INL/EXT-16-39577

Laboratory Agenda 2016

INL Vision

INL will change the world's energy future and secure our critical infrastructure.

INL Mission

Discover, demonstrate and secure innovative nuclear energy solutions, clean energy options and critical infrastructure.

Idaho National Laboratory

Introduction

As the nation's lead nuclear energy research, development, demonstration, and deployment laboratory, Idaho National Laboratory (INL) has an important mission and a grand vision. Our vision is to change the world's energy future and secure our critical infrastructure through our mission to discover, demonstrate, and secure innovative nuclear energy solutions, other clean energy sources, and critical infrastructure.

Completing the mission—and fulfilling our vision—requires carefully charting our course for this year and years to come. Our laboratory agenda articulates our path to achieve our vision through strategic, effective, efficient, and collaborative mission delivery. The laboratory agenda describes our commitment to simultaneous excellence in science and technology, management and operations, and community service. It identifies our major priorities and critical outcomes, defines our core capabilities, and provides a roadmap to success.

In the laboratory agenda, four critical science and technology outcomes include the following:

(1) INL will enable advanced nuclear energy systems by delivering the Gateway for Accelerated Innovation in Nuclear (GAIN) initiative. To ensure GAIN's success, INL will expand testbed capabilities at the Materials and Fuels Complex (MFC) and Advanced Test Reactor (ATR) and serve as a demonstration platform in partnership with industry.

(2) INL will partner with industry to license and construct a first-of-its-kind small modular reactor and continue the research and development that will pave the way for innovative advanced reactors.

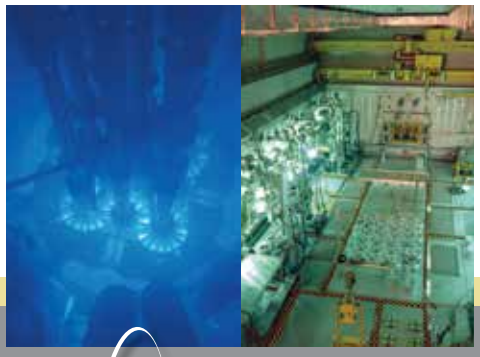
(3) INL will advance clean energy and environmental systems at scale and accelerate deployment of new technologies through regional innovation and demonstration.

(4) INL will develop enduring cyber physical innovation capabilities, advance cyber science and engineering, and establish a cyber security innovation center to ensure national security.

Achievement of high-impact scientific and technical outcomes is enabled through safety, security, and operational excellence, today and into the future, and will require the following:

(1) Development of our talent pipeline to continuously attract the top people in their respective fields.

Deliver GAIN



GAIN
Gateway for Accelerated Innovation in Nuclear

Enable the nation's first Small Modular Reactor

(2) Delivery of laboratory operations in a reliable and effective manner to use resources most efficiently, protect the environment, and ensure the safety and health of our staff, visitors, and the public.

(3) Advancing our IT infrastructure to ensure staff have easy access to lab resources and capabilities.

(4) Cultivating positive and enduring partnerships with researchers, academia, industry, other national laboratories, the community, and regional, state, and federal policymakers.

Our laboratory agenda sets us on a path to deliver our mission while accelerating the pace for addressing some of the most challenging energy and security issues the world faces today: clean energy development and demonstration at scale; nuclear non-proliferation; energy transmission and distribution; first-responder training; transportation systems performance; and energy system dynamics capability, to name but a few.

INL's research, development, demonstration, and deployments are critical in meeting the nation's energy, security, and climate change goals. This is our laboratory agenda. By following this path, we will fulfill the mission and fulfill our vision of providing the clean energy needed to power the future and ensure national and homeland security.

Dr. Mark Peters
Director, Idaho National Laboratory

Implement regional innovation for clean energy systems

Build/establish enduring cyber-physical innovation capability

The INL Lab Agenda provides a structured framework championed by the Leadership and Management Team that identifies the critical outcomes , strategic initiatives, and near-term research and development (R&D) and mission support activities necessary to accomplish INL strategic objectives for the Department of

	SCIENCE & TECHNOLOGY		
Strategic Objective (10–20 years)	Accelerate deployment of nuclear energy	Provide at-scale clean energy systems integration and demonstration and complementary environmental solutions	Develop critical national and homeland security capabilities
Critical Outcomes (5–10 years)	• Deliver the Gateway for Accelerated Innovation in Nuclear (GAIN) • Enable the first small modular reactor (SMR)	• Implement regional innovation for clean energy systems	• Provide the nation with an enduring cyber-physical innovation capability centered on the INL control systems cyber innovation center to advance cyber-informed science and engineering
Strategic Initiatives (2–5 years)	**GAIN** • Establish/revitalize use of the experimental facilities • Enhance advanced computational capabilities • Establish knowledge and validation center • Develop streamlined CRADA and SPP models to address industry concerns • Develop approach for phased reduction in licensing risk • Complete at least two industry pilots • Develop CD-1 for fast spectrum test reactor • Revise NE's advanced reactor strategy and roadmap **SMR** • Direct R&D to retire commercial risk cooperatively through partnerships with vendors, utilities, and industry • With NRC and industry, prioritize and enhance regulatory readiness levels to retire risk for innovative reactor designs • Remove barriers to siting the first SMR and set precedent to attract other SMRs • Enable rapid access to private partnerships and government support for first-of-a-kind (FOAK) SMR	• **Business development and outreach** Develop innovative regional partnership constructs and systems • **Strategic regional research capability** Aggregate, enhance, and employ leadership-class research capabilities targeted toward regionally relevant clean energy challenges • **Strategic infrastructure** Develop and employ collaborative research, design, development, testing, and demonstration infrastructures • **Talent** Develop regional partnership center(s) of excellence	• **Multi-Agency Center** Create national partnership to holistically address automation and control systems challenge • **Talent** Create nationwide pipeline to attract, develop, and provide access to the nation's top-tier control systems cyber workforce • **Energy** Advance energy infrastructure reinvention for cyber resiliency with DOE lab partners • **DOD/IC** Develop/advance the national defense security solutions to cyber threats in critical infrastructure and embedded systems • **Nuclear-Cyber** Holistically address research, engineering, and technical policy challenges in nuclear-cyber security by deploying impactful solutions across the energy and materials lifecycle

Energy (DOE), Office of Nuclear Energy (NE), and other DOE programs and federal agencies, and delivers on INL's commitment to simultaneous excellence in science and technology (S&T), operations, and community service.

OPERATIONS	STAKEHOLDER ENGAGEMENT & COMMUNITY SERVICE
Achieve excellence in Laboratory operations	Achieve excellence in stakeholder engagement and community service
Transform INL's infrastructure, capabilities, systems, and processes to enable modern science	Establish INL as high value partner nationally, and in community, state, and region
• Optimize and integrate INL management systems to enable research • Build INL's future workforce by developing talent pipeline and improving employee experience • Implement user-friendly systems and processes that enable rapid and responsive access to INL's resources and capabilities • Optimize cost management to provide more resources to mission • Revitalize security and enabling infrastructure • Continuously improve safety and operations culture	• Communicate INL's mission and priorities to Idaho and region to broaden understanding of outcomes and impacts • Strengthen academic partnerships • Foster entrepreneurial culture and effective partnerships, translating research to innovation

Critical outcomes are institutional outcomes focused on fulfilling INL's mission, vision, and strategic objectives. They distinguish INL and represent our greatest potential for scientific and technical leadership and inspire sustained stewardship investment from sponsors, stakeholders, and ourselves.

I.1. Deliver the Gateway for Accelerated Innovation in Nuclear (GAIN)

Establish GAIN as a public-private partnership model to be used as the organizing principle for the DOE's nuclear energy RD&D programs, which aim to achieving the following three strategic goals simultaneously: (1) Maintain technology leadership in nuclear energy; (2) Enable industrial leadership for advanced nuclear energy systems; and (3) Enable optimized deployment of advanced nuclear energy systems within the clean energy portfolio.

Responsibility

Kemal O. Pasamehmetoglu, Sean O'Kelly, Ronald Crone, John Bumgardner, Rita Baranwal

Outcomes

1. R&D test bed that includes knowledge and validation center and state-of-the art experimental and computational capabilities within.
2. Public-private partnership model with streamlined access to the R&D test bed and Demo Platform for cost effective and accelerated process to achieve commercial readiness of innovative technologies.
3. Advanced reactor licensing requirements accomplished jointly with NRC.

2–5 Year Initiatives and Responsibility

- Establish/revitalize use of the experimental facilities.

TECHNOLOGY

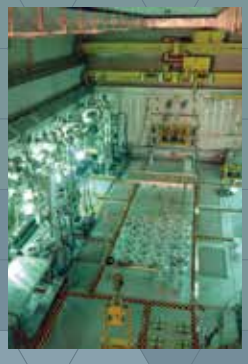
  - Initiate use of new facilities and capabilities with world-class expertise (e.g., Advanced PIE and transient testing).
  - Streamline ATR operations and use of online instrumentation to improve impact of the irradiation tests.
  - Establish a reliable MFC operations model with increased and predictable throughput.
- Enhance advanced computational capabilities.
  - Upgrade the computational capabilities to ~1 petaflops for simulations dedicated to NE programs.
  - Complete validation of MOOSE-based application software.
  - Adopt RISMC to advanced reactor concepts.
- Establish the knowledge and validation center to capture historical data and knowledge and develop validation methodologies for the multi-scale, multi-physics simulations.
- Develop streamlined CRADA and SPP models that address industry concerns with respect to IP protection and schedule/cost reliability.
- Develop approach for phased reduction in licensing risk through development of licensing readiness level concept jointly with NRC.
- Complete at least two industry pilot projects to address industry concerns using specific innovative technology development being pursued by vendors, suppliers, and start-up companies.

Core capabilities to deliver this critical outcome

- Advanced computer science, visualization, and data
- Applied materials science and engineering
- Chemical and molecular science
- Chemical engineering
- Condensed matter physics and materials science
- Decision science and analysis
- Large-scale user facilities/advanced instrumentation
- Mechanical design and engineering
- Nuclear and radiochemistry
- Nuclear engineering
- Power and electrical engineering
- Systems engineering and integration

- Develop conceptual design, partnership model, and final design and construction strategy for fast spectrum test reactor.
- Revise the NE advanced reactors strategy and roadmap consistent with GAIN objectives.






I.2. Enable the first Small Modular Reactor (SMR)

Enable deployment of the nation's first commercial SMR utilizing INL expertise to support the project in overcoming technical, regulatory, operational, and first-of-a-kind constraints

Responsibility

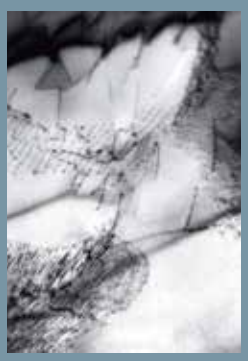
Cory McDaniel, George Griffith, Kathryn Mccarthy

Outcomes

1. Overcome the siting, manufacturing, construction, and regulatory challenges for an advanced LWR SMR, and establish a foundation for achieving the objectives of GAIN for advanced reactors looking to overcome similar hurdles.
2. Position INL as the hub for advanced reactor deployment by enabling siting of Nation's first SMR.
3. Enable deployment of other SMRs and advanced reactors in the U.S. and internationally.

2–5 Year Initiatives and Responsibility

- Address technical challenges/constraints by directing DOE assets toward R&D programs that retire commercial risk in partnership with vendors, utilities, and industry.
  - Hybrid Energy Systems (HES) modeling, testing, and demonstration for renewable integration, load following, desalination, hydrogen production, district heat, and CHP.
  - Advanced manufacturing and best engineering, digital I&C, and remote modeling.
  - LWRS lessons learned, technology forward planning.
  - Safeguards.



TECHNOLOGY

- Address regulatory challenges by prioritizing and enhancing regulatory readiness levels in collaboration with NRC and industry, and retire risk through R&D and policy support of anticipated challenges for innovative designs.
  - Emergency planning zone (EPZ).
  - Seismic modeling and simulation.
  - Broad site licensing strategy for multiple technologies.
  - Site monitoring and collection systems to support further reactor deployments at INL.
- Address operations challenges by removing barriers to siting the first SMR while establishing precedents that attract other SMRs and advanced reactors.
  - Coordinate and support other sites where appropriate.
  - Cooperate on Secure Microgrid modeling, testing, and demonstration with ORNL.
  - Multi-module control room operations licensing, demonstration, and training.
  - Share siting lessons learned and assist local issues (e.g., water rights, services, public meetings).
  - Investigate power purchase agreement options to reduce financial risk.
- Address financial barriers to enable rapid access to private partnerships and government support for first-of-a-kind SMR.
  - Financial incentives for clean, reliable, and secure power for critical infrastructure.
  - Cooperative agreements to expand U.S. SMR markets internationally.
  - LDRD, CRADA, SPP, innovative financing and cost recovery models.
  - Support technically-based policies that reduce financial risk (lease/own R&D module[s]).
  - Coordinate communications highlighting SMR advantages domestically and internationally.
  - Integration with other national laboratory SMR efforts (ORNL/TVA, PNNL/ENW, SNL, SRNL, military).

Core capabilities to deliver this critical outcome

- Advanced computer science, visualization, and data
- Chemical engineering
- Decision science and analysis
- Large-scale user facilities/advanced instrumentation
- Mechanical design and engineering
- Nuclear engineering
- Power systems and electrical engineering
- Systems engineering and integration




I.3. Implement regional innovation for clean energy systems

Accelerate the pace of innovation and deployment of clean energy technologies through strategic regional partnerships, leveraging national laboratory, private sector, and academic stakeholders and focusing on regionally relevant technology needs

Responsibility

Steven Aumeier, Michael Hagood

Outcomes

1. Enable expanded deployment of affordable clean energy technology through innovation and deployment risk reduction obtained by leveraging Laboratory, private sector, and academic capabilities.
2. Realize a step-change in the impact and efficiency of national laboratories through the development

TECHNOLOGY

and implementation of innovative regional research collaboration models that leverage national laboratory, private sector, and academic collaborations—create "the Lab of the future."

3. Expand U.S. leadership position and influence in global clean energy markets by leveraging regional clean energy technology partnerships and regional clean energy deployment for global markets.
4. Establish leadership-class regional innovation cluster that substantially enhances clean energy implementation, economic development, INL research quality and focus, and talent.

2–5 Year Initiatives and Responsibility

- Develop innovative regional partnership constructs and systems, leverage regional assets, teams, and capital to implement game-changing affordable clean energy approaches of regional relevance.
- Build strategic regional research capability. Aggregate, enhance, and employ leadership-class research capabilities targeted toward regionally relevant clean energy needs and expected energy transitions impacting power, transmission, manufacturing, and transportation.
- Enhance/build strategic Infrastructure. Develop and employ collaborative research, design, development, testing, and demonstration infrastructures using novel financing and management, and access business models to become the regional destination for systems integration, testing, and clean energy innovation.
- Build/enhance regional talent. Develop regional partnership center(s) of excellence that attract and develop world-class clean energy RDD&D talent.

Core capabilities to deliver this critical outcome

- Advanced computer science, visualization, and data
- Applied materials science and engineering
- Biological and bioprocess engineering
- Chemical and molecular science
- Chemical engineering
- Decision science and analysis
- Environmental subsurface science
- Large-scale user facilities/advanced instrumentation
- Mechanical design and engineering
- Power systems and electrical engineering
- Systems engineering and integration




I.4. Provide the nation with an enduring cyber-physical innovation capability centered on the INL

Apply INL's world-leading research, engineering, and user facilities to solve complex global security challenges in the areas of critical infrastructure, national and homeland security, nonproliferation, and intelligence




TECHNOLOGY

control systems cybercore innovation center

Responsibility

Brent Stacey, Zachary Tudor, Wayne Austad

Outcomes

1. An enduring cyber-physical innovation capability for the nation centered on the INL control systems cybercore innovation center.
2. Global transformation to cyber-informed science and engineering applied to control systems in critical infrastructure and national security systems.

2–5 Year Initiatives and Responsibility

- Create a multi-agency center. Create national partnership to holistically address automation and control systems challenge.
- Establish/develop talent pipeline. Create nationwide pipeline to attract, develop, and provide access to the nation's top-tier control systems cyber workforce.
- Reinvent/advance cyber resiliency for energy infrastructure with DOE lab partners.
- Advance national defense security solutions to cyber threats in critical infrastructure and embedded systems to become the recognized technical leader in this area.
- Holistically address research, engineering, and technical policy challenges in nuclear-cyber security, nationally and internationally, by deploying impactful solutions across the energy and materials lifecycle.

Core capabilities to deliver this critical outcome

- Advanced computer science, visualization, and data
- Applied materials science and engineering
- Condensed matter physics and materials science
- Cyber and information sciences
- Decision science and analysis
- Large-scale user facilities/advanced instrumentation
- Mechanical design and engineering
- Nuclear and radiochemistry
- Power systems and electrical engineering
- Systems engineering and integration




II. OPE

II.1. Optimize and integrate INL management systems to enable research

Simple and intuitive workflows that deliver value to users, are designed from their perspective, and seamlessly integrate all requirements

RATIONS

Responsibility

Juan Alvarez

Outcomes

1. Mature CAS system that promotes achievement of lab mission, effectively identifies and mitigates risks, and fosters a robust performance improvement culture.
2. Efficient and intuitive INL workflows, eliminating, whenever possible, the current 284 active laboratory-wide procedures. This includes elimination of non-value-added training.
3. Identification and subsequent elimination of overlapping contract requirements within DOE orders and directives and self-imposed requirements that unnecessarily impede research.

2–5 Year Initiatives and Responsibility

- Enhance CAS maturity path.
  - Align lab-level performance reporting to the lab agenda and PEMP, identify and manage enterprise risks, improve Operations Council efficiency and effectiveness, and deliver integrated assessment solutions and assurance mapping that leverages CAS data.
- Design and transition to integrated management system (next-gen management systems). Leverage MSL Forum, REB, RIT, IOPAC and Operations Council for strategic direction and priorities.
  - Streamline management systems and processes.
  - Improve access to management systems and processes.
  - Integrate and simplify requirements.

II. OPE

II.2. Build INL's future workforce by developing talent pipeline and improving employee exper

Develop talent pipeline that continuously attracts top talent to INL, grow a culture of talent development and engagement, and reward employees with innovative, cost effective, market-based compensation and benefit programs

Responsibility

Mark Holubar

Outcomes

1. Workforce requirements aligned directly to Laboratory's strategic and annual business plans.
2. Intern and post-doc experiences enriched, delivering a strong pipeline of early career STEM talent.

RATIONS

ience

3. Key strategic hires filling roles with enhanced and strengthened capabilities critical to our mission success.
4. Effective, market-based compensation, benefits, and wellness programs that enable attraction and retention of talent.
5. Future career development and growth opportunities for employees, as well as mentoring and knowledge transfer processes that properly engage all levels of employees.
6. A supportive and inclusive workplace environment with practices that enable diversity and foster inclusion.
7. Effective administration and negotiation of collective bargaining agreements that promote a positive relationship focused on Laboratory goals.

2–5 Year Initiatives and Responsibility

- Analyze and develop a comprehensive understanding of INL's talent gaps and implement gap-reduction strategies.
- Understand and address issues related to employee turnover and partner with leadership to institute actions that reduce top performer and new hire turnover.
- Implement leadership assessment centers and talent development opportunities to increase knowledge transfer and career growth.
- Implement a revised market-driven job classification system, align pay programs to improve laboratory's competitive position in the marketplace
- Adapt and implement a suite of benefits that covers a spectrum of generational differences and complies with a changing landscape of oversight and regulations.
- Improve Laboratory-wide human capital management systems in partnership with Information Management and Business Management organization.
- Mature Laboratory's ability to host international personnel and visitors.
- Expand internships, postdoctoral assignments, and joint appointments leverage current university outreach and partnerships programs, including CAES and NUC to attract talent.
- Grow and leverage current Inclusion and Diversity Councils while embedding management accountability for inclusion and diversity into performance goals.




II. OPE

II.3. Implement user-friendly systems and processes that enable rapid and responsive access to IN

Advance INL research and mission outcomes through access to relevant and timely information and effective enabling processes




R A T I O N S

L's resources and capabilities

Responsibility

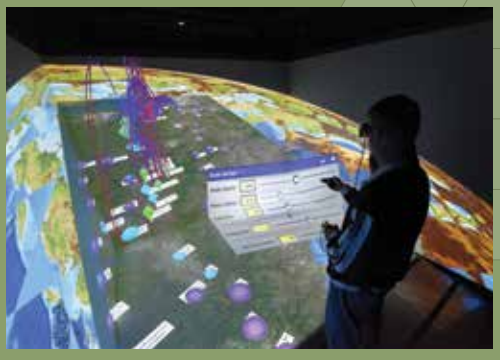
Denise L Stephens

Outcomes

1. Research outcomes achieved through the support of modern, high-performance computing and data analytics capabilities that scale to growth in mission needs.
2. Efficient and effective business decisions and mission delivery enabled by timely information, automated analytic tools, and streamlined business processes.
3. Enhanced mission communications and collaboration through advanced, reliable communication capabilities that support a dispersed workforce.
4. Enhanced workforce productivity through intuitive and seamless access to Laboratory support services.
5. Secure, reliable, and compliant access to INL's vast knowledge base and research information.

2–5 Year Initiatives and Responsibility

- Implement the next generation high-performance computing capability.
- Enhance enterprise business processes and systems—specifically, financial systems, human resource management systems, the contract/agreement system, and the business intelligence system.
- Implement a unified service management approach and common Laboratory tool for delivery of and access to commonly used support services.
- Define and implement the strategy and tactics for enabling contractual/partnering and other collaborative initiatives, including effective and rapid access to INL's capabilities and resources.
- Improve INL collaboration platforms to include mobile application, document delivery, messaging, and personal productivity tools.
- Develop secure, low cost, scalable "Platform as a Service," IT platform for rapid deployment of computing to enable R&D.
- Integrate voice and electronic messaging and notification into an efficient solution for seamless communication (unified communications).



II.4. Optimize cost management to provide more resources to mission

A cost management culture and model that enables mission performance and is valued for the R&D output delivered per dollar spent

RATIONS

Responsibility

Dennis Newby

Outcomes

1. A cost model that is competitive in the markets we serve, drives cost-conscious behavior, and aligns stewardship and resource allocation decisions to the responsible program owners.
2. A culture that fosters the importance of creating more value at lower cost.
3. A planning and decision process that is efficient, focused on enabling mission priorities, and provides insightful decision support.
4. An increased amount of indirect funds available for discretionary investments, while maintaining competitive rates, to improve and sustain the Laboratory's infrastructure, capabilities, and growth agenda.
5. An effective and efficient model for providing services to site contractors and users of the INL site.
6. A scaled approach to project management and life cycle support that delivers best value to INL's customers.

2–5 Year Initiatives and Responsibility

- Build resiliency into INL's indirect planning to weather funding perturbations and market volatility.

- Assess INL's benefit plan to provide a competitive package at the lowest cost, including defining and executing strategies to address the evolving regulatory environment (e.g., Affordable Care Act, Cadillac tax).
- Define and implement a graded approach to project management; this includes a revised federal oversight model for capital asset and other sensitive projects.
- Mature the Laboratory's indirect planning process.
- Develop and implement (for FY18 budget formulation) a revised funding and cost model for R&D infrastructure, capability, and other "mission-ready" costs.
- Improve site contractor management.




II.5. Revitalize security and enabling infrastructure






Provide safe, secure, sustainable, and efficient facilities and end-to-end infrastructure that meet the mission needs while supporting our goals to consolidate and revitalize our campuses

Responsibility

Carlo D. Melbihess, Thomas J. Middleton, Ronald Crone, Sean O'Kelly, Ron Novich, Denise Stephens



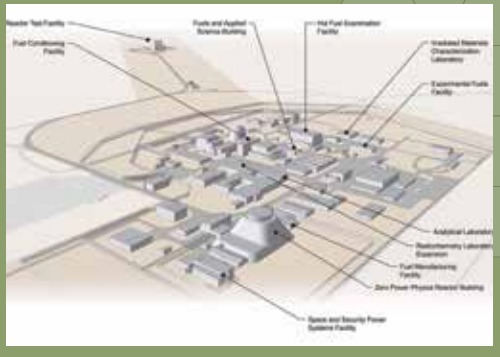

R A T I O N S

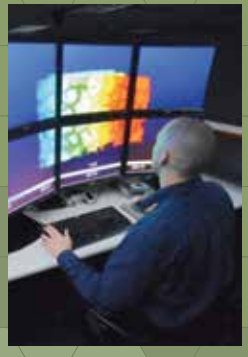
Outcomes

1. INL facilities, infrastructure, and capabilities are leveraged and right-sized to meet the nation's nuclear, clean energy, and cyber innovation research and development needs.
2. INL facilities and infrastructure are operated and maintained safely, reliably, and securely within approved facility budgets to support R&D missions while providing a work environment that protects workers and the environment.
3. Enabling infrastructure and systems (e.g., roads, roofs, power, sewer, fleet, communications, IT, and security systems) are sustained and renewed to enable mission readiness and reliability.
4. Master campus design is optimized and enhances capability to support R&D outcomes.
5. INL is recognized as a leader in implementing sustainable practices that meet or exceed our commitment to conservation and the protection of the environment.

2–5 Year Initiatives and Responsibility

- Leverage existing while establishing new capabilities. Utilize and develop capabilities necessary to fully achieve priority and other mission objectives.
- Sustain key campus capabilities:
  - Revive and improve historical MFC capabilities that support demonstration-scale activities.
  - Continue to update life-cycle security infrastructure and technology based on the INL's Site Security Plan.
  - Address deferred maintenance, repair needs, and aging facilities through phased activities to improve plant reliability, achieve predictable annual operation, and reduce operational risk.
  - Consolidate and renovate vacated space for the betterment and enabling of our staff to advance the INL's vision and mission.
  - Address circulation, transportation, and pedestrian pathways and gateways by developing a wayfinding strategy.
  - Reconfigure existing parking lots to gain capacity, enhance efficiencies in bus transportation, and develop new parking lots to meet growth and sustainability needs.
  - Emphasize environmentally sustainable practices in campus operations and processes.
  - Continue to promote and leverage internal and external partnerships for the betterment of the campuses and the community we serve.
- Optimize space and land use decisions. Strategically target space and land resources for development and meet growth needs, while maintaining a focus on nuclear energy research first.
- Improve computing infrastructure. Upgrade communications infrastructure to increase IT functionality across the Laboratory.
- Promote site sustainability. Take action to maximize energy and water efficiency; minimize chemical toxicity and harmful environmental releases, promote renewable and other clean energy development; and conserve natural resources.





II.6. Continuously improve safety and operations culture

Perform lab operations in a reliable and effective manner to protect the environment and ensure the safety and health of our staff, our visitors, and the public

R A T I O N S

Responsibility

Carolyn S Mascareñas, Carlo D Melbihess

Outcomes

1. Efficient and effective implementation of operations through a culture that values safety, health, quality, security and environmental management requirements.
2. Embedded organizational values, adjusting to change as well as driving collective purpose and giving employees a sense of purpose to give their best performance.

2–5 Year Initiatives and Responsibility

- Incorporate consistent safety culture principles, behaviors (Safe Conduct of Research), and use of human performance tools.
- Continue use of culture survey and collaboration with HR to improve overall Laboratory culture.
  - Individual organization focus.
  - Build laboratory level safety culture. This will be based on FY17 survey and validation by existing employee forums.
- Re-evaluate programs to be flexible to individual organization needs (maintain core elements vs. one size fits all).
- Enhance the dialog: regulator vs. owner.

III. STAKHOLDER ENGAGEM

III.1. Communicate INL's mission and priorities to Idaho and region to broaden understanding of o

Enable discovery in energy and security by cultivating positive and enduring partnerships with researchers, academia, industry, national laboratories, and community

ENT & COMMUNITY SERVICE

utcomes and impacts

Responsibility

Amy Lientz

Outcomes

1. Increased collaboration between the State of Idaho, CAES, and INL, as well as increased public and government awareness of INL/CAES capabilities.
2. Reinvigoration of the Governor's Leadership In Nuclear Energy (LINE) Commission to address growing focus on nuclear energy research and development and our overall clean energy mission as a result of climate concerns.
3. Expanded outreach and relationships with government officials and community leaders in neighboring states.
4. Expanded connections with Idaho industry, universities and colleges, and leaders in regards to talent pipeline, research collaboration, and strengthened rural connections in and around the state as it relates to tech-based economic development.
5. Engaged Idaho businesses and small businesses that enable Laboratory mission.

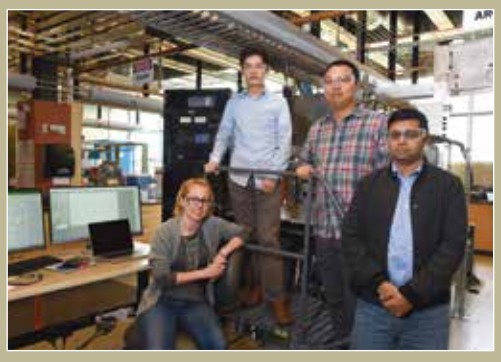
2–5 Year Initiatives and Responsibility

- Expand the INL Boise office to increase partnership breadth and depth and increase connections to talent and research opportunities.
- Increase positive engagement with Attorney General and staff and past Idaho Governors.

Grow and enhance our relationships with the government leadership of regional states.

- Reinvigorate the LINE Commission to bring focus and impact.
- Maintain and expand State's interest and investment in CAES and other programs.
- Revise key outreach programs, such as tours, events, and STEM outreach to be strategic to INL needs and available resources.
- Partner with trade associations, business development organizations, and similar organizations to target and identify Idaho businesses (including small businesses).
- Develop an INL program to reach rural Idaho communities to share INL capabilities and resources in support of STEM, economic development, and talent pipeline needs, while leveraging the Laboratory's participation in the Idaho Rural Partnership.

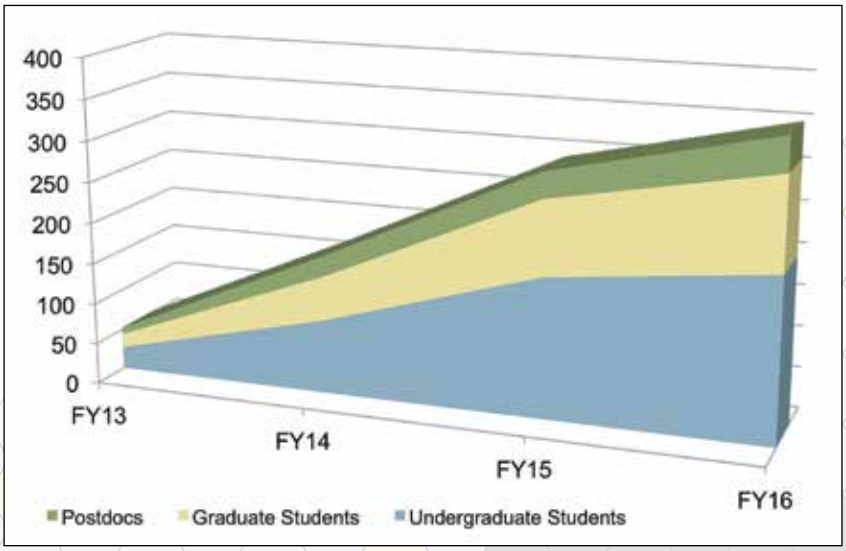
III.2. Strengthen academic partnerships



ENT & COMMUNITY SERVICE

Responsibility

Amy Lientz



Outcomes

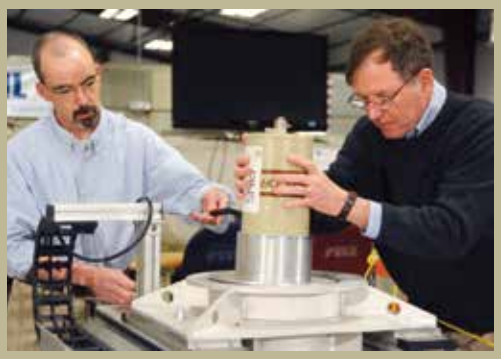
1. Greater awareness, interest, and engagement of students (especially those from rural, under-represented communities) in STEM career opportunities linked to INL needs.
2. Enhanced capacity and knowledge of STEM content for teachers, as well as capability of fostering student knowledge, skills, and career pathways.
3. Increased collaborative partnerships with Idaho K-12 entities, universities, technical colleges, businesses, and community-based organizations.
4. Targeted relationship between National University Consortium (NUC) and INL mission needs in research and in future talent.
5. Enhanced capacity to educate students with the skills and degrees needed to support growing needs in nuclear engineering, energy research, and cyber security.

2–5 Year Initiatives and Responsibility

- Successfully manage the transition of the Idaho Science Technology Engineering and Math (iSTEM) Professional Development outreach and summer institutes to a model for enhancing awareness of INL career pathways in STEM with emphasis on Idaho rural communities.
- Build on existing relationships with Idaho universities, NUC partners, and other strategic institutions to build research capacity tied specifically to INL needs through joint appointments, internships, and postdocs.
- Invest in STEM programs, tools, and outreach to allow INL capability to be more accessible to Idaho teachers and students by leveraging other STEM outreach initiatives.
- Provide students the opportunity to solve real-world problems and develop skills unique to INL's talent pipeline needs.




III.3. Foster entrepreneurial culture and effective partnerships translating research to innovation



ENT & COMMUNITY SERVICE

Responsibility

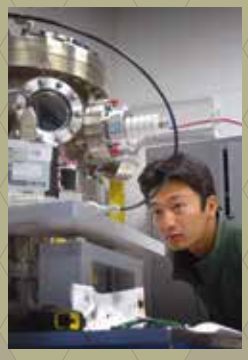
Amy Lientz

Outcomes

1. Increased industry, university, government and other DOE laboratory R&D partnerships.
2. Improved access and transparency of INL (and DOE) partnership, agreement, and deployment processes and opportunities.
3. Standardized terms and conditions for the State of Idaho to streamline partnership agreement negotiations.
4. INL is recognized as an asset for Small Business Technology Transfer (STTR), Small Business Innovation Research (SBIR), and Technical Assistance Program support for industry.

2–5 Year Initiatives and Responsibility

- Review and define State of Idaho agreement requirements to generate standardized terms and conditions.
- Participate in key industry organizations to expand partnerships and networks, and develop outreach efforts to broaden entrepreneurial business training in Idaho that connects to INL needs.
- Leverage a growing INL presence in Boise, to bring more collaboration between INL and its partners.
- Build relationships with the Technology Transfer Office (TTO), Small Business Technology Transfer (STTR) office, and Small Business Innovation Research (SBIR) office, and share capabilities and resources to grow industry connections.
- Create a research collaboration database to facilitate opportunities and generate resources needed to support mission objectives.
- Develop communication tools and training for external audiences on INL partnering and collaboration agreement mechanisms and programs.



INL's core capabilities lay the foundation for mission outcomes

Mission Outcomes

- Develop, innovate, secure, and demonstrate nuclear energy technologies
- Provide national security solutions and protect critical infrastructure
- Provide at-scale clean energy systems integration and demonstration and complementary environmental solutions

Leadership Position

- Nation's premier nuclear science and technology laboratory
- World-class and unique RD&D facilities in nuclear energy, security, and clean energy deployment
- Physical and cyber-based protection of critical infrastructure and integrated energy systems – Securing and modernizing critical infrastructure
- Leadership in clean energy engineering, performance validation, at-scale systems integration and demonstration

INL Core Capabilities

Advanced Computer Science, Visualization, and Data	Environmental Subsurface Science
Applied Materials Science & Engineering	Large-Scale User Facilities/Advanced Instrumentation
Biological and Bioprocess Engineering	Mechanical Design and Engineering
Chemical and Molecular Science**	Nuclear and Radio Chemistry
Chemical Engineering	Nuclear Engineering
Condensed Matter Physics and Materials Science**	Power Systems and Electrical Engineering
Cyber and Information Sciences	Systems Engineering and Integration
Decision Science and Analysis	

** Emerging core capability for INL

Advanced computer science, visualization, and data

This capability is centered on the Multiphysics Object Oriented Simulation Environment (MOOSE), an open source, HPC-based simulation framework, to rapidly create applications for nuclear energy, materials, structural dynamics, multiphase flow, waste management, and geophysics. National and international labs and universities have developed over 40 MOOSE-based applications. These extend our understanding beyond the limitations of experiments.

APABILITIES

Applied materials science and engineering

This is integrated set of capabilities that supports study of nuclear fuels and materials across the continuum, from nano-scale through proof-of-concept to actual proof-of-performance. INL's strategic intent is to decode response mechanisms—a coupled testing and characterization approach to decipher and predict property evolution over time in a corrosion environment and to enable intelligent design of alloys to enhance nuclear fuels.

Biological and bioprocess engineering

This capability spans bench-top analysis through scale-up and integration to address challenges in biomass preprocessing solutions, logistics, feedstock supply/specification, supply chain development, and demonstration challenges. INL focuses on providing (1) technical expertise and experience to DOE and industry with scale-up and startup of commercial biorefining technologies and facilities and (2) a basis for U.S. biomass standards.

Chemical and molecular science (emerging)

INL has expertise in understanding, predicting, and controlling physical and chemical transformations, and has a robust knowledge of chemical separations, electrochemical separation, separations science, membrane science, radiochemistry, actinide chemistry, catalysis, and trace analytical measurement. INL's focus is to sustain the U.S. supply of critical material, save energy for resource-intense processes, understand catalytic processes at the intersection of complex materials and reaction mechanisms, increase U.S. industrial competitiveness, and create skilled jobs.

Chemical engineering

These achievements are related to nuclear fuel separations, radioactive waste treatment, chemical transformation of energy-intensive industrial processes, catalysis, securing supplies of critical energy materials, and the shift to clean transportation. Applied chemical engineering research at INL bridges a range of scales, from molecular studies to large scale process and system design, and seeks to discover and develop unique chemical-based solutions for complex energy and national security problems. INL maintains a large number of laboratories and process development facilities dedicated to generating these innovative solutions. INL's strategic intent is integrated flowsheet demonstration—joint fuel cycle study, flowsheet modeling, and advanced rare earth metals industry production and recycling.

Condensed matter physics and materials science (emerging)

Research includes modeling and measurement of transport and mechanical properties of nuclear fuels. INL has a state-of-the-art facility for characterization of irradiated fuels and advanced in-pile instrumentation for characterization of materials far removed from equilibrium. INL's strategic intent is to connect the science of defects and thermal transportation in nuclear materials, understand mechanisms controlling mechanical properties in extreme environments, model defect formation/clustering and elemental redistribution, and provide the nuclear community with access to world-class characterization capabilities at INL.

Cyber and information sciences

INL focuses on building economic security through secure, resilient critical infrastructure, advancing nuclear energy security, and providing national security solutions for military, intelligence, and first responders. INL's strategic intent is to secure the nation's critical infrastructure, respond to threats, defeat malware, re-engineer for cyber through advancements in cyber-physical science and cyber-informed engineering, and prevent strategic surprise through threat prediction.

Decision science and analysis

The focus is on deriving knowledge from measured, modeled data sets to further the understanding of resource and technology options, to identify and quantify the risks and impacts of current and emerging technologies, and to assess the impact of market dynamics, human behavior, regulations, policies, and institutional practices on their decisions. INL provides credible, objective information to assist DOE and others with strategic planning and program direction, policy formulation and implementation, and efforts to remove market barriers to deployment and improve stakeholder engagement. INL's strategic intent is to build advanced control systems for operating NGNP, develop regulatory framework for advanced reactors, and provide decision makers, policy makers, and regulators with risk-informed options for viable technical, economic, environmental, and financial concerns.

Environmental subsurface science

INL's environmental subsurface science research is focused primarily on developing a predictive understanding of: (1) the fate and transport of metal and radionuclide contaminants under natural and far-from-equilibrium conditions and (2) the geomechanical responses of the subsurface to energy resource extraction and waste storage. The strategic intent is remediation of radionuclide contamination, geothermal energy production, geological storage of nuclear waste, and combined recovery of unconventional fossil fuels from and CO_2 sequestration in nanoporous shale.

Large scale user facilities/advanced instrumentation

Capabilities in nuclear and clean energy and security RDD&D available at INL enable pilot-, engineering-, and prototype-scale testing under normal and abnormal conditions for advancing energy and security technologies. The strategic intent is to integrate these facilities and capabilities across the nation to create an R&D testbed and demonstration platform where university, industry, and government users enable rapid design, development, and commercialization of clean energy and security solutions.

Mechanical design and engineering

INL's capabilities are used for nuclear system design, other energy and industrial processes, and development of technologies for evaluation of materials behavior in support of national defense programs. The strategic intent is to advance composite materials engineering and manufacturing, advance nuclear fuels and materials, and develop solutions for the military.

Nuclear and radiochemistry

INL has deep expertise in the unique chemistry and analysis of radioactive decay and transmutation of chemical and material behavior in applications such as energy production, waste management, and nuclear nonproliferation. The key strategic intent is to develop a scientific basis for separation processes, thermodynamics, kinetics, and the effects of radiation on process chemistry, and to develop and demonstrate industry-relevant separation for fuel cycles based on used nuclear fuel.

APABILITIES

Nuclear engineering

INL's capability spans multiple disciplines required to analyze, design, test, demonstrate, deploy, and operate nuclear systems. INL has capabilities in neutronics, thermal hydraulics, safety, structural design analyses for small- and large-scale experiments, and mechanistic and probabilistic safety analyses, as well as development of nuclear-grade instrumentation, control systems, and destructive and non-destructive detection and safeguards technologies. The strategic intent is to advance nuclear systems design, analysis, and operation, build unique nuclear energy technologies and systems, reduce nuclear threat, and develop radioisotope power systems for space and military use.

Power systems and electrical engineering

This supports clean energy system design, analysis, and integration; state awareness diagnostics, prognostics, and control data analysis; process system state analysis; mitigation of natural and man-made hazards; electrical/economic modeling analysis; and performance design requirements development. The strategic intent is to establish anticipatory cyber state control systems and optimize integration of renewable and hybrid energy systems through grid integration of electricity, address issues in variable power generation, improve energy storage, and enhance security.

Systems engineering and integration

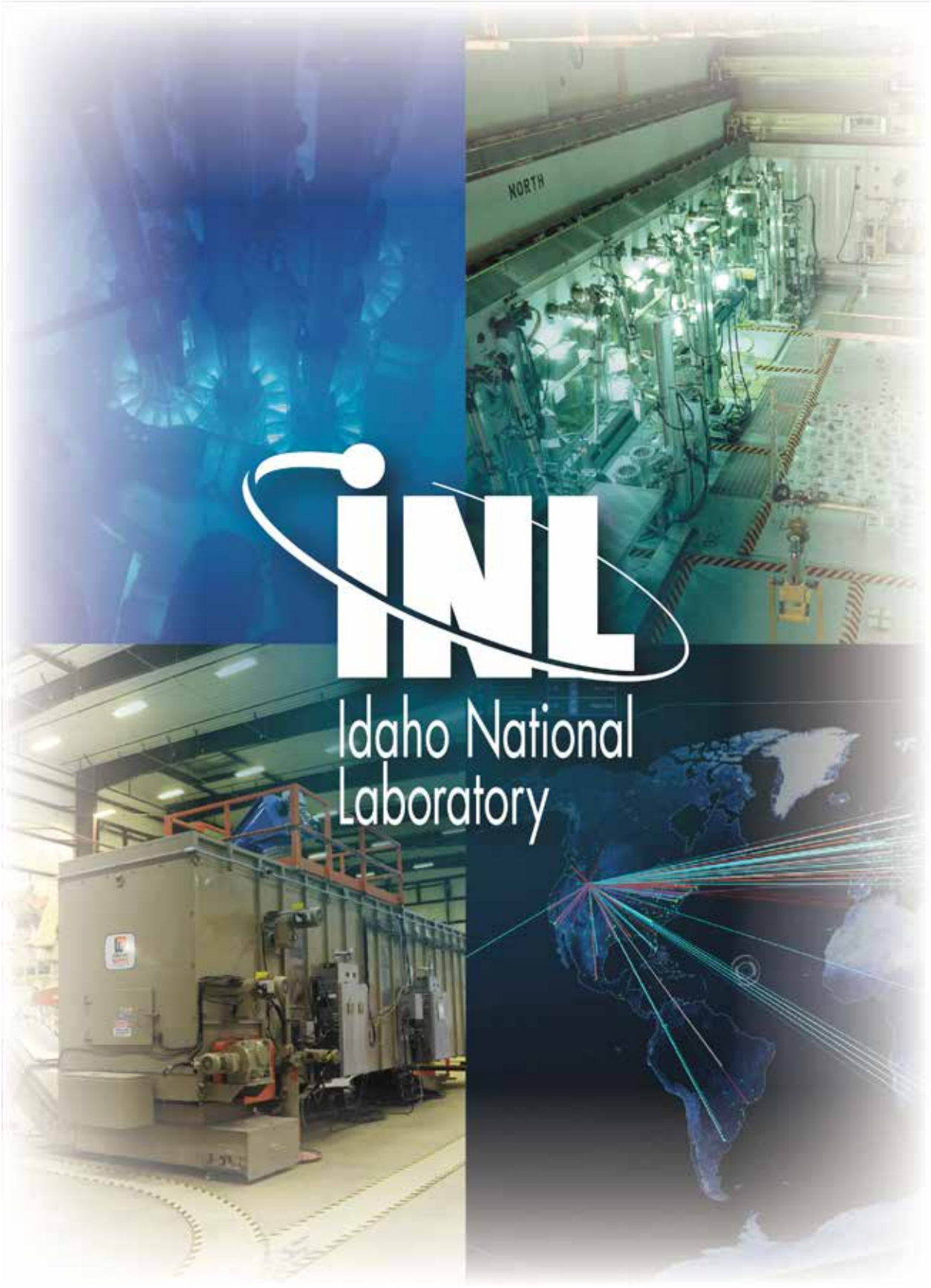
Holistically address problems/challenges in energy and security to enable optimal solutions. These capabilities support design and fabrication activities, experiment design and development, instrumentation controls, data analyses, and quality assurance. The strategic intent is integration and optimization of HES, biomass feedstock, and advanced transportation systems operations.

In closing

As the nation's leading nuclear energy research, development, and demonstration laboratory, Idaho National Laboratory has an important mission and a grand vision to change the world's energy future and secure our critical infrastructure. The lab agenda identifies our critical outcomes, strategic initiatives, near-term R&D, and mission support activities necessary to deliver our grand vision. INL's lab agenda was developed through a rigorous planning process and input from many. I applaud our scientific community, industrial stakeholders, science advisors, and the visionary leadership of the staff at INL for their contributions and valuable input leading to the development of our lab agenda. I am honored and pleased to submit - The INL Laboratory Agenda for 2017–2021.

Dr Kelly Beierschmitt,
Deputy Director for Science and Technology

16-GA50310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