

INTEGRATION OF RESEARCH & DEVELOPMENT AND OPERATIONS ACTIVITIES AT THE IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

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ABSTRACT

This paper highlights the form and function of the Idaho National Engineering and Environmental Laboratory as it meets the challenge of integrating its research and development activities with its operational capabilities. It observes how operational needs can be defined, budget gaps overcome, protection of health and environment enhanced, and how collaborations speed delivery of technologies. A description of how to increase communication and awareness among employees to align technological innovations with operational challenges is addressed. The primary benefits of integration in reducing costs, risks and delays, and accelerating schedule and increasing performance are explored.

INTRODUCTION

There was a time during the early days of Idaho's national laboratory, that enthusiastic and hopeful scientists and engineers were called on to explore and solve one of the world's greatest challenges--splitting the atom for the peaceful purpose of generating electricity. In a few short years, the trials of these adventurous nuclear pioneers paid off when their work culminated in the generation of electricity--enough to light a town.

During the intervening years, 52 nuclear reactors were designed, constructed, tested and operated at what is now known as the Idaho National Engineering and Environmental Laboratory. The variety of reactor designs built and operating test scenarios conducted at the INEEL turned this little-known national laboratory into the world's leader for reactor design, operation and safety training.

Over time, new missions were given to the Laboratory and programs with separate managing and operating contractors were created. Each mission and specialized program was essentially self-contained and had little reason to coordinate with others to accomplish its unique tasks. The independent nature of these missions and programs at the Laboratory persisted for decades. There are instances where services and functions were duplicated in various projects, but because of the secretive nature of some missions, cross-communication and resource sharing didn't occur.

The Point

So what's the point? The point is--times have changed. Today there is an emphatic need to open communications across the Laboratory's major programs by integrating scientific, engineering, and operations teams. Team interactions are crucial to finish the cleanup work. It's clear that the future of DOE's lead Environmental Management Laboratory--a role assigned to the INEEL--

will be questioned if the INEEL fails to resolve significant environmental dilemmas in its own backyard.

WHAT "INTEGRATION" MEANS

The literal definition of integration is "the act or process of bringing all parts together to make a whole--to unify all." There really is no mystery associated with integration. It's just very challenging to put together a puzzle when individual pieces appear not to fit.

One word describes integration pretty well-- "teamwork". The underlying theme is to get individuals who work together to talk with one another about using their respective skills to complete essential work. It means discussing problems with team members and other reliable resources to complete what they set out to do. In a broad sense, integration at the INEEL means:

"The art and science of bringing operational know-how and research and development capabilities together to solve the INEEL's most difficult environmental and operational challenges."

The result of good integration efforts is the delivery of environmental responses that achieve technical accuracy, protect workers and the public, and safeguard the environment; and comply with regulations and meet milestones on time or ahead of schedule while working within set budgets.

Integrating work activities has a short- and long-term focus. Integration in the short-term means employees identify barriers to completing their tasks on a day-by-day or month-to-month basis by solving problems in a direct manner using the simplest technology available. To achieve short-term integration in a seamless manner, all workers in every branch of the INEEL need to communicate and coordinate ideas that may or resolve technical challenges they encounter on the job or in planning the next year's workscope.

Integration in the long-term consists of two types. First, there is the year-to-year cycle of identifying the larger and more complex challenges that may keep programs from meeting schedules, budgets, and required milestones. Second, there are grand challenges related to the long-term stewardship of managing the Laboratory decades into the future once missions end and environmental monitoring and surveillance begin. These situations call for anticipating problems ahead of time, in some cases years in advance, and requesting technological assistance to meet challenges posed by foreseeable problems or new opportunities.

WHY IS INTEGRATION IMPORTANT?

It's simple. There's not enough money. In order to complete successful projects today, all affected parties need to cooperate in sharing information, resources and collaborative efforts to streamline the search for technologies, that in fact, make work safer, easier, faster, and less expensive. The innovations are available. They just have to be located, understood, and matched with onsite needs environmental managers identify.

For the foreseeable future the INEEL will experience a flat funding profile. Cost estimates for compliance-related work show a funding gap of \$861 million between fiscal years 2001 and 2006. This gap represents a monumental challenge and will require the continuous application of innovative methods and technologies to replace today's state-of-the-art operation and management practices. The grand challenge is to achieve better results with fewer dollars.

Integration intensifies efforts to develop actions and solutions that change project baselines by decreasing programmatic risk, reducing costs and schedule delays. Bringing in technologies with superior reliability and performance reduces programmatic risk. This in turn prevents schedule delays, and lowers overall costs.

INEEL POLICY

Integration is being institutionalized at the INEEL with its framework spelled out in company policy. The policy explains INEEL's goal and commitment to effectively integrate research and development with site operational activities. Specifically, the form and function of the major programs responsible for cleanup, research, technology development, and project management are described and encouraged. The Policy's bottom line is to formally acknowledge resource integration as the way to conduct business at the INEEL.

Integration goals include performing cleanup activities in a technically defensible manner; focusing environmental research in support of cleanup objectives and regulatory compliance; and, actively pursuing the development and deployment of technologies and innovative solutions as a part of problem-solving.

Complete integration will occur when employees from Laboratory operations and programs work together to find answers to problems that stall or impede work. When this occurs, the INEEL will achieve one of five critical outcomes called for in the INEEL Institutional Plan.

MAJOR PROGRAM RESPONSIBILITIES

Integration calls for using the INEEL's extensive research science and technology development base to assist operations project managers in solving grand environmental challenges. Project managers also actively pursue the development and deployment of technologies and innovative solutions as part of problem solving. Fostering this type of synergy is the best way to ensure scientific defensibility and engineering feasibility in ways that are mutually acceptable to those responsible for practical successes.

As work project teams are established they will assess baseline plans and assumptions, involving both Operations and R&D work activities, while looking for opportunities to deploy innovative technologies in planning and implementation of strategic activities. R&D projects are planned and executed with Operations involvement in order to maintain viability.

Tactical Plan

To bring about needed improvements in communications and coordination between R&D and Operations; a tactical plan for integration was prepared. The plan establishes a Leadership Council that maintains ownership of the tactical plan. The Council makes sure that Operations and R&D organizations revise appropriate roles, responsibilities, accountabilities and authorities for their respective staffs. Intertwined into these descriptions are actions that integrate technological advances with the removal of operational barriers.

The Council assures that science and technology needs identified by environmental management operations, provide the basis for research and development activities, and that Integration Liaisons will be established to support integration across operational programs. Integration is to be managed in concert with project engineering processes, procedures and principles. It is expected to take several years to implement activities outlined in the Tactical Plan.

The Tactical Plan is comprised of seven general elements. Each element contains discrete instructions to bring about the benefits of integration among all INEEL operations and research and development programs. The elements are:

1. Establish Leadership for Behavior and Culture Change
2. Focus Research and Development on Grand Operations Challenges
3. Deploy Proactive Solutions
4. Implement Integration Policy and Procedures
5. Enhance Baseline Planning and Teamwork Interfaces
6. Expand Technology Deployment Services
7. Communicate Mission Success

To foster communication necessary to meet the grand challenge of finding and using reliable technologies, the INEEL develops and uses work practice interface models, enhanced baseline planning, and Technology Deployment services. The use of critical project-specific technology roadmaps is also employed to pinpoint opportunities to accelerate the INEEL's efforts to integrate R&D and Operations. The INEEL will also develop an R&D master schedule to enhance the Laboratory's ability to quickly identify and respond to technology needs. The solutions that are created as a result of collaborative relations aren't of value until they are implemented. And they won't be implemented unless they are useful, timely and help accomplish project goals.

There are two concurrent problem-solving efforts associated with integration. The first is on the Operations side; the second is on the Research and Development side. A discussion is included in the following sections indicating how each effort functions and relates to other business centers at the INEEL.

What Operations Does

Operations project managers prepare Project Baseline Summary reports identifying work scope to be completed during the next fiscal year. Included in the workscope are statements about

anticipated difficulties that might delay projects. Once problems and difficulties are identified and documented, the information is forwarded to the Site Technology Coordination Group that manages the database of technology needs across the site. Currently, there are over 200 needs identified in the INEEL's Science and Technology Needs and Opportunities database. Some of these needs require a workable technology within six to nine months, while others may require a better understanding of basic science before a solution can be developed. In each case, its up to Operations to complete detailed work plans identifying both short- and long-term needs.

Having identified needs, project managers also specify the criteria for scientific or technological assistance to complete planned work on time and under budget. To complete its integration model role, Operations takes the following actions:

- seeks and funds the Integration Liaison to coordinate research and development integration
- details technology planning in operational baselines
- deploys new environmental technologies safely, quickly, and cost-effectively
- documents benefits derived and lessons learned and communicates with others about successful deployments

What Research and Development Does

On the research and technology development side of the Laboratory, the person in the newly created "Integration Liaison" position becomes the key player in keeping science research and technology development focused on satisfying Operations needs. The Liaison has to understand project limitations such as regulatory constraints, schedule and time demands, budget targets, and have familiarity with a project's science and technology needs.

The Liaison also coordinates the preparation of critical science and technology roadmaps that assess ongoing R&D activities and allocation of Laboratory resources. With oversight by the Integration Liaison, research and development and engineering activities remain focused on the priority needs identified in master project schedules.

To facilitate the productive exchange of information, the Liaison works with Operations personnel to clarify technology needs, and then organizes the right combination of team members from both Operation and R&D organizations that are technically qualified to find practical and defensible solutions. When research technicians and operations specialists come together, their eagerness to get the job done intensifies and takes on a life of its own.

As integration team members contact other local and national R&D technical leads, science researchers and technology developers, they determine if an emerging or existing technology profile matches up with needs identified by INEEL managers in the field. Even prestigious Laboratory partners are canvassed to seek possible R&D collaborations--whether from the seven-university member Inland Northwest Research Alliance, commercial sector, or DOE's national programs and focus areas. Team members make every attempt to secure the right combination of technical knowledge, skill, and experience to formulate and apply the best solutions to INEEL challenges.

In review, Research and Development takes the following actions:

- participates on a project team to find and deploy appropriate technologies
- searches for links to related successful technology applications
- coordinates development of tested and proven science-based technologies
- focuses on cost effective and lasting solutions
- ensures that solutions meet regulatory and legal requirements
- partners with Operations to become the solution provider

COMPELLING COLLABORATIONS

The key to unlocking technological responses is gaining a better understanding of environmental challenges through science. And, not all solutions need to be invented or developed within the INEEL. Where partners with strengths beyond those of the INEEL can be found, compelling collaborations can be formed to tap into proven technology lifelines. These alliances form compelling collaborations in the sense that with the unique experiences and technologies these partners bring to the table--research, demonstration and deployment initiatives have a higher likelihood of succeeding. The Laboratory is compelled to align itself with the most authoritative resources it can find to compliment its own unique abilities.

The following are a few examples of partners with whom collaborations have been forged:

- Inland Northwest Regional Alliance (alliance between INEEL and 7 northwest universities)
- National programs and focus areas headquartered at the INEEL (nine subject areas)
- Argonne National Laboratory
- Pacific Northwest National Laboratory
- Savannah River Technology Center
- Other universities, DOE national laboratories, and commercial technology providers

Successful Collaborative Efforts

Bringing diverse interests and disciplines together enhances the ability of the Integration Liaison to find, develop, and align environmental solutions with environmental challenges. There have already been a number of collaborative successes at the INEEL that deal with persistent environmental problems created by wastes generated during the Cold War era.

The following are a few examples among several dozen collaborative efforts that have resulted in the development and deployment of technologies at the INEEL to solve specific environmental challenges:

- Light Duty Utility Arm--a remotely controlled robotic arm that reaches into highly radioactive waste storage tanks to sample waste and assess tank integrity
- Enhanced Bioremediation--a process using a harmless additive placed in groundwater to feed native bacteria that ultimately destroys contaminants

- Advanced Tensiometer--a tensiometer probe developed to measure soil tension and provide information used to predict water movement in the subsurface.

CHALLENGES

For the INEEL, the commitment to integrate functions of the company to solve environmental challenges in its own backyard was a thoughtful and necessary commitment to make. Beyond buying into the concept though, the difficult aspect of integration lies in the day-to-day relationships between employees and separate organizations with different missions.

The test of how well integration works will occur during implementation of the detailed work plans in each fiscal year. It is during this timeframe that the Integration Liaisons will begin to support Operations by focusing on integrating technology into work practices as thoroughly as possible. This new focus and company-backed emphasis should speed the delivery of technological solutions for operational needs.

Changes will have to be made to the way work is planned, managed, and executed in order to realize sustained benefit from integration. INEEL Research and Development and Operations programs must form close partnerships in order to grow the laboratory and meet INEEL commitments. The critical support of science and technology interests must be ensured. Bridging the gap between those with research and development knowledge and those with operations experience to create the most efficient use of Laboratory resources has begun, but still has room for improvement.

Change is a dynamic that must be managed. The volatile nature of internal and external politics is a prime example of a time-consuming dynamic affecting accomplishment. Another example of change, is the increasing sensitivity for human health and safety, and environmental protection reflected in environmental regulations.

Accomplishing compliance with level funding certainly will be one of the Laboratory's grand challenges. Because future budget forecasts are based on today's technology costs, it will take the involvement of all employees to be dollar wise in the performance of work assignments.

Becoming more collaborative and efficient in finding the right solution for the right problem, using the right resources, is another facet to the challenge of integration.

CONCLUSIONS

Earlier in the INEEL's history, the country viewed this national laboratory in Idaho as a safe place to develop, demonstrate, and deploy nuclear reactor programs. Now years later, the nation looks again to Idaho's national laboratory as DOE's lead lab for Environmental Management to play a major role in the search for solutions to radioactive waste storage, disposal and cleanup. The preeminence the Laboratory achieved in the development of nuclear reactor research is now being replicated in the realm of integrating scientific research and technology deployments for sound environmental responses.

As the INEEL makes strides to integrate operations with research and development activities, many direct benefits accrue to the Laboratory. For instance, using R&D resources in support of operational needs promotes employee morale and intensifies the drive for accomplishment. Successful integration is strong justification for the Department of Energy's investments at the INEEL. Continued investment in the Laboratory demonstrates national program leadership and continued support for the establishment of an integrated system of national laboratories.

Integration also results in building infrastructure for future INEEL missions. Having good infrastructure in turn strengthens the Laboratory's business position and increases leadership and competitiveness in the market for environmental technologies. Competitiveness improves long-term planning and better awareness of technology voids. Awareness and need accelerate the delivery of new innovations that reduce human and environmental risks, and avoid project delays. New innovations and technology can contribute directly to closing the funding gap necessary to meet EM cleanup mission requirements.

The INEEL's ability to make technically defensible and lasting decisions is enhanced as a result of interactions by professionals from diverse technical backgrounds. With this ability, the INEEL can significantly impact responses to environmental problems created over the past 50 years.

The INEEL's strategy is to first address environmental contamination by focussing science and technology advances on its facilities and environment. Then, with help from collaborating partners and a system of national laboratories, the tools of remediation and waste management developed at the INEEL will ultimately be counted among those delivered to the nation.