2013 LSO Workshop
Speaker Abstracts and Bios

Will Arthur, Kentek

Technical and Practical Considerations in the use of laser protective eyewear (LPE) employing Dielectric Coatings

Laser protective eyewear (LPE) employing dielectric coatings are in common use. They differ from absorptive LPE technologies in that the method of laser wavelength(s) attenuation is achieved by means of reflective coatings. Absorptive LPE technologies employ either: dye formulations which are then integrated onto and/or into polymeric LPE lens configurations; or optical filtering mineral glass (e.g., Schott KG3, KG5 and others) with their attendant properties. Both dye and optical glass technologies achieve their attenuation by absorption of the wavelength(s) or wavelength region(s) of interest. Conversely, the bandpass (e.g., short pass, long pass, notch, etc.) section(s))of an interference filter is comprised of repetitive vacuum deposition of thin layers of partially reflecting dielectric coatings onto (typically) a glass substrate. The paper presents a brief synopsis of the technical procedures relevant to the creation of dielectrically coated LPE with a concerted focus on the practical considerations relevant to the selection and use of dielectrically coated LPE products.

Thomas Bett, AWE, Aldermaston, UK

Panel Discussion on Eyewear for Multi-wavelength Operation

Mendy Brown, Sandia National Laboratory

Unique Challenges and Improvements to Sandia's Laser Safety Program

Sandia National Laboratories' (SNL) research and development environment presents unique challenges when applying laser safety practices, especially Laser Safety Officer (LSO) responsibilities. SNL has very diverse laser applications carried out at multiple sites and by many different organizations. To meet the applicable LSO requirements and provide for the safe use of lasers and laser systems, SNL has implemented a shared approach through a network of Deputy Laser Safety Officers (DLSO). The necessity to establish a different approach was emphasized during a program self-assessment and an internal audit. Responsibilities for laser safety are now shared between SNL's Corporate Laser Program and researchers in the Line organizations. This shared responsibility required additional training at the LSO level for approximately 30 Line researchers. The changes made to SNL's Corporate Laser Program included revising the Laser Safety Corporate Procedure, updating the available laser program guidance tools, requiring additional training for Line Deputy Laser Safety Officers, and new training for managers of laser personnel.

Mendy Brown, CIH, CSP received her BS in Environmental Health from West Chester University, West Chester, PA and a MS in Industrial Hygiene from the University of Massachusetts Lowell, Lowell, MA. She is currently employed as an industrial hygienist for Sandia National Laboratories in Albuquerque, NM. Mendy serves as the Corporate Laser Safety Officer and the Nonionizing Radiation Subject Matter expert. She is currently serving on the EFCOG Laser Safety Subgroup as the Secretary.

Michael Buric, National Energy Technology Laboratory

Engineering Laser Safety into the Raman Gas Analyzer for Industrial Applications

Recently, NETL scientists have been working to develop a real-time Raman-based sensor for gaseous species analysis. The new system is an industrial sensor capable of analyzing fuel gases, exhaust streams, or other mixtures of scientific significance. It can simultaneously measure all hydrocarbon species, hydrogen, nitrogen, oxygen, steam, CO, and CO2 to better than 1% concentration accuracy in less than a second measurement time. Because the instrument presents new capabilities for measurement using a laser-pumped device, it also presents new hazards which must be mitigated for safe operation. This presentation will address general hazards associated with the use of medium power level visible lasers for industrial applications. The talk will focus on the specific hazards involved with using laser equipment in areas classified as hazardous due to the possibility of explosion. Various mitigation methods will be discussed as they were implemented for this unique application.

Michael Buric obtained his PhD at the University of Pittsburgh's Department of Electrical and Computer Engineering with a dissertation in Lasers and Raman spectroscopy. He later came to the Morgantown, WV campus of the National Energy Technology Laboratory to build a program in Raman sensing and instrumentation. He is now a member of the Sensors and Controls Team working with advanced combustion diagnostics and laser applications in clean energy. His research interests include optical design, spectroscopy, fiber optics, lasers, and instrumentation development. He is currently deputy LSO for the Lab under Dr. Steven Woodruff, LSO.

Rex Craig, Ball Aerospace & Technologies Corporation

Outdoor Laser Operations: Experiences and Safety Considerations

With the surging interest in fielded and aerial remote sensing, primarily lidars (both imaging and non-imaging), the need for laser probes has surged as well. By virtue of their relative coherence, spectral and polarimetric purity, and high fluence, lasers have enabled a vast range of remote sensing options. With this opportunity has come the responsibility to reduce public and operator risk to a low level. This can be done in a variety of ways which will be discussed as well as some noting some experience gained in ongoing operations.

Rex Craig is a Principal Optical Engineer with Ball Aerospace and Technologies Corp. with a background in physics and instrument development while with the National Institute of Standards and Technology (NIST). His main focus since 2004 is that of guiding and developing active remote sensing technology for Ball Aerospace. His current goal is commercialization of active 3D video imaging LiDAR technology from all platforms - airborne to space to serve scientific, commercial, emergency and military markets. He was principally responsible for the design, construction, test and deployment of the Total Sight™ 3D imaging video LiDAR. Author of and contributor to many articles, chapters and patents in laser remote sensing, instrumental radiometry and fiber optic polarimetry.

Chris Cromer, National Institute of Standards and Technology

Portable High-Power Laser Radiometer (with co-worker, Xiaoyu Li)

High-power lasers for industrial and military applications have been in development for many years, and are now becoming feasible for field applications due to recent advances in solid-state laser technology. Accurate laser power measurements above 1 kW are now becoming critical for process control and accurate modeling of laser-material interactions. We describe a novel flowing water power meter (FWOPM) for high-power laser radiometry in the range of 500 W to 100 kW. The FWOPM has several design features including a rotating mirror oriented at 45° with respect to the incoming radiation, a conical cavity coated with a multiwall carbon nanotube composite. We estimate the absolute uncertainty for these measurements at ~ 1% for 1.06 μm and 10.6 μm wavelengths.

Dr. Christopher L. Cromer received his B.S. degree in physics from Rochester Institute of Technology in 1978 and his Ph.D. degree in physics from the University of Southern California in 1983. His thesis work consisted of laser spectroscopy of autoionizing states in alkaline earth metals using non-linear four-wave mixing techniques. He then joined NIST (then NBS) as a NRC/NBS Postdoctoral Research Associate working in vacuum UV spectroscopy of laser excited and ionized metal vapors. Dr Cromer served as group leader in the Radiometric Physics Division at NIST from 1991-1995, and project leader for the Laser Pulse Radiometry Project in the NIST Optoelectronics Division from 1996-2005. His research areas now include developing measurement methods and high accuracy standards for characterizing pulsed and CW lasers, and optical fiber power.

Rebecca Daskalova, Ohio State University

Discussion Panel on Eyewear Selection for Multi-wavelength Operation

Rebecca Daskalova is the Laboratory Supervisor for the Scarlet Laser Facility in the High Energy Density Physics Research group at The Ohio State University. She acts as LSO and general safety officer for the HEDP research group. Rebecca has a B.S. and M.S. in Physics from The Ohio State University. She has worked with short pulse lasers in a university research setting for 12 years.

Gary De Winkle, Pacific Northwest National Laboratory

Integrated Operations System and Laser Use Permits (with co-worker Jennifer Nuzum)

Integrated Operations System (IOPS) helps managers and staff to identify and mitigate operational risks associated with research activities in Pacific Northwest National Laboratory (PNNL)-operated workspaces. IOPS utilizes a suite of software tools and manual processes that support and enable researchers to perform work safely in laboratory workspaces. The processes involve identifying and managing risks and hazards associated with activities performed in each IOPS workspace, continually assessing ongoing or changing work risks, and controlling access so that only trained and authorized people are working in the workspace.

The program is underpinned by a philosophy and practice of assigning workspaces to accountable research staff, known as Cognizant Space Managers (CSMs), and providing them the authority to manage hazards and control access to their workspace. CSMs use

IOPS to grant workers access to a particular workspace. IOPS provides the authorized workers information they need, including hazard communication, required training and permits, to make sure risks are managed while performing work. IOPS also provides them with step-by-step workflow processes to effectively implement controls required to support their work. Through IOPS, managers and workers are provided access to the information they need so that work is properly configured and controlled to manage risk. Hazards associated with Class 3B and 4 lasers are controlled through IOPS. The DOE Worker Safety & Health Program Rule (10 CFR 851) requires application of ANSI Z136.1 American National Standard for Safe Use of Lasers in national laboratories. Pacific Northwest National Laboratory has developed a Laser Use Permit to address ANSI Z136.1 requirements for hazard evaluation, control measures, training, medical examinations, non-beam hazards and exposures of eye and skin. The Laser Use Permit is fully integrated with the IOPS system and provides electronic processes for authoring, review and approval routing, worker assignment, and mentoring. These tools do not eliminate the need for personal accountability and interaction, but they do ensure consistent and efficient application of administrative processes.
PNNL's Quality & Assurance Division is the steward of IOPS for the Laboratory, and provides resources to develop, manage, maintain, and improve the content and software tools in the system. A governance committee structure for IOPS has been established which has collective responsibility for the overall vision of the IOPS program and tool, including strategic alignment, goal setting and risk/limit approval and monitoring. IOPS is a key component of the DOE-required Integrated Safety Management System.

Gary De Winkle is the Industrial Hygiene Program Lead and Laser Safety Officer for Pacific Northwest National Laboratory (PNNL). He has a bachelor's degree in Chemistry from Calvin College, Grand Rapids, MI and a Master of Technology Management degree from Washington State University. Gary maintains professional certifications in Industrial Hygiene and Safety. He has worked as an Occupational Health and Safety professional for over 30 years with the last 22 at PNNL. From 2001 to 2010, he also served as the Integrated Operations System Chief Engineer/Program Manager.

Bill Ertle, Rockwell Laser Industries

Risk Analysis

Bill has been associated with Rockwell Laser Industries (RLI) since 1989 and has served as President since 2003. He has provided in-depth lectures and training presentations for numerous RLI Training Institute courses, industry conferences, as well as presentations for events at Sandia National Laboratories, Los Alamos National Laboratories, The Fabricators and Manufacturers Association, IEEE/LEOS, OPTCON, ALAC, Bay Area Laser Safety Officers (BALSO) and the International Laser Safety Conference (ILSC). Bill has also authored and co-authored several laser safety articles.
Bill has served as the Chairman of the ANSI Z136 Technical Subcommittee on Control Measures and Training (TSC-4) since 2003 and is a voting member of the Accredited Standards Committee, the main Z136 committee. In 2008, Bill was appointed Secretary of the IEC TC 76 Committee - Optical radiation safety and laser equipment, that prepares international standards for equipment (including systems) incorporating lasers.

He is an active member of the Laser Institute of America (LIA) and a former member of their Board of Directors as well as a member and fellow of the American Society for Lasers in Medicine and Surgery (ASLMS). He is a member of the Canadian Standards Association (CSA) Technical Committee on Laser Safety and is a Certified Laser Safety Officer and Medical Laser Safety Officer by the Board of Laser Safety. Bill is a graduate of Xavier University, Cincinnati, OH.

Robert Fairchild, Lawrence Berkeley National Laboratory

Discussion Panel on Z136.1 and Z136.8

Robert Fairchild received a certificate in Power Reactor Health Physics Technician Training from Academy of Institute for Resource Management (IRM), Inc. in May 1988. Robert then pursued a career as a radiological control technician working commercial nuclear power, where he supported 32 refueling outages and 2 steam generator replacement projects for 19 different commercial nuclear power plants. Robert also supported various projects for Los Alamos National Lab, Nevada Test Site, and the Advanced Test Reactor at Idaho National Engineering Lab prior to accepting a full time position at Lawrence Berkeley National Lab (LBNL) in 1997. In 1998 Robert became National Registry Radiation Protection Technologist (NRRPT) certified and successfully became a CLSO in June 2013. Robert is currently a health physicist in the LBNL Radiation Protection Group where he is the Radiation Generating Device and radiological D&D subject matter expert, as well as the LBNL Deputy LSO.

Heath Garrison, National Renewable Energy Laboratory

Electrical Safety

This presentation discusses dangers when working around electricity, especially if you are not properly qualified. Topics include stored energy sources (capacitors), live energy sources (power supplies, flash lamps, cooling systems), and requirements and guidance in safety standards and other references.

Heath Garrison is an Electrical Safety Professional at NREL. He is working in Site Operations and with the EHS department to provide electrical safety guidance for all of NREL. Heath is a Master Electrician in Texas and Colorado, and is an ICC certified Electrical Inspector. Previously, Heath worked as an Electrical Safety Inspector at B&W Pantex, a DOE nuclear facility in Texas. He helped build the current electrical safety program at Pantex and worked there for 10 ½ years. He is an IBEW Electrician since 1996.

Tim Gerke, Fianium

Continuum "White Light" Generation

Supercontinuum lasers are a relatively new technology that provides spectral coverage from 400nm to well over 2 microns; similar to lamp sources but with extremely useful characteristics that are limited to laser sources. Supercontinuum lasers are coherent broadband sources and can thus focus down to diffraction-limited spot sizes less than one micron and provide many orders of magnitude higher power densities than lamps. These enourmous achievable power densities are monumentally important for investigation and interrogation of samples such as single molecules, nanomaterials, metamaterials, photonic crystals, waveguides, nonlinear absorption, and many more. Supercontinuum lasers are also picosecond pulse laser sources, and such short pulsewidths provide the capability for lifetime study applications like cavity ring-down spectroscopy and fluorescence lifetime. In this seminar we will provide an overview of how supercontinuum generation works, where it is going, and outline some of the vast array of applications that can and have benefitted from the sources in recent years.

Tim Gerke received his B.S. and M.S. degrees in Electrical and Computer Engineering from Purdue University in 2002 and 2004 respectively, and his Ph.D. in Electrical and Computer Engineering at the University of Colorado in 2011. He is currently a Laser Applications Engineer for Fianium Inc., a fiber laser company specializing in ultrafast fiber lasers. His academic research background includes diffractive optics, 3D ultrafast laser nano-machining, ultrafast material processing, and characterization and fabrication of nanophotonic devices.

Joshua Hadler, National Institute of Standards and Technology

Panel Discussion on Eyewear for Multi-wavelength Operation

Joshua Hadler is the NIST Chief Laser Safety Officer, and has been with NIST since July 2002, and has been a Laser Safety Officer within the Quantum Electronics and Photonics Division since 2003. Mr. Hadler is a Physicist and Calibration Leader in the Laser Radiometry project of the Quantum Electronics and Photonics division in Boulder. In addition to Mr. Hadler's scientific duties, he is the program manager for the laboratory laser safety program at NIST. Mr. Hadler brings a broad range of experience to the safety program at NIST. Prior to joining NIST, Mr. Hadler was an Engineering Physicist at the Stanford Linear Accelerator Center, in Menlo Park, CA, with numerous scientific and safety responsibilities. Following his work at SLAC, Mr. Hadler worked at the University of Colorado at the Laboratory for Atmospheric and Space Physics, helping develop space flight instrumentation. Between CU and NIST, Mr. Hadler worked at ILX Lightwave, in Boulder, developing fiber optic test and measurement equipment. Mr. Hadler's experience brings a combination of research and industry perspective to both his research and safety duties at NIST.

R. DeWayne Holcomb, University of Texas

Fire Safety

There are multiple aspects to be considered regarding an evaluation of Fire Safety and Life Safety in a laser lab. The lab environment, local fire codes, institutional policies, and conflicting requirements are a few at the starting block. The ANSI, NFPA, and European standards for safety and fire mitigation all come into play. This presentation is an overview of some of the issues that may need to be addressed to improve fire safety in a laboratory.

R. DeWayne Holcomb started his career in the US Navy Nuclear Program, and has been working in the field of Health Physics since his discharge in 1987. He has worked in radiation and laser programs across the country, including three major research Universities, NASA and DOE facilities, and commercial industry. He maintains his CLSO, CHP, and NRRPT certifications. DeWayne has a B.S. in Technology from Excelsior College, Albany NY.

Steve Jefferts, National Institute of Standards and Technology

Laser-Cooled Primary Atomic Clocks at NIST

Steve Jefferts is the Project Leader for Primary Frequency Standards.

Karen Kelley, University of Maryland

Panel Discussion on Z136.1 and Z136.8

Karen Kelley has a BS in Mathematics, an MS in Environmental Health and is a Certified Industrial Hygienist and Certified Laser Safety Officer. Karen is currently the Manager of Laboratory Safety and Industrial Hygiene at the University of Maryland. Prior to coming to Maryland, Karen was a Senior Industrial Hygienist and the Laser Safety Officer at the University of Pennsylvania. Karen has approximately 17 years of experience in the occupational safety and health field.

Mike Kelley, National Institute of Standards and Technology

Welcome to NIST

Mike Kelley is the Acting Director for NIST Boulder Laboratory Operations.

Jamie King, Lawrence Livermore National Laboratory

Beyond the Basics - Engineering Safety for High-Powered Lasers

Safety controls for typical Class 4 laser laboratories are generally well understood and easily implemented. Most items used are of typical construction or simply procured through a vendor. When it comes to very high powered lasers (>15kW average power), some of these items may not stand up to the test or may not be commercially available. Non-beam hazards such as the production of ionizing radiation, toxic fumes, and electrical safety also become a primary concern. This paper discusses the issues and concerns that need to be address for high-powered lasers.

Comparison/evaluation of Z136.1 and Z136.8

Across the DOE Complex, most contractor operated facilities utilize ANSI Z136.1(2000) for the Safe Use of Lasers due to contractual constraints of 10CFR835. While a small number of laboratories are utilizing ANSI Z136.1(2007), a new standard ANSI Z136.8(2012) for Safe Use of Lasers in Research, Development, or Testing has been released. With that, an updated ANSI Z136.1 is expected to be released in 2014. This presentation will discuss and compare the ANSI Z136.1(2007) to the ANSI Z136.8(2012).

Jamie King is a Certified Laser Safety Officer with over 20 years of experience practicing laser safety. He is the laser safety officer for Lawrence Livermore National Laboratory and the National Ignition Facility. Jamie is a longtime member of the Laser Institute of America and the Bay Area Laser Safety Officers. He currently serves as the Secretary for the Department of Energy, Energy Facility Contractors Group, Laser Safety Subgroup.

John Lehman, National Institute of Standards and Technology

Optical Detectors for Laser Measurements

During this presentation I will describe the basis of laser power and energy meters for NIST calibration services and recent developments to accommodate measurements for evaluating multi-kilowatt lasers. A summary of detector types and their application to laser power and energy measurements will provide an introduction to making practical measurements. A few case studies will be discussed based on measurement results that are relevant to good practice and accuracy.

John Lehman is the Project Leader for NIST Laser Radiometry, which provides the US and much of the world with laser power meter calibrations. The project generates approximately 10% of NIST's calibration income. We seek to develop sources and detectors for absolute radiometry ranging from single photons to 100 kW, and ranging in wavelength from the ultraviolet to far infrared. John is particularly interested in the optical characteristics and low-temperature electrical properties of carbon nanotubes and exploiting radiation pressure for a variety of detector applications.

David Marshall, Spectra Physics (Newport)

Laser Safety Lessons Learned & Best Practices at Newport/Spectra Physics

(Joint presentation with Al Roth). My portion of our presentation will encompass Laser Safety Training of Spectra-Physics Field Service Engineers, Laser Lab Safety Auditing, Laser Lab Work Area Requirements, and Accident Investigations.

David Marshall is the Sr. Regulatory Compliance Engineer and Laser Safety Officer for Spectra-Physics. As Compliance Engineer it is David's responsibility to insure that all lasers manufactured by Spectra-Physics comply with national and international laser safety standards. David is also responsible for all CDRH submissions, and TUV NORD and Underwriters Laboratory Factory Follow-Up Product Safety Inspections. In the capacity of LSO, David is responsible for Laser Safety Training, Laser Lab safety inspections, and assignment and purchase of Laser Safety Eyewear. David has worked for Spectra-Physics for over 37 Years, and has been the company's LSO since 1992. Awards: 2009 Bay Area Laser Safety Officers Jim Rockwell award for Outstanding Contribution to Laser Safety in Industry.

Leon McLin, Air Force Research Laboratory (Human Performance Wing, Fort Sam Houston)

Case Study of a Recent Femtosecond Laser Injury

A worker in an Air Force laboratory sustained a bilateral laser injury from a 100 femtosecond Ti:Saph laser. The accident victim's immediate report was small spots in his vision. His visual acuity was 20/20 acuity for each eye, but he reported he needed to fixate slightly eccentrically to read 20/20 letters. Damage was apparent centrally in both eyes with OCT. At one month after the injury, he reported that he did not see the blurry spots unless he thought about them. His visual acuity was right eye 20/15 and left eye 20/13. However, when reading the eye chart he reported the blurry spots to be about the same size as the letter. The ocular findings of visual acuity, fundus images, and OCT will also be reported. In addition, the details of the accident from a laser safety officer's perspective will be reported, including laser energy, root cause, contributing factors, and corrective measures. Ultra-short lasers have an especially low damage threshold compared to longer pulsed lasers. The plasma flash induced by a focused femtosecond laser has been reported to cause retinal injury. This case highlights that special vigilance in safety practices is necessary when working with ultra-short pulsed lasers.

Dr. McLin is employed by the Air Force Research Laboratory, 711 Human Performance Wing, Optical Radiation Branch, Fort Sam Houston, TX. He has worked for the Air Force as a researcher on laser visual and bioeffects since 1987. He has served as a member of the voting committee for the American National Standards Z136.1, the Safe use of Lasers and Z136.6, Safe Use of Lasers Outdoors. Dr. McLin has a B.A. in biology, (Temple University), an O.D. (Doctor of Optometry, Pennsylvania College of Optometry, and an M.S. in physiological optics, (University of California, Berkeley).

Tom O'Brian, National Institute of Standards and Technology

NIST on a Chip: Revolution in Measurement Science

Recent advances in measurement science enable realistic planning for a broad range of SI-traceable precision measurements that can be deployed almost anywhere: on the factory floor, in operating aircraft and motor vehicles, in the doctor's office. Most of these new measurement systems can be made the size of computer chips and bring the accuracy and precision of quantum-based measurements out of the metrology lab and into a broad range of applications. I will discuss some examples of early NIST-on-a-chip measurement technologies and ideas for the future.

Tom O'Brian received his PhD in experimental atomic physics from the University of Wisconsin in Madison, and initially worked at NIST Gaithersburg as a National Research Council postdoctoral fellow and then as a physicist leading research in fundamental atomic physics, synchrotron radiation for metrology, and precision temperature measurements. In 2003, O'Brian moved to NIST Boulder to become Chief of the Time and Frequency Division, and in 2009 he added service as Chief of the Quantum Physics Division (JILA) to his responsibilities. The Time and Frequency Division provides official time for the United States and for international time coordination, with impacts on US industry, commerce and all citizens. The Time and Frequency Division also performs world-leading research in many fields evolving from making better atomic clocks, including quantum computing. The Quantum Physics Division, as part of the JILA joint institute with the University of Colorado, performs world-leading research on laser physics, ultracold atoms and molecules, biophysics, and nanotechnology. JILA scientists train about 150 graduate students and postdoctoral fellows at any time, and JILA-trained scientists have founded many high-technology companies. The Time and Frequency Division and Quantum Physics Division currently include three Nobel Physics Laureates (Eric Cornell-2001, Jan Hall-2005, Dave Wineland-2012) and many other world-leading scientists and metrologists.

Barbara O'Kane, National Renewable Energy Laboratory

Recent Incident and Non-Compliance Reports at DOE labs

This talk will review Department of Energy laser safety performance expectations and briefly review requirements for reporting incidents and non-compliances. Also included will be a quick look back at DOE laser related events over the years, with a deeper look into the events of the past year. All this will be tied together with overarching lessons learned that may help you monitor your own facility's laser safety performance.

Barb O'Kane is the Health and Safety Manager and Laser Safety Officer for the National Renewable Energy Laboratory in Golden, Colorado. Her primary role at NREL is leading a staff of 15 EHS professionals supporting the mission to address the nation's energy and environmental goals. She has been a board member on the Laser Safety Subgroup EFCOG since 2009. She has a bachelor's degree in Botany and a master's degree in Industrial Hygiene; both from Colorado State University. She maintains professional certifications in Industrial Hygiene, Safety and Laser Safety. She has worked as a safety and IH professional in industry and research for more than 15 years. She is married and has two boys with whom she pursues fun in the great outdoors.

Judith Reilly and Hans Richter, Massachusetts Institute of Technology

Confocal Microscopes and Evolution of Imaging

This talk will describe the use of Confocal Microscopy and Two Photon Microscopy at MIT. Laser Safety considerations during the setup and use of these systems will be discussed.

Judith Reilly is currently the Assistant to the Environment Health and Safety (EHS) Director at MIT. She has been at MIT for 28 years in positions that include EHS Officer/Radiation Protection Officer, Laser Safety Officer, and Assistant to the Director (EHS). This has allowed her to offer significant contributions to MIT programs that span the educational, consulting, governmental, and private-sector industries. She is certified by the Board of Laser Safety as a Certified Laser Safety Officer (CLSO).
Judith has knowledge and the experience to perform initial reviews, and routine oversight in Radiation safety programs including: six Megawatt research reactor, accelerators, x-ray machines and several Co 60 irradiators. As LSO, she is responsible for the safe operation of over 700 Class 3b and Class 4 laser systems located at MIT/Lincoln labs. Coupled with her various DOE/DOD work at Lincoln Laboratory through MIT, it has provided her with the ability to assist clients in finding solutions to high profile, challenging multi-facet risk assessments and hazard evaluation for various projects/programs while encouraging best practices wherever appropriate in Laser Safety.

Hans Richter is the Environment, Health and Safety (EHS) Officer in Radiation Protection at MIT for the past 11 years and was EHS Specialist in Radiation Protection at the University of Southern California for previous 10 years. The MIT Radiation Protection Program has oversight of the safe use of both ionizing and non-ionizing radiation on the main campus, at the research reactor, Bates Accelerator and at Lincoln Laboratories. In addition Hans is the "EHS Lead Contact" for the Department of Biology, the Koch Institute for Integrative Cancer Research, Microsystems Technology Laboratories, and the Department of Mechanical Engineering which includes Ocean Engineering.

Al Roth, Newport Corporation

Laser Safety Lessons Learned & Best Practices at Newport/Spectra Physics

(Joint presentation with David Marshall) I will provide attendees an overview of laser safety management experiences at Newport Corporation. Whether at Spectra-Physics Lasers, other Newport Corporation facilities or in field service to our customers, as a laser company there have been many successes but also challenges in managing workplace laser safety. Examples of "real life" incident situations and the key lessons learned from those, including best practices adopted, will be discussed.

Al Roth has 29 years' experience in the field of Occupational/Environmental Health & Safety. He has served as an effective external & internal consultant within a variety of industries including manufacturing, engineering, information technology, retail,

transportation and construction. These companies include Pfaltzgraff Ceramics, The Vons Companies and Toro Irrigation.
Mr. Roth has broad expertise in the OHS/EHS field including ergonomics, laser safety, environmental sustainability/energy management and Emergency Response/ Business Continuation planning. His focus is on developing programs that are effective in responsiveness and cost control. He currently serves as Director of Environmental, Health & Safety for Newport Corporation with responsibilities in support of the global operations of a major laser, optics and scientific research equipment manufacturer.
His affiliations include American Society of Safety Engineers and Orange County Red Cross. He is a graduate of California State University – Long Beach & UC Irvine and has the professional designation of Certified Safety Professional.
Mr. Roth has presented on a variety of topics at several professional development conferences over the past several years (ASSE, National Safety Council, American Red Cross). He and his family currently reside in Lake Forest, CA..

James Santucci, Fermi National Accelerator Laboratory

Commissioning of the ASTA Photo-Injector Drive Laser System

Currently an advanced superconducting test accelerator (ASTA) is being built at Fermilab. The accelerator will consist of a FLASH-type photo electron gun, ILC-type cryomodules and multiple downstream beam lines for testing cryomodules and carrying advanced accelerator researches. In this talk we will report the commissioning of the ASTA drive laser system, its control system, and its safety system.

James Santucci received his BS in Physics/math from Elmhurst College in 1993. He has worked at Fermi National Accelerator Laboratory since 1994. When first joining Fermilab he trained as an operator on its accelerator systems. He quickly moved to the Advanced Accelerator R&D Group to work on the team that was building and commissioning the A0 Photoinjector. There he was intimately involved with the laser, cryogenic, RF, vacuum, instrumentation, power, control, and safety systems. He is currently working on the team that is planning, building, and commissioning the photoinjector for ASTA at Fermilab. He also volunteers in Fermilab's K-12 Education Outreach program.

Bill Shiner, IPG Photonics

High Power Fiber Lasers

The first kilowatt class fiber laser entered the material processing market in early 2002. Since that time the power of these lasers have continued to increase to the 100 kilowatt level along with numerous new fiber laser product offerings addressing all major markets in the material processing arena. The market acceptance and market share growth of fiber laser technology has been exceptional and is becoming the dominate technology for material processing applications. The presentation will review the various fiber lasers currently available, principle applications and a peek into the future.

Mr. Bill Shiner has been Vice President of IPG Photonics since 2002, is a past President and Fellow of the Laser Institute of America, has published numerous articles and made presentations at major Laser conferences on Laser Technology, and is a member of the Photonic Spectra editorial advisory board. BSEE and MBA from Northeastern University

David J. Wineland, National Institute of Standards and Technology

Single-Atom Laser-based Clocks*

With the availability of spectrally pure lasers and the ability to precisely measure optical frequencies, it appears the era of optical atomic clocks has begun. At the expense of signal-to-noise ratio, in one project at NIST we have used single trapped atomic ions because uncertainties in systematic effects are smallest, reaching $\Delta f/f_0 = 0.8 \times 10^{-17}$. At this level, many effects, including those due to special and general relativity, must be calibrated and corrected for.

*NIST work supported by ONR, AFOSR, and DARPA

David Wineland received a bachelor's degree from Berkeley in 1965 and his Ph.D. from Harvard in 1970. After a postdoctoral appointment at the University of Washington, he joined NBS (now NIST), where he is the leader of the Ion-Storage Group in the Time and Frequency Division at Boulder. The group's research has focused on laser cooling and spectroscopy of trapped atomic ions with applications to atomic clocks, quantum-limited metrology, and quantum state control.

David is the 2012 Nobel Laureate in Physics.

Michael Woods, SLAC National Accelerator Laboratory

Welcome to the LSO Workshop

Performance Metrics - Using Laser Operator and Laser Approval Surveys

Two types of laser surveys are used at SLAC to help assess the lab's laser safety program and practices. The first survey is an annual questionnaire completed by laser operators at the lab to help assess safe laser practices and the effectiveness of the laser safety program. The second survey is completed by laser operators when they receive approval for one of the following: a new or revised laser safety document, a laser service subcontractor visit, or annual laser lab operation. An overview of these surveys is presented as well as results for some of the specific questions. A survey for Workshop participants has been completed using a subset of questions from the annual questionnaire – I will compare some results from this survey with results from SLAC's survey of laser operators.

Discussion Panel on Z136.1 and Z136.8

Michael Woods, CLSO, is the Laser Safety Officer at the SLAC National Accelerator Laboratory. He is an Engineering Physicist, with a B.Sc. in Engineering Physics from Queen's University in Kingston, Ontario, Canada and a Ph.D. in High Energy Physics from the University of Chicago. He has been at SLAC for 25 years – initially as a

postdoc, then as a staff physicist in the Accelerator Department and then for 15 years as a researcher in experimental particle physics. He has spent 15 years utilizing high power laser systems for photo-injectors, Compton polarimeters and electron beam diagnostics. He became SLAC LSO in 2008. He is a member of the ANSI Z136 SSC-1, TSC-4 and TSC-5 committees and is Secretary for TSC-4. He is a member and past vice-chair of DOE's EFCOG laser safety subgroup.