

# Connecting Our Innovation Strategy with the Los Alamos Strategic Plan

## Mission

"The nation faces significant challenges in its ability to maintain the technology edge that we rely on for our security and our prosperity. Los Alamos' ability to deploy solutions to our national security customers is increasingly reliant on partnerships with the public and private sectors. This capacity to innovate, and to do so with speed and agility, has become a new expectation for meeting our missions."

– Andy Erickson, Deputy Principal Associate Director, Global Security

## Capability

"Finding the proper balance between the near-term pulls from industry and the critical need for long-term science excellence is a constant challenge that often stresses our enterprise. In managing strategically the trade-offs that come with translational research we are finding win-win outcomes that benefit the Laboratory and our partners. Los Alamos is evolving to enable innovation to play a growing role in support of stable and enduring capabilities."

– John Sarrao, Associate Director, Theory, Simulation, and Computation

## People

"Our talent is our Laboratory's most important resource. Creating the right climate for innovation can be a big part of how we make Los Alamos the best place in the world to work. We are improving how the Laboratory recognizes and enables our staff in this area. I am optimistic that the drive to see ideas in use is a powerful motivation for our staff."

– Carol Burns, Deputy Principal Associate Director, Science, Technology, and Engineering

"Innovation is a very difficult thing in the real world."

– Richard P. Feynman



# People Drive the Innovation Network

Multiplying the power of what you know by the power of who you know

### TOM TERWILLIGER / Phenix

The partnership to create the Phenix software, led by Los Alamos researcher Tom Terwilliger, with Lawrence Berkeley National Laboratory, and Duke and Cambridge universities, makes complex algorithms easy to use for thousands of structural biologists.



### DIPEN SINHA / Safire

Dipen Sinha and his collaborators from Chevron, in partnership with GE, used Swept Frequency Acoustic Interferometry technology to develop Safire, the world's most cost-effective topside multiphase flow meter.



### HARRY MARTZ & MICHAEL HAMADA / Reliability Technology

The relationship developed over a decade ago to create Procter & Gamble's Reliability Technology continues with P&G and its partners to find new disruptive innovations.



### XCP-3: MONTE CARLO CODES / MCNP

MCNP6 represents one piece of a set of synergistic capabilities developed through the decades by Los Alamos contributors. It is the simulation tool of choice for neutronics in nuclear materials when the best answers are mandatory.



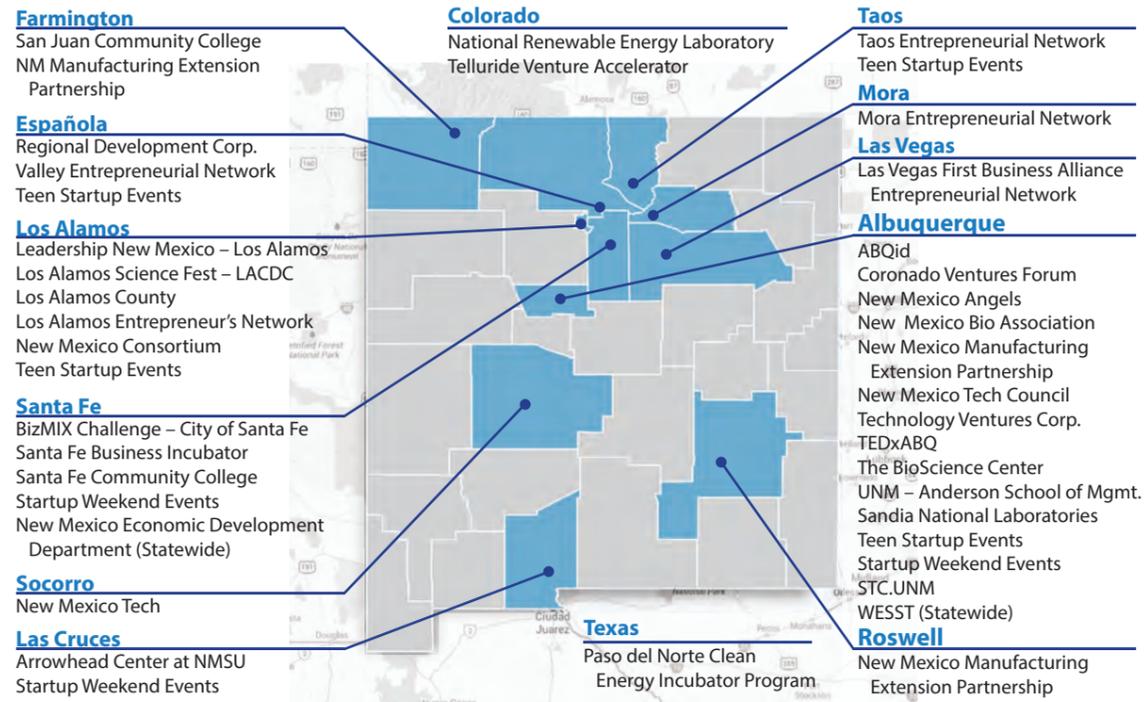
### GREGORY KADUCHAK / Acoustic Focusing Cytometry

Launched by Life Technologies, the Attune® Acoustic Focusing Cytometer was built upon sound-related research and development at Los Alamos.



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# An Evolving Regional Network



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Los Alamos National Security, LLC, for the National Nuclear Security Administration of the U.S. Department of Energy under contract.



# Power of the Network 2014 Progress Report



## Defining and Developing the Los Alamos Innovation Network

Innovation is the delivery of a solution to address an unmet need. Once again we come together to recognize Los Alamos National Laboratory's excellence in innovation and our achievements in connecting our best solutions to our customers. Through our accomplishments, we witness the power of technology to leverage a network in our most widespread software tools, MCNP and SOLVE, as well as in successful commercial products originating at Los Alamos, such as the Attune® NxT Acoustic Focusing Cytometer. The Laboratory is making progress in connecting innovation with its broader strategy and we are proud when we have a positive impact on execution of current missions and we contribute to our evolving capabilities. The accelerating pace of technology development and the potentially disruptive impacts of technical surprise are some of the primary reasons this Laboratory exists. Recognizing the innovative contributions that the Laboratory has made to the national security enterprise should give us a great sense of pride in what we have done and hope in what we have yet to do.



David Pesiri  
Division Leader, Richard P. Feynman Center for Innovation

## Our Innovation Network

Innovation is powered by people. Los Alamos has a remarkable 70-year legacy of creating entirely new technologies that have revolutionized the country's understanding of science and engineering. We have shaped a seven-decade streak of excellence bookended by the Trinity test and the Trinity Supercomputer. In doing so, our people have demonstrated an ability to bring new solutions to some of the world's toughest national security problems. Through our success, we recognize the critical importance of our networks. Successful innovation can almost always be traced to a collection of talent that links together with a common purpose—the product of what we know and those whom we know.

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## 2014 Richard P. Feynman Innovation Prize Recipient: MCNP6 Team for Monte Carlo Radiation Transport Code



Back row: Jeffrey S. Bull, XCP-3; Gregg W. McKinney, NEN-5; Lawrence J. Cox, XCP-3; Michael L. Fensin, NEN-5; Avneet Sood, XCP-3; Trevor Wilcox, NEN-5. Middle row: Forrest B. Brown, XCP-3; Roger L. Martz, XCP-3; Grady Hughes III, XCP-3; Garrett E. McMath, NEN-5. First row: Laura Casswell, HPC-1. Not pictured: Richard E. Prael, XCP-3; Stepan G. Mashnik, XCP-3; Brian C. Kiedrowski, XCP-3; Michael R. James, NEN-5; John T. Goorley, XCP-3.

In 1947, John von Neumann sent a letter to Robert Richtmyer, a Los Alamos scientist, proposing the use of a statistical method to solve neutron diffusion and multiplication problems in fission devices. The Monte Carlo method for radiation particle transport originated from this exchange and continues driving the computational developments of today, in the form of the Monte Carlo N-Particle (MCNP) Transport Code.

Currently in its sixth iteration, MCNP's advancement over the last decade has been exponential, from approximately 100,000 lines of code to 500,000+ lines of code. This explosion in capability has been driven primarily by MCNP's applications for its primary sponsors and user communities. MCNP6 represents fifty years of contributions by many Los Alamos scientists who have made it the impactful software it is today.

The key value MCNP provides is a predictive capability that can replace expensive or impossible-to-perform experiments. It is often used to design large-scale measurements, providing significant time and cost savings to the community. MCNP6 represents one piece of a set of synergistic capabilities, each developed at Los Alamos, that includes evaluated nuclear data (END) and the data processing code, NJOY. The Radiation Safety Information Computational Center (RSICC) is responsible for releasing all versions of MCNP on behalf of Los Alamos. More than 14,000 MCNP and 3,000 NJOY licenses have been issued to global user communities.



### Gregory Kaduchak

Life Technologies Corporation, a brand of Thermo Fisher Scientific (then Invitrogen), provided the resources necessary to quickly deploy the first-of-its-kind cytometer system based on technology developed at Los Alamos. The company is still upping the game by building the next generation Attune machine (the Attune® NxT Acoustic Focusing Cytometer) with much more capability that further improves the performance, reliability, and robustness of the instrument.

### Thomas Terwilliger

Los Alamos creates advanced algorithms for determining the structures of proteins and other macromolecules, and is the driving force behind the software that makes these algorithms easy to use for thousands of structural biologists worldwide. Los Alamos partnered with Lawrence Berkeley National Laboratory, as well as Duke and Cambridge universities, to create Phenix, a user-friendly and comprehensive software system that guides users through all the complicated steps necessary to determine the 3D structure of their macromolecules. Some 13,000 scientific papers have cited and several hundred licensees have used the Phenix software.

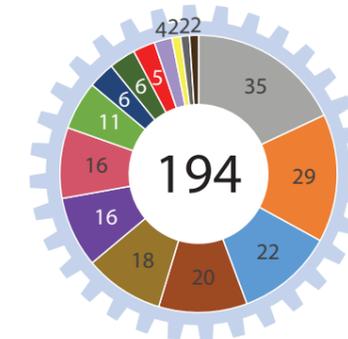


## 2014 Metrics

Los Alamos National Laboratory expands its innovation network by engaging in sponsored research and licensing across technical disciplines. These agreements are the basis of a working relationship with industry and other research institutions and highlight the diversity of our collaborations.

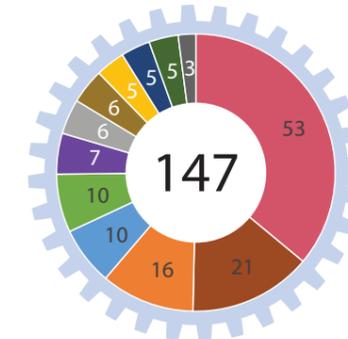
### Strategic Partnerships Projects

In FY 2014, Los Alamos performed work on 194 active Strategic Partnership Projects with non-federal entities ranging across 15 Department of Energy defined science areas.



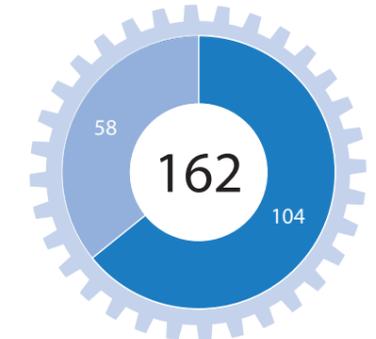
### Cooperative Research and Development Agreements

In FY 2014, Los Alamos had 147 active collaborative projects in over 12 research areas outlined by Department of Energy taxonomy.



### Licenses

In FY 2014, 58 patent license agreements and 104 software license agreements were executed for commercial, non-commercial, and government uses.



- Advanced Computation
- Advanced Manufacturing
- Advanced Materials
- Bioscience
- Biotechnology
- Chemical Science & Technology
- Earth & Environmental
- Electrical Systems & Engineering
- Energy Storage
- Fuels
- National Security
- Nuclear Power
- Renewable Energy
- Power Distribution
- Physics
- Other
- Patents
- Software

## Innovation on the Horizon



Los Alamos National Laboratory and Whitewood Encryption Systems, Inc. of Boston, a wholly owned subsidiary of Allied Minds, are working to bring the potential for truly secure data encryption to the marketplace after nearly 20 years of development in the laboratory.

Traditional approaches to quantum key distribution for networks required a dedicated point-to-point link between each pair of users, leading to redundancy of resources. In contrast, this new quantum key management approach offers the advantages of quantum key distribution even to users who have no direct quantum link. The technology can also be applied as an overlay to existing optical networks, eliminating the need for a dedicated optical communications infrastructure.

*"Whitewood aims to address one of the most difficult problems in securing modern communications: scalability—meeting the need for low-cost, low-latency, high-security systems that can effectively service increasingly complex data security needs."*

— John Serafini, Vice President at Allied Minds

