

# GAIN

*Gateway for Accelerated  
Innovation in Nuclear*

## Update

Dr. Rita Baranwal

Director, GAIN

October 4, 2016

Molten Salt Reactor Workshop, Oak Ridge, Tennessee



# GAIN Initiative: Simultaneous Achievement of Three Strategic Goals

- **GAIN** is based on the following premise:
  - National and global demand for nuclear energy is increasing and U.S. global leadership is eroding
  - There is a sense of urgency with respect to the deployment of the innovative nuclear energy technologies
  - An effective public-private partnership is required to achieve the goals
- Achievement of **GAIN's Strategic Goals** will bridge the gap between technology leadership and industrial leadership, and combined with optimized domestic deployment, will enable rapid, cost-effective development of innovative nuclear energy technologies towards market readiness



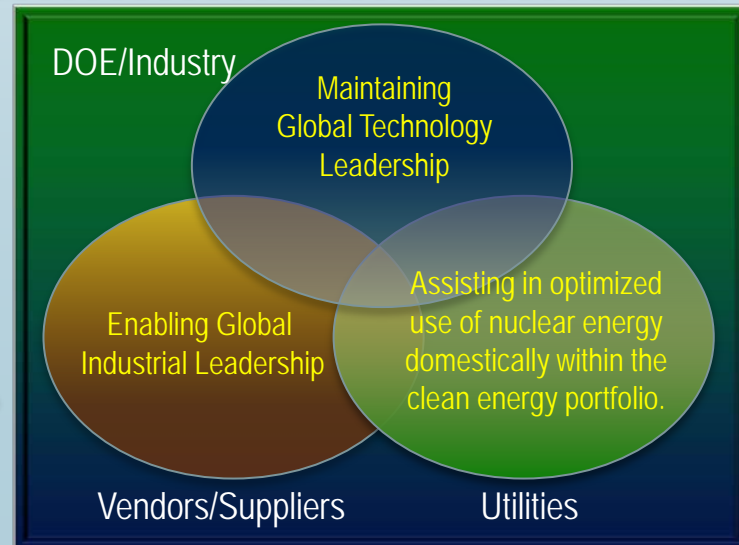
# GAIN Explores New Model For Faster and More Cost-Effective Innovation Cycle for Nuclear Energy

## OLD: SEQUENTIAL PROGRESSION FOR INNOVATION

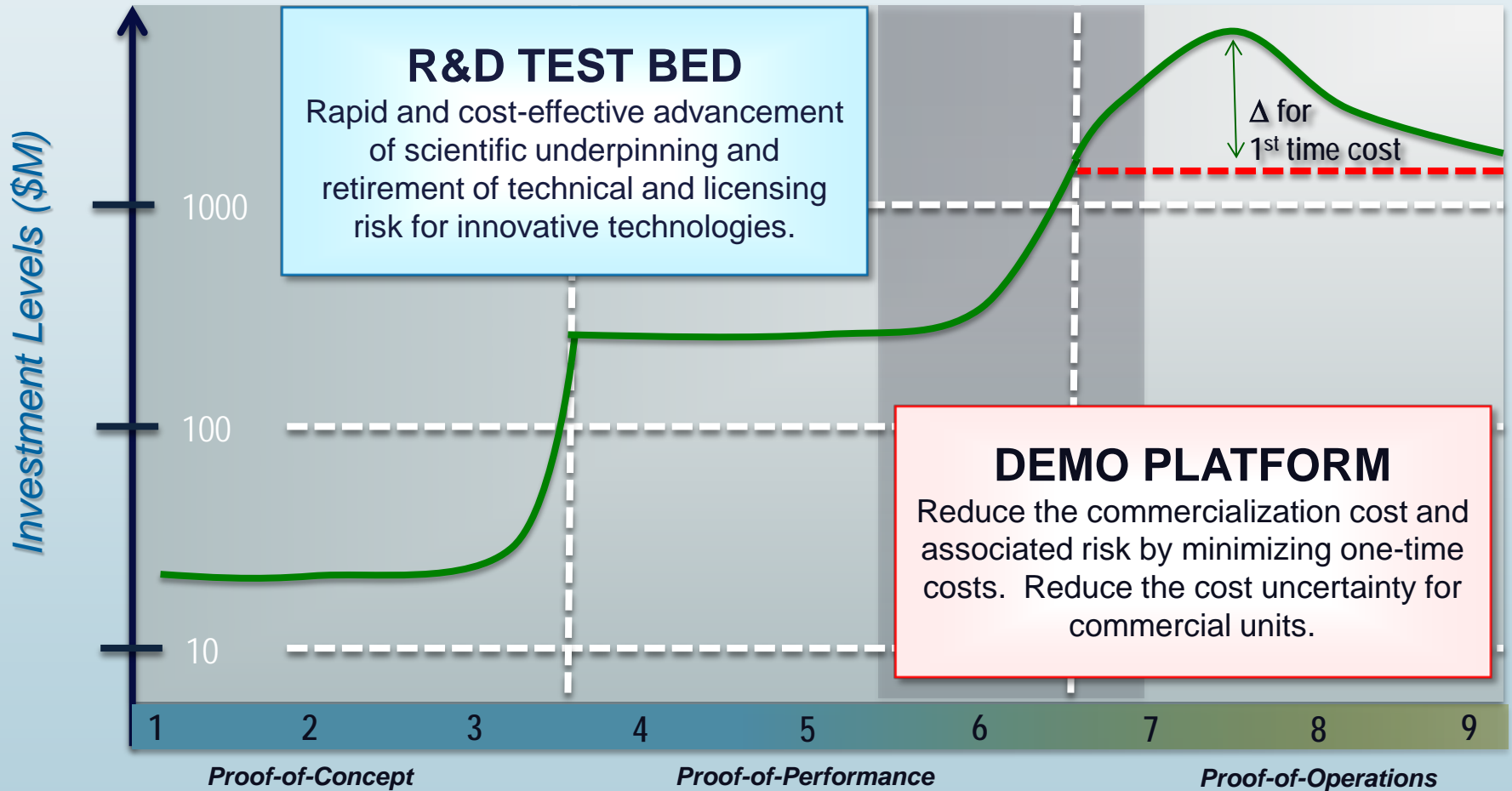


*For complex technologies such as nuclear energy, the sequential model becomes less effective when federal funding is limited and the technology maturation cycle is long.*

## NEW: INTEGRATED PROGRESSION FOR INNOVATION TO ACHIEVE STRATEGIC GOALS SIMULTANEOUSLY

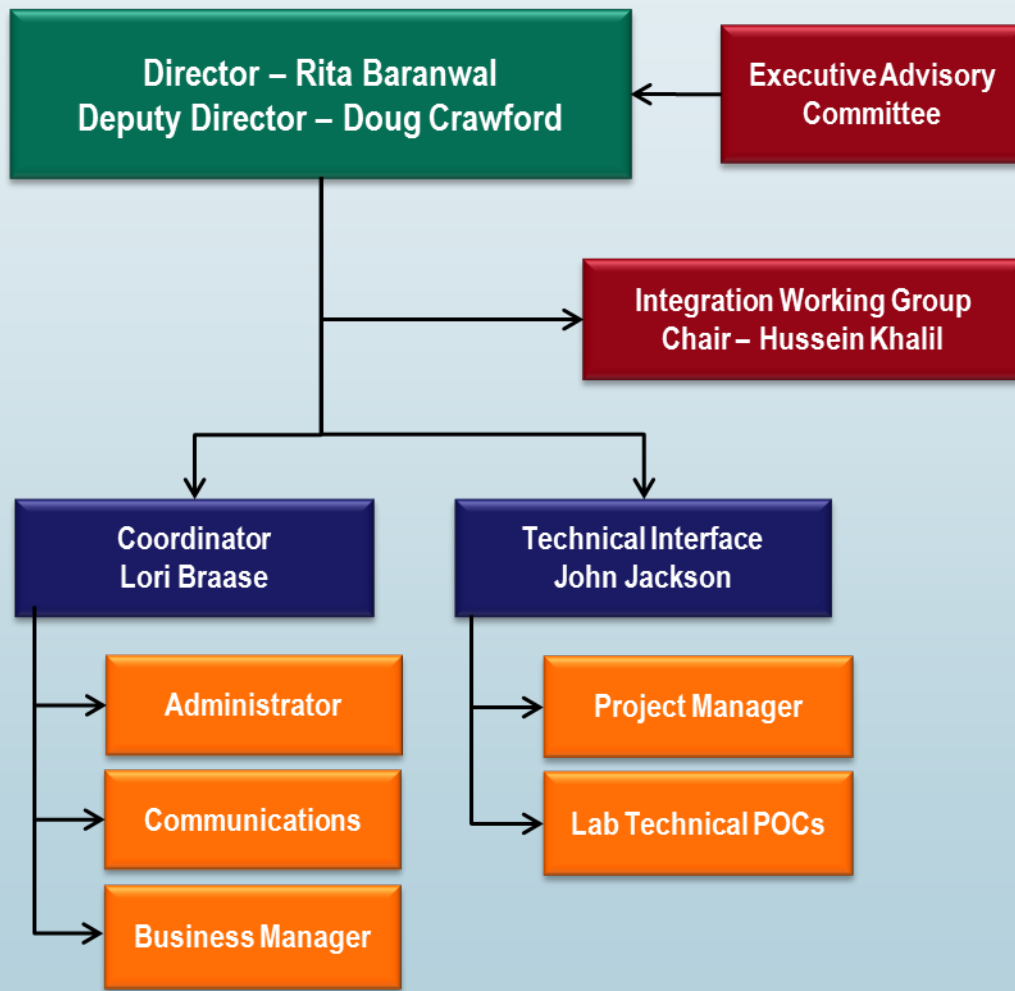


# GAIN: Crossing “Valleys of Death” rapidly & cost-effectively



\*Refers to the concept of incremental reduction in licensing risk. The definition needs to recognize that technology development precedes licensing development.

# GAIN ORGANIZATION



Neil Wilmshurst, EPRI – Chair  
Dale Klein, University of Texas  
Maria Korsnick, NEI  
Steve Kuzinski, SNC  
Peter Littlewood, ANL  
Thom Mason, ORNL  
Chris Mowry, NIA  
Mark Peters, INL  
Ray Rothrock

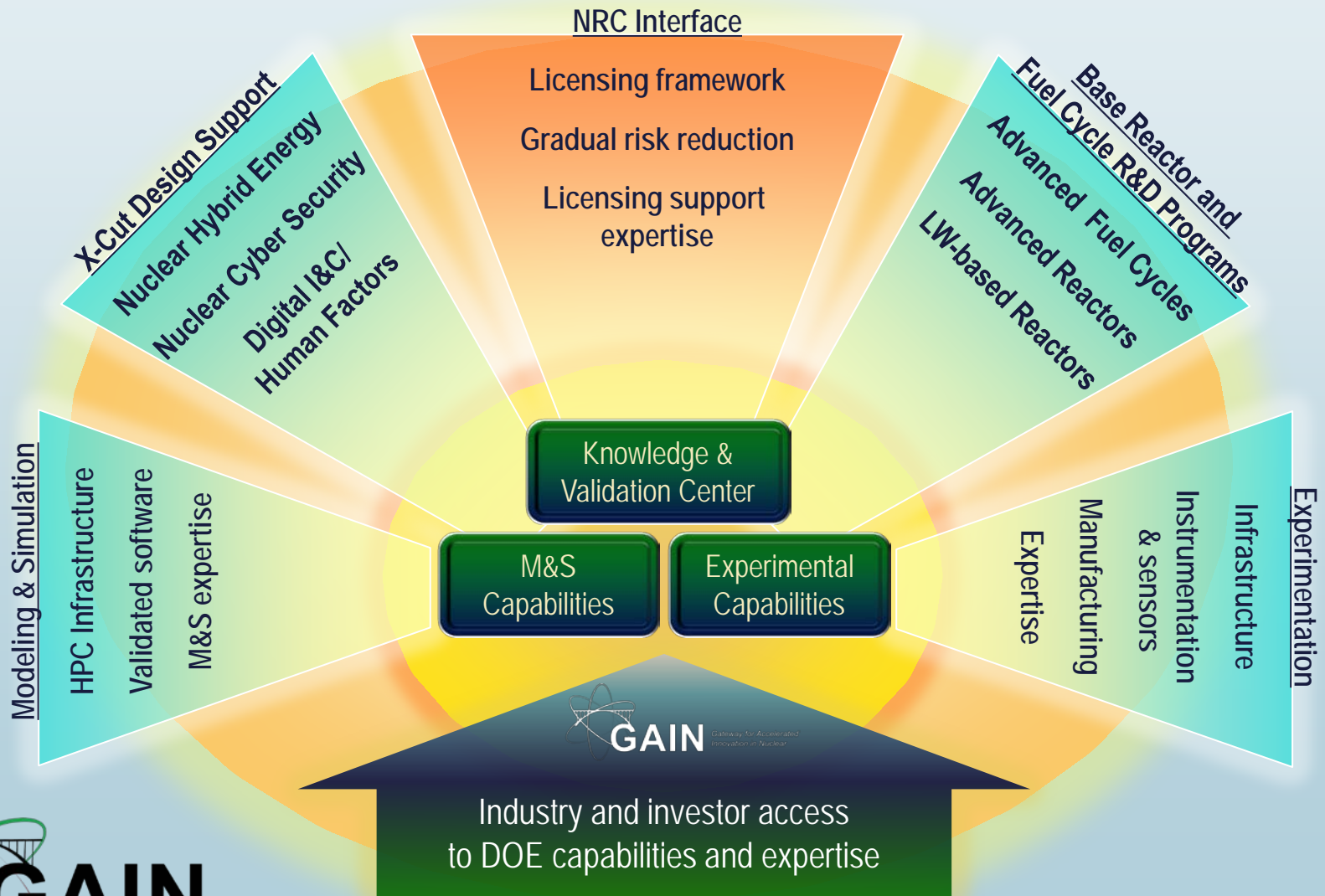
*Expert oversight of GAIN execution strategy and high-level documents/deliverables.*



Idaho National Laboratory

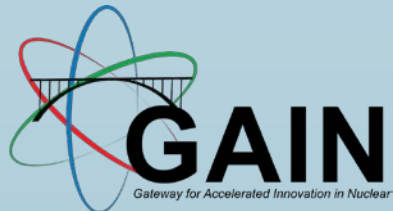


# GAIN: Organizing Principle for DOE-NE RD&D Programs Through Comprehensive Systems Analysis



# Activities to Date

- **GAIN Operations**
  - Established small, agile organization
  - Issued GAIN Execution Plan
  - Issued Draft GAIN Communication Plan, Revision 0
  - Implemented Standard CRADAs/TAPAs for NE vouchers
- **GAIN Outreach**
  - Presented GAIN to multiple conferences/meetings to solicit input from stakeholders
  - Organized 3 Technology Specific Workshops (with NEI and EPRI) to solicit input on private-sector R&D needs for DOE-NE R&D program
  - Sponsored: DOE Summit Improving the Economics of America's Nuclear Power Plants (May 19, 2016) and DOE-NRC Workshop on Advanced Non-Light Water Reactors (June 7-8, 2016)
- **GAIN Support of Private Sector**
  - Awarded \$2M USD to developers in pilot NE Voucher Program
  - Initiated industry-led, laboratory-supported expert group for advanced reactor licensing framework development
  - Submitted FY 2018-2022 DOE-NE RD&D funding request consistent with GAIN strategic goals



# Technology-Specific Workshops

- Hosted by GAIN, NEI, and EPRI
- Discussed RD&D needs of advanced nuclear energy technologies
- Identified technical issues that DOE is uniquely suited to address

<b><i>Molten Salt Reactor Technology Workshop July 11-12, 2016 EPRI Offices</i></b>	<b><i>High Temp Gas Reactor Technology Workshop July 14, 2016 NEI Offices</i></b>	<b><i>Fast Reactor Technology Workshop July 21-22, 2016 NEI Offices</i></b>
<b>Elysium Industries Flibe Energy Southern Co. Southern Co. / TerraPower LLC Terrestrial Energy USA Transatomic</b>	<b>AREVA General Atomics X-Energy</b>	<b>Advanced Reactor Concepts General Atomics General Electric-Hitachi Oklo Westinghouse</b>



# Technology-Specific Workshops: Industry Provided Concept Information and RD&D Needs

- General concept overview
- Technology commercialization strategy; demonstration reactor vs. pilot scale vs. first-of-a-kind
- Schedule constraints and critical path items
- RD&D needs; generic and not necessarily design-specific (e.g. modeling & simulation, test loops)
- Infrastructure gaps; major missing infrastructure that requires substantial investment and time
- Licensing support, e.g. safety analysis tools and licensing strategies
- Recommendations on contracting and collaboration mechanisms with DOE

# Technology-Specific Workshop Outcomes: Collaboration

- **Formation of two Industry-Led Technology Working Groups (TWG)**
  - Initial meetings held in September 2016
  - Molten Salt Reactor
  - Fast Reactor
- **Roles & Responsibilities**
  - EPRI: engage with subject matter experts and stakeholders
    - Define gaps in M&S code development and V&V for design and licensing for all three advanced reactor technologies
  - NEI: facilitate and coordinate activities of TWGs with those of NEI Advanced Reactor Working Group (ARWG)
    - Coordinate with GAIN and EPRI to support working groups
    - Work with industry, DOE, and NRC to understand issues associated with obtaining 5% < enriched uranium < 20%

# Technology-Specific Workshops: High-Priority Recommendations to DOE on Cross-cutting RD&D

- **Access to Applied Technology (AT) documents**
  - Create database of AT-marked documents
  - Streamline access to AT documents, removing AT designation where appropriate
- **M&S Code Development and V&V for Design & Licensing**
  - Describe DOE-NE's advanced M&S tools
  - Develop plans for additional code development to address gaps
  - Develop joint strategy with stakeholders for V&V of advanced tools, including cross-cutting and design specific issues
  - Develop joint strategy with NRC for V&V and usage of advanced tools for licensing analyses
- **Advanced Reactors Licensing Framework**
  - Accelerate joint work with NRC for advanced reactor licensing
    - General design criteria
    - Gradual reduction of licensing risk
    - Risk-informed and performance-based licensing strategy

# Technology-Specific Workshops: High- Priority Recommendations to DOE on Design-Specific Technology

- **Molten Salt Reactor Technology**
  - Perform feasibility assessment for megawatt scale, molten-salt fueled critical system to be tested at DOE site
  - Identify alternatives to critical-system demonstration for meeting all identified data needs using different and simpler options
- **Fast Reactor Technology**
  - Complete options and requirements assessment for domestic fast spectrum test reactor
  - If need and feasibility are validated, complete mission need
- **High Temperature Gas Reactor Technology**
  - Complete on-going TRISO fuel and graphite qualification program

# Future Activities

- **Identify/develop Streamlined Contracting Process**
  - Streamline and tailor DOE contracting mechanisms to meet GAIN's goals
  - Conduct lessons learned meeting on NE Voucher Program (October 18, 2016)
  - Identify candidate project and participants for multi-party CRADA (contracting pilot)
- **Second NE Voucher call (~March, 2017)**
  - Pending DOE approval and Congressional funding and authorization
- **Conduct Feasibility Study for Molten Salt Engineering Facility**
- **Complete study of Fast-Spectrum Test Reactor requirements and options**
- **Develop database of historical advanced-reactor documents to support knowledge transfer; facilitate access to key documents**
- **Identify opportunities for GAIN priorities within DOE-NE R&D program**
  - Prioritize R&D to be impactful to the market

# Summary

- GAIN is underway to fulfilling a 3-way partnership
- GAIN is being implemented as the organizing principle for relevant DOE programs
  - Technology-Specific Workshops provided critical input towards aligning NE-funded base programs towards industry/investors' needs
  - \$2M USD NE Voucher Awards provided initial new access to national laboratory expertise
- Future efforts intend to improve GAIN effectiveness and impact

