



JUDICIAL SCIENCE SCHOOL

Los Alamos National Laboratory

Confidence

Theory

Probability

Simulation

Testimony



Justice Edward Chavez

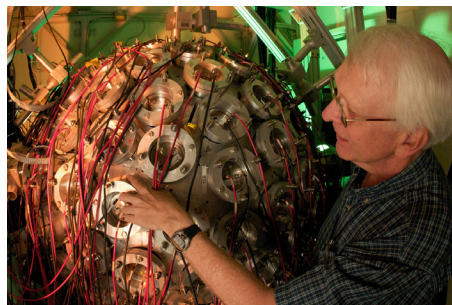
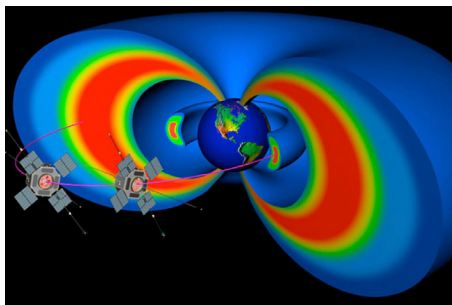
JUDICIAL SCIENCE SCHOOL

Foreword

Scientific evidence is introduced in our courts with increasing frequency and greater complexity, which requires judges to have a better understanding of science. Preparing judges to competently rule on the admissibility of scientific evidence represents a new challenge in judicial education. The role of uncertainty in science requires special attention.

What better way to educate judges than to collaborate with some of the top scientists in the world working at our national laboratories? This question led to the collaboration between New Mexico judges and Los Alamos National Laboratory to develop the Laboratory's Judicial Science School. The pedagogical relationship between the courts and the Laboratory scientists will enable judges to make more informed decisions about the admissibility of scientific evidence. When judges improve, lawyers must improve, and the people and businesses in our courts will benefit from a better justice system.

– Hon. Edward L. Chavez, Justice
New Mexico Supreme Court



Executive Summary

Launched in the spring of 2014, our weeklong program was developed through close collaboration among the New Mexico judiciary, the Laboratory's top science and engineering leaders, and our Laboratory's Legal Counsel. The close collaboration between our science and legal professionals has helped to develop a complete primer on the scientific method that is tailored for judges. The purpose of the course is to provide the judges with an understanding of the methodology of modern scientific research and the role of uncertainty inherent in all measurements, models, and predictions. Our goal is to offer the knowledge and tools that will better prepare judges to evaluate science based evidence in the courtroom, whether determining threshold admissibility or making decisions that involve evidence-based court practices or risk assessments.

Our immersion course is a unique combination of lectures from senior scientists and engineers, tours of specialized laboratory facilities, a hands-on experience in a laboratory, and the application of knowledge to a real-world legal problem. Throughout the week, judges are exposed to how scientists and engineers go about their work in the laboratory and in the field and how they use advanced theory, modeling, and simulation to make predictions about the natural world. The hands-on laboratory exercise allows the judges to learn about sources of error and recognize that uncertainty is unavoidable in science. During a mock hearing at the end of the course, judges have an opportunity to apply what they have learned regarding the admissibility of scientific information. Throughout the course, judges work closely with scientific mentors to ensure that the experience is interesting, engaging, and informative.

– David Clark, Laboratory Fellow
Senior Scientist

– Cynthia Blackwell, Laboratory Counsel
Senior Attorney

– Charles Farrar, Laboratory Fellow
Senior Engineer



David Clark



Cynthia Blackwell



Charles Farrar

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Introduction

Los Alamos National Laboratory is a multidisciplinary scientific research and development institution whose purpose is to solve national security challenges through scientific excellence. In the 21st century, we focus on problems that are large scale, highly complex, and of high global impact. Such problems require fundamental research and development from scientists and engineers who work in multidisciplinary teams and use large or highly specialized experimental facilities. The multidisciplinary nature of our work creates a very special working environment of scientific discovery. With more than 2000 PhD scientists and engineers, we hold ourselves to a high standard through continual evaluation, questioning, and refining of knowledge. This backdrop of a working multidisciplinary scientific laboratory provides a unique setting for introducing judges to the process of modern science and technology, discovery, validation, and peer review. We welcome the opportunity to share this unique scientific environment with the judiciary.

Goal of the Program

The goal of the Los Alamos Judicial Science School is to provide judges with knowledge and experience that will enhance their ability to evaluate whether scientific arguments meet the threshold requirements of admissibility. This goal is accomplished through a combination of interactive classroom instruction, tours of unique facilities, and hands-on laboratory exercises aimed at the following objectives:

- Understand and apply basic experimental methods common to all scientific problem solving
- Examine data collected from hands-on scientific investigations and formulate conclusions
- Explore and practice analytical methods used to interpret scientific data and understand the uncertainties associated with such analyses
- Present, argue, and qualify conclusions and inferences based on scientific data
- Discover connections in methods and language between law and science

"... a well-integrated education program that combines direct classroom instruction with hands-on science activities and peer-to-peer engagement between judges and scientists and engineers. It would be impossible to replicate this program anywhere but at a national laboratory facility."

*—Hon. Debra L. Stephens, Justice
Washington State Supreme Court
Chair, NCSI Center for Graduate
and Advanced Degree-earning Judicial Science Education*



Los Alamos National Laboratory sits on top of a once-remote mesa in northern New Mexico with the Jemez mountains as a backdrop to research and innovation covering multi-disciplines from bioscience, sustainable energy sources, to plasma physics and new materials.

Structure

The science school takes place over five consecutive days and consists of five primary components:

- Classroom lectures
- Cutting edge scientific research presentations
- Hands-on laboratory exercises
- Field trips to unique experimental facilities
- A mock admissibility hearing to evaluate science

Each day of the course will include elements from multiple components. In some cases, the participants will get hands-on experience with new material introduced during exercises that follow the primary lecture. In others cases, material will be introduced first through hands-on exercises and then covered in more detail in subsequent lectures. Participants are tested before and after the program to evaluate their understanding of key learning objectives. After fundamental concepts have been discussed and explored, participants will engage in a mock scientific evidence admissibility hearing that will provide an opportunity to apply what they have learned in a more familiar courtroom setting.

Evening social events are scheduled in addition to the program curriculum. Social events include a reception at the Bradbury Science Museum, where senior Los Alamos scientists interact, in a casual setting, and discuss the science and technology on display in the museum. An evening meal in historic Santa Fe allows participants to have informal discussions with course instructors.

Late afternoon hikes for the more adventurous are available to explore ancient native American sites or the scenic wilderness of Northern New Mexico.

"While the teaching examples originated in the large and exciting physical sciences and engineering projects of [the] National Laboratory, the fundamental concepts of mitigating uncertainty carry over to our everyday interactions as judges with behavioral and social science."

– Hon. George M. Lipman, Judge
District Court of Maryland
Member, Governing Committee, NCSI Center for Basic
and Continuing Judicial Science Education



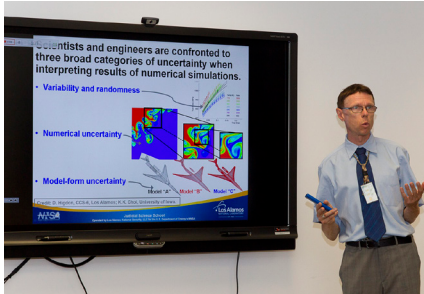
The Judicial Science School strives to maintain a stimulating class setting where participants and instructors interact in a friendly and professional environment.



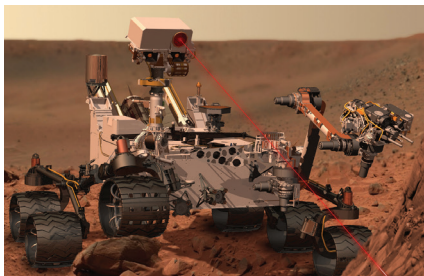
Participants get a broad exposure to how science is conducted in the laboratory, in the field (shown here), and through the use of advanced modeling and simulation.



Los Alamos senior scientist Dr. David Clark (right) discusses nuclear batteries used in Mars exploration. Participants and instructors have many opportunities for informal discussions, as in this visit to the Bradbury Science Museum.



Los Alamos senior engineer Dr. Francios Hemez discusses uncertainty and how it is applied to science and engineering problems.



Los Alamos' role in Mars exploration has been a favorite science lecture for judges. The ChemCam instrument uses powerful laser pulses to study the chemical composition of the Martian soil and rock formations.



Los Alamos senior engineer Dr. Charles Farrar demonstrates the use of an experimental apparatus before the judges perform a hands-on experiment.

Course Components

Classroom Instruction

Participants are introduced to the scientific method through a series of lectures by Los Alamos scientists. Throughout the lectures participants are encouraged to interact with the speaker. In addition, time is set aside for discussion. The following areas are covered:

- Scientific hypotheses, theories, and laws
- The scientific method and its modern day forms
- Causality, correlation, probability, and coincidence
- Understanding and quantifying confidence and uncertainty
- Building and validating models

Technical Seminars on Current Topics

Prominent Los Alamos scientists discuss current research during participant seminars. There is sufficient time for in-depth discussions. Typical topics include the following:

- Climate Modeling
- Mars Exploration
- AIDS Vaccine
- Magnetic Sensing
- Biofuels for Energy Security

Interactive Laboratory Exercise

Participants are provided with sets of problems that need scientific solutions requiring hands-on laboratory work. Scientists work with participants on individual and team exercises. Participants complete some of the following activities:

- Frame the research problem as a simple question or two
- Negotiate and outline a credible and defensible experimental design
- Collect and analyze data
- Iterate on the scientific method: hypothesize, predict, experiment, and analyze
- Assess error, uncertainty, and the validity of assumptions
- Present and defend predictions and conclusions

Field Trips to Unique Experimental Facilities

Participants tour research facilities where scientists demonstrate how the scientific method is applied to solve complex problems.

Examples include the following:

- Tree Mortality Laboratory, where scientists seek to understand the effects of climate change
- High-performance computing facilities housing the world's fastest computers and visualization capabilities
- National High Magnetic Field Laboratory containing the world's strongest magnets that are used to explore fundamental properties of materials

Judging Science (Interactive Mock Admissibility Hearing)

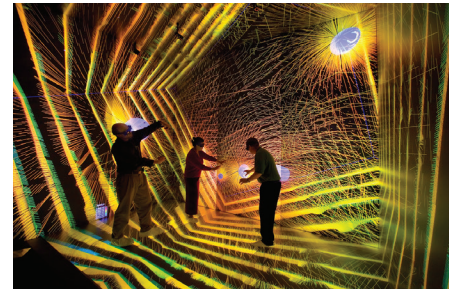
This culminating activity puts judges back into the courtroom to assess and compare scientific arguments offered through a mock admissibility hearing where scientists take on expert witness roles. This simulated proceeding in a courtroom setting provides judges with an opportunity to demonstrate what they have learned during the Judicial Science School.

This small-group activity includes the following exercises:

- Read and review background information on the case
- Evaluate opposing or conflicting arguments
- Formulate a set of questions to establish the relative validity and reliability of the competing scientific arguments
- Query Los Alamos scientists through mock cross-examination
- Formulate statements of judgment indicating the rationale for ultimate preference
- Share and discuss the case with colleagues and scientists

"The material was top-notch, well presented and among the most useful I have received in two decades on the bench. . . . I wish every judge in the state, and frankly the country, had the opportunity you gave my colleagues and me."

—Hon. Kevin L. Fitzwater, Judge
Metropolitan Court
Bernalillo County, New Mexico



Researchers investigate details of an astronomical simulation in the Cave Automatic Virtual Environment (CAVE) at the Los Alamos Supercomputing Center.



In his outdoor Laboratory, Dr. Nate McDowell, a tree physiologist at Los Alamos National Laboratory, pushes trees to the limits of moisture deprivation and heat.



2015 Judicial Science School Tour of The Los Alamos campus of the National High Magnetic Field Laboratory.

Preparing judges to competently rule on the admissibility of scientific evidence represents a new challenge in judicial education.

— Hon. Edward L. Chavez, Justice
New Mexico Supreme Court

Scientific issues are involved in an ever-increasing number of cases, both civil and criminal. The Judicial Science School is astonishingly effective at teaching judges how to assess the validity of scientific expert testimony

— Hon. Cheryl Johnson, Judge
Texas Court of Criminal Appeals
Chair, Governing Committee,
NCSI Center for Basic and Continuing Judicial
Science Education



For more information:

National Security Education Center (505) 665-0983
Charles Farrar, farrar@lanl.gov
David Clark, dlclark@lanl.gov

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Judicial Science School Instructors:

Cynthia Blackwell, *Laboratory Counsel*
Leigh J. Cash, *Theoretical Design, Primary Physics*
David L. Clark, *National Security Education Center*
Jerry Dixon, *Dixon, Scholl & Bailey, P.A.*
Charles R. Farrar, *Engineering Institute*
Eric B. Flynn, *Engineering Institute*
Francois M. Hemez, *Theoretical Design, Integrated Design and Assessment*
Alexandria N. Marchi, *Engineering Institute*
David D. L. Mascarenas, *Engineering Institute*
Duncan W. McBranch, *Chief Technology Officer*
Albert Migliori, *G. T. Seaborg Institute for Transactinium Science*
Catherine S. Plesko, *Theoretical Design, Nuclear Threat Assessment*
Pablo Prando, *Laboratory Counsel*
Scott A. Robbins, *National Security Education Center*
Steve Scholl, *Dixon, Scholl & Bailey, P.A.*
Michael D. Todd, *Univ. of Cal. San Diego, Dept. of Structural Engineering*
Scott A. Vander Wiel, *Statistical Sciences*

Judicial Science School Staff:

Ellie Vigil, *National Security Education Center*



UC San Diego
Jacobs School of Engineering