAC) indicates slow groundwater flow and contaminant transport. These studies are being conducted in preparation for Remedial Investigation/Feasibility Studies to begin next year and will assist in defining strategies for characterization.

Contamination resides in groundwater within Miocene sandstone, a several-thousand-foot-thick unit of silty sandstone, partially cemented by calcite, gypsum, and locally, silica. The unit represents a shallow oceanic environment with local shell beds, abundant shark teeth, and a few large mammal fossils. Fractures, faults, and locally permeable (coarser-grained) beds probably convey most of the groundwater. However, all have generally very low permeability. Aquifer tests performed within the Miocene unit over the last 30 years have been used to estimate groundwater velocities of 3.6×10^{-5} to 3.6×10^{-6} centimeters/second or 3.7 to 37 feet per year. However, this represents an overestimate because groundwater flow in almost one third of the tests attempted was too slow to measure.

Slow groundwater movement is further substantiated by the groundwater geochemistry. The major ion signature of groundwater at SLAC is distinct from nearby surface water, from rain water, and from nearby groundwater in the downgradient direction. Characterized by a high total dissolved solids content of 3,000 to 10,000 parts per million and dominated by the sulfate anion, the

chemical signature suggests slow recharge and discharge and a long residence time for rock-water interactions to occur. In addition to major ion chemistry, investigations using stable isotopes of oxygen 18 and deuterium are currently underway to compare SLAC groundwater to rainwater, to San Francisquito Creek water which runs along the entire southern and eastern ends of the SLAC site, and to facility water. The results may provide further evidence that SLAC groundwater has a long residence time. The first stable isotopic results will be available in August and presented at the symposium.



Lawrence Berkeley Laboratory's Environmental Restoration Program

Jackie Thomas (Lawrence Berkeley Laboratory)

See addendum.

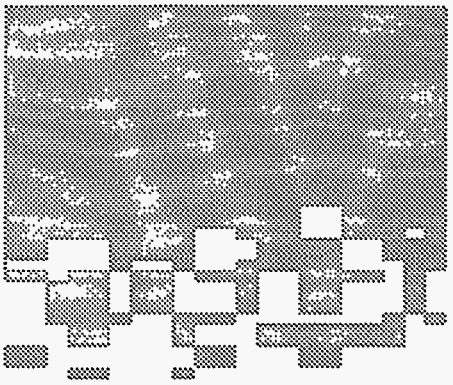
It's YOUR Business

Chair: Toni Bettencourt (Salon C)

It's YOUR Business

Panel Members: Jane Butler, Jean Deir, Carol Engelund, Pamela Kappelhof, Kimberly Pangborn, and Sandy Vinson

In this panel presentation, panel members will address a number of business and financial topics. Kimberly Pangborn will present information regarding the Services and Distribution Department's Donation Program to Educational and Non-profit Agencies. The Laboratory is one of very few DOE contractors that has been given the authority to donate DOE/LLNL excess property to education and non-profit agencies for scientific and mathematical education. Jane Butler will present an overview regarding the new travel process being developed for Laboratory business travel. Pamela Kappelhof will present information regarding services available through the budget office. Specific information concerning budget training courses available and how to obtain resource information will be presented. Jean Deir will present information concerning services available through the Finance organization; in particular, information regarding Finance training and resource information. Sandy Vinson of the Contracting and Materiel Management Department will present information regarding navigating the procurement maze and a decision tree for determining what purchase method to use in which situations (i.e. Petty Cash, A Orders, ProCard, Purchase Order, etc.). Carol Engelund of Business Operations will present cost information associated with each of the purchasing options funded by the MPC. The session will conclude with a question and answer period.



Emerging Tools and Processes for Tomorrow's Science

Chair: Denise Koker (Sandia National Laboratories) (Salon F)

ChemTrack, A Computerized Chemical Tracking and Material Safety Data Sheet Management System

Patti Zazueta

Almost all activities at LLNL use chemicals of one kind or another, and many of them are reactive or toxic. It is essential that we maintain a current inventory of the chemicals stored and used at the Laboratory to provide for safe and efficient management of hazardous chemicals, and to meet regulatory reporting responsibilities.

With over three years of design and development behind us, LLNL has implemented a state-of-the-art computerized chemical inventory system called ChemTrack. ChemTrack uses bar codes, laser scanners, and customized computer software to inventory and track nearly all chemical containers located on-site.

ChemTrack allows us to meet community right-to-know regulatory reporting requirements while also facilitiating chemical sharing and waste minimization. Laboratory employees can now call a ChemTrack Hotline number and find out where a needed chemical is located on-site prior to purchasing new material. This saves money, time, and reduces hazardous waste disposal costs.

ChemTrack information will also be used to improve emergency planning and response (such as in the event of an earthquake or accident). In addition, many other potential uses for ChemTrack are expected to be developed over the next several years to improve chemical management practices at LLNL.

Flat Panel Displays: The TVs of Tomorrow

Elaine Chandler, J. Norman Bardsley, Yim Lee, Bernie Penetrante, John Verboncoer, and Peter Vitello

With the advent of high-definition TV (HDTV) standards, large screen TVs will be even more desirable than they are now. The biggest limitation to the appeal of these large screens for the consumer is the physical bulk that the current CRT tube technology necessitates. As a result, there is a world-wide race to develop large flat panel color screens to capture the home market. This talk will describe the state of the art of the most promising technology in flat panel displays, the plasma flat panel display, and will summarize the efforts of the plasma simulation group in the LLNL Physics Department to model and understand the operation of this type of display.

Strategic Planning Tools and Results

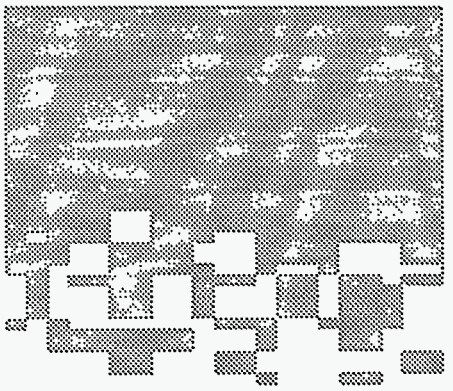
Denise Koker (Sandia National Laboratories) and Marcie Weeber (Sandia National Laboratories)

The diverse talents and knowledge of the newly formed Site Planning and Implementation Group (SPIG) are a major factor in the group's success. Having team members from all sides of the organization (administrative and business, as

well as technical) goes far towards providing objectivity and understanding in a "highly technical arena."

In its first year, SPIG has introduced a number of tools to aid top management in decision making and strategic thinking. We have worked with the site's Planning Team, our "grass-roots" Environmental Council, and others to prioritize the work so that investment decisions can be made based on a prioritized portfolio and the organization can become more customer or market focused.

Being a new group, we are learning as we go. For instance, in the past there has been no formalized "process" for strategic planning. SPIG is working to change that by developing a standard, straightforward Global Planning Process (including strategic, business and operational planning and communications) that is in alignment with our Corporate office and Sandia's missions.



What's It All About: Benchmarking—a Buzzword???

Darlene M. West (Sandia National Laboratories)

Sandia National Laboratories in Livermore, California, recently conducted a full-scale benchmarking project on convenience copiers. The project met with great success and is now in the implementation phase.

Benchmarking is one of the hottest buzzwords in the quality arena today. Companies all over the world are involved in benchmarking projects, and those who have yet to begin are discussing the topic with increasing interest.

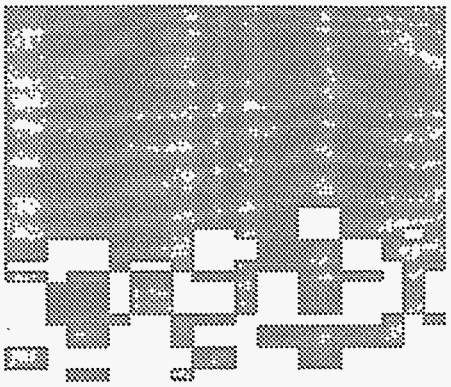
Benchmarking is not JUST a buzzword; it is a process and commitment that requires people, dollars, time and management buy-in. Benchmarking can be defined as the process of continually measuring and comparing an existing process, product, or service against that of recognized top performers both within and outside the parent organization. The purpose of benchmarking is to improve the process, product, or service. Benchmarking is exciting and can be extremelyeffective if done correctly, resulting in both process improvement and cost savings in both administrative and technical areas.

This overview on benchmarking will focus on benchmarking as a methodology, outlining who is involved, what is the goal, and how benchmarking is conducted. In addition, lessons learned from the Sandia activity will be shared.

Chart Your Course

Jane Tutko (Salons G and H)

For many women, life can seem like a stormy sea of confusion and uncertainty. Juggling the demands of work life and home life can be likened to being tossed around like a cork, never feeling satisfied with where we are. One of the most important things we can do to deal with life's challenges is to FOCUS our energies on what we clearly want and move in that direction day by day. In this session, participants will discover how to be their own navigators. They will gain an understanding of the benefits of examining individual values and goals. Through discussion and exercises, they will have an opportunity to learn specific techniques in visualizing, goal setting, and establishing a plan for action.



Computer Modeling and Simulation

Chair: Ellen Corey (Pleasanton and Danville Rooms)

Numerical Models of Material Equation-of-State for LLNL Applications

Ellen M. Corey and David A. Young

Equation-of-State (EOS) models are used to develop tabular EOS that are used for material motion simulations. The code used at LLNL to generate the EOS data is QEOS. It is an approximate model of pressure and energy as functions of temperature and density for any material with well defined chemical composition. It models the EOS over a wide range of temperature and density conditions.

QEOS is based on the Thomas-Fermi approximation for atoms, with no inherent treatment of molecular structure. It is possible, however, to add molecular degrees of freedom and dissociation as part of the nuclear motion subroutine in the code. This gives the ability to fit QEOS to molecular fluids and covalently bonded compounds. QEOS is generally fit to experimental shock compression EOS data but can be improved to agree with other experimental data as well, thus improving the overall quality of the QEOS output. Other experimental data that have been used to fit QEOS include :

- porous Hugoniots
- high pressure isotherms
- critical points
- Gruneisen parameter
- expansion isobars for solid and liquid materials

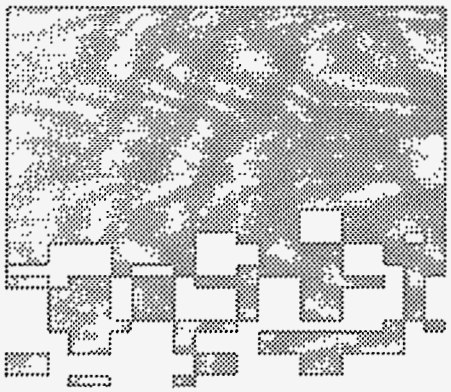
Data from other high energy experiments are expected to be included in the future.

The accuracy of the fit to experimental data can be improved by adding more flexible functions to QEOS. An example of this is the piecewise fitting of the Hugoniot data. Demand is increasing for improved accuracy in EOS tables so that hydrodynamic simulations can be as realistic as possible. Upgrading QEOS is a response to this demand and will keep QEOS in the forefront of material models.

An Adaptive Projection Method for the Incompressible Navier-Stokes Equations

Ann Almgren, J.B. Bell, P. Colella, and L. Howell

In this talk I present a method for solving time-dependent low Mach number equations, such as the incompressible Navier-Stokes equations and the anelastic equations governing the atmosphere, on an adaptive grid. The method is based on a projection formulation in which we first solve convection-diffusion equations to predict intermediate velocities, and then project these velocities onto a space of approximately divergence-free vector fields. Our approach to adaptive refinement uses a nested hierarchy of grids with simultaneous refinement of the grids in both space and time. The integration algorithm on the grid hierarchy is a recursive procedure in which coarse grids are advanced, fine grids are advanced multiple steps to reach the same time as the coarse grids, and the grid levels are then synchronized. Examples will include a co-flowing jet and a density current in the atmosphere.



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