Decision Sciences

YOUR ANALYTICAL PARTNER IN HARDTECH INNOVATION

The Concorde supersonic passenger jet, once touted as the future of commercial flight, made its final landing in Bristol, England on Nov. 26, 2003. Despite being revolutionary technology, the aircraft failed commercially due to high costs, noise pollution concerns, and safety issues.

This is one example of hardtech, an innovative physical technology, that didn't achieve its intended outcomes because of unanticipated critical flaws. Even promising technologies can fail if they're misaligned with market needs, regulations or infrastructure.

The Decision Sciences Department in Idaho National Laboratory (INL)'s Energy and Environment Science and Technology directorate helps energy technologies reach readiness by integrating scale-up and adoption considerations early in the design process. Led by Department Manager Thomas Mosier, the department helps innovators scale technologies and drive adoption by providing clear, actionable contextual insights into the design process.

"Most departments at INL are structured to advance a specific technology," said Mosier. "We're structured to innovate on analysis capabilities that enable technologies within all of INL's mission spaces to be successful. We partner with hardtech innovators to help them identify key scale-up needs and risks, and then we use these insights in formal decision-making frameworks to develop mitigation actions."

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy

Idaho National Laboratory

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What is decision sciences?

Decision science is the study of how individuals and organizations make choices and how those choices can be improved. It draws on disciplines such as economics, operations research, behavioral science and systems engineering to evaluate risks, trade-offs and potential outcomes.

INL's Decision Sciences department combines expertise in these fields to generate insights and uses AI to uncover patterns that human analysis might miss. Their work helps:

- Sponsors build stronger portfolios of R&D investments with programmatic impact
- Hardtech innovators identify barriers earlier in the process, so technologies are more likely to succeed in the market

WE ORIENT STAKEHOLDERS

- Assess landscape
- Identify key activities and constraints
- Design portfolio of interventions

WE HELP TECHNOLOGIES SCALE

- Conduct holistic tech-to-market analyses
- Assess and support deployment
- Optimize operations

Why partner with Decision Sciences?

Our Decision Sciences researchers collaborate with teams advancing hardtech to integrate key factors such as markets and technology adoption into the design and development process. This can save time and money, while paving the most direct pathway to national impact.

"Innovators can spend millions of dollars de-risking a technology over years, only to discover a critical flaw in the assumptions around scale-up and deployment," said Mosier. "We help our partners understand key factors to adoption that are outside their area of expertise."

Involving Decision Sciences at the proposal stage lets the team help you design a process that integrates the technical and nontechnical factors needed to achieve your goals.

"There's a higher likelihood of success if you engage with us at the concept stage," said Mosier. "Historically, researchers and hardtech innovators request the analyses they want us to do after they've scoped the project, but we can add more value if we work together to identify the analyses needed to achieve the intended outcomes. We can help our partners have the impact they want and show them how to get there."

Decision Sciences expertise

- **Economics and markets:** Estimating cost trajectories, assessing regional economic impacts and identifying incentives to influence behavior
- **Supply chains:** Identifying vulnerabilities, estimating impacts of interventions and improving logistics
- **AI and geospatial intelligence:** Using large language models and spatial tools to assess local and regional conditions
- **Technology adoption:** Identifying policy and regulatory considerations, testing assumptions about behavior change, and anticipating community dynamics
- **Infrastructure planning and deployment:** Integrating insights to improve project planning and execution
- **Operations research and optimization:** Ensuring deployed technologies function as designed and improving performance based on real-time conditions

Decision Sciences vignettes

Our Decision Sciences department supports a wide range of high-impact programs across INL and DOE mission areas. Examples include:

- **Advancing nuclear energy:** Will Jenson, Haydn Bryant and Nahuel Guaita provide economic, workforce and supply chain analyses that help policymakers and the private sector meet U.S. nuclear deployment goals.
- **Advancing critical material supply chain resilience:** Ruby Nguyen, Lionel Toba, Mike Severson and their team evaluate how new technologies can reduce U.S. reliance on foreign sources of key materials. They work with researchers at DOE's Critical Materials Institute early in development to assess and strengthen technologies.
- **Strategic critical materials road mapping:** Sameer Kulkarni and Jonathon Taylor support DOE's Office of Critical Materials and Energy Innovation by performing landscape assessments and developing portfolios of high-impact actions.
- **Characterizing innovation in bioenergy:** Tammy Lin leads annual analysis for DOE's Bioenergy Technologies Office that assesses technology readiness and integrates supply chain, market, logistics and economic factors to provide a comprehensive view of the sector.

Measuring success

Decision Sciences has two main goals:

- Help more innovations achieve meaningful commercial impact
- Strengthen the U.S. energy sector's ability to deliver large-scale infrastructure projects

Success is measured by how quickly and effectively the U.S. energy sector transforms and how much more capable hardtech innovators and sponsors become through their partnership with Decision Sciences.

Both goals rely on structured methods to understand how risk and uncertainty evolve over time. By applying these methods and working closely with innovators, the private sector and sponsors, the departments improves outcomes across a wide range of projects.

By combining deep technical expertise with structured decision making, the Decision Sciences department helps hardtech innovators navigate uncertainty, avoid costly missteps and bring transformative technologies to market. Their work strengthens the foundation of the U.S. energy sector and ensures that promising ideas have the best chance to succeed in the real world.

To work with the Decision Science department, contact Thomas Mosier at thomas.mosier@inl.gov.

INL is the nation's center for nuclear energy research and development and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment. For more information, visit www.inl.gov.

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