## New S&T Research Center to Develop and Share Computational Tools
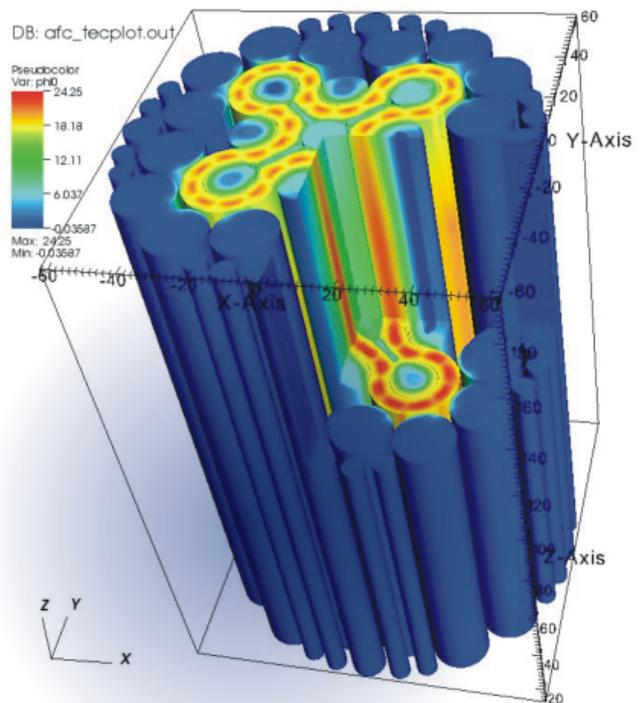
Associate Laboratory Director of Science & Technology J.W. Rogers, Jr., has assembled a team of top INL researchers to launch and staff the new "Center for Advanced Modeling and Simulation (CAMS)." This new Center will enable the use of state-of-the-art computational tools related to the development of advanced energy systems, such as the Next Generation Nuclear Plant (NGNP) and Gen IV nuclear reactor concepts. The Center has already begun to collaborate with national and regional university consortia involving Massachusetts Institute of Technology, North Carolina State University, Oregon State University, University of New Mexico and the University of Idaho. The Center will initially focus on five major modeling and simulation areas:

- 3-D transport modeling
- Behavior of solid and fluid materials in extreme conditions
- Integration of fundamental science data into engineering applications
- Design of instrumentation and control systems
- Implementation of appropriate hardware and software computing infrastructure.

One workshop involving 22 INL employees has already been held to outline a roadmap that will guide where this capability

This computer simulation of heat distribution in the Advanced Test Reactor core is a good example of 3-D transport modeling.

### State of the Directorate

**Dr. J.W. Rogers, Jr.**
*Associate Laboratory Director,
Science and Technology*

As the name of this newsletter implies, I have been thinking about the progress we have made as a new directorate, and I'm looking to this newsletter and other communication vehicles to help share some of the interesting and highly valued accomplishments we experience as a team.

We are about where we expected to be after six months of being on the job.

To some, our forward progress may seem fairly modest, and to others of us, the daring proposals that have been put on the table – that are within our reach – motivate and inspire us to stay engaged and to perform to the very best of our abilities.

I believe we're beginning to pick up momentum, both as a company and as individual

**INL** Idaho National Laboratory

needs to be and what it needs to accomplish in two, five and ten years. A second workshop, in June, resulted in finalizing elements of the roadmap. The roadmap is expected to be written by Aug. 30, 2005. The group is also in the process of soliciting applications for the director to head up the Center's activities, a task expected to be completed by the end of August.

### Brains and Chips

A Phase I proposal titled, "Brains and Chips: A system for analyzing differences in imagery," was recently selected for funding by the Defense Advanced Research Projects Agency (DARPA). The proposal team, headed by Julie Marble, Ph.D., of the Robotic & Human Systems Department, will explore how brain function-ing and associated electrophysi-ological signals may possibly be used in assisting human imagery analysts in fast and accurate image triage. The specific goal of the proposed Phase I research is to identify the neurophysiologi-cal characteristics of change detection that can be used to signal real, practical differences in geosatellite imagery. The first year of this project will be funded at approximately $350,000, with a possible total value of $6 million.

### Spray Rolling Aluminum Strip Process

INL has been awarded a new three-year project to develop and demonstrate a strip casting technology for aluminum flat products. The project, titled "Spray Rolling Aluminum Strip: Process Scale-Up and Steady-State Operation," is follow-up work to a successful feasibility study. Funded by DOE's Office of Industrial Technologies, it is a collaborative project with the University of California–Davis and an industry team consisting
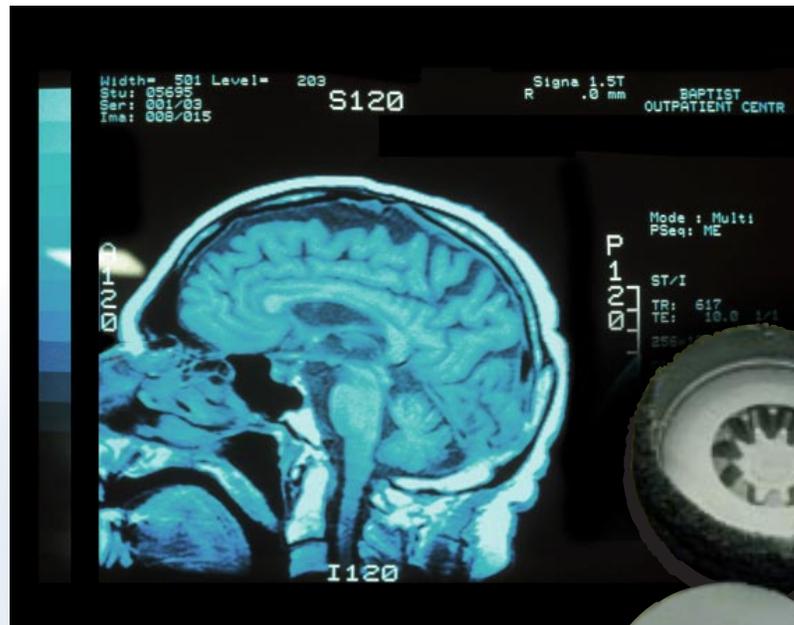


*The recently funded "Brains and Chips" proposal will explore how brain functioning and associated electrophysiological signals may possibly be used in assisting human imagery analysts in fast and accurate image triage. The Spray Rolling Aluminum Strip project will involve RSP Tooling LLC, an INL spinoff company (right).*

of Alcoa, Pechiney Rolled Products, Inductotherm Corporation, The United States Council for Automotive Research (USCAR), Fata-Hunter Inc., Belcan Engineer-ing, RSP Tooling LLC, and Metals Technology Inc. The project is valued at $3.3 million,

including industry cost share. INL will receive $1.05 million in new funding over three years.

### Big Sky Regional Carbon Sequestration Partnership

INL has received notice of award of the Big Sky Regional

Carbon Sequestration Partner-ship – Phase II Proposal from DOE's National Energy Technology Laboratory (NETL) office. The $17.9 million proposal includes funding from DOE and a 20 percent match for the four-year effort. INL will provide a significant role in

**DIRECTORATE**

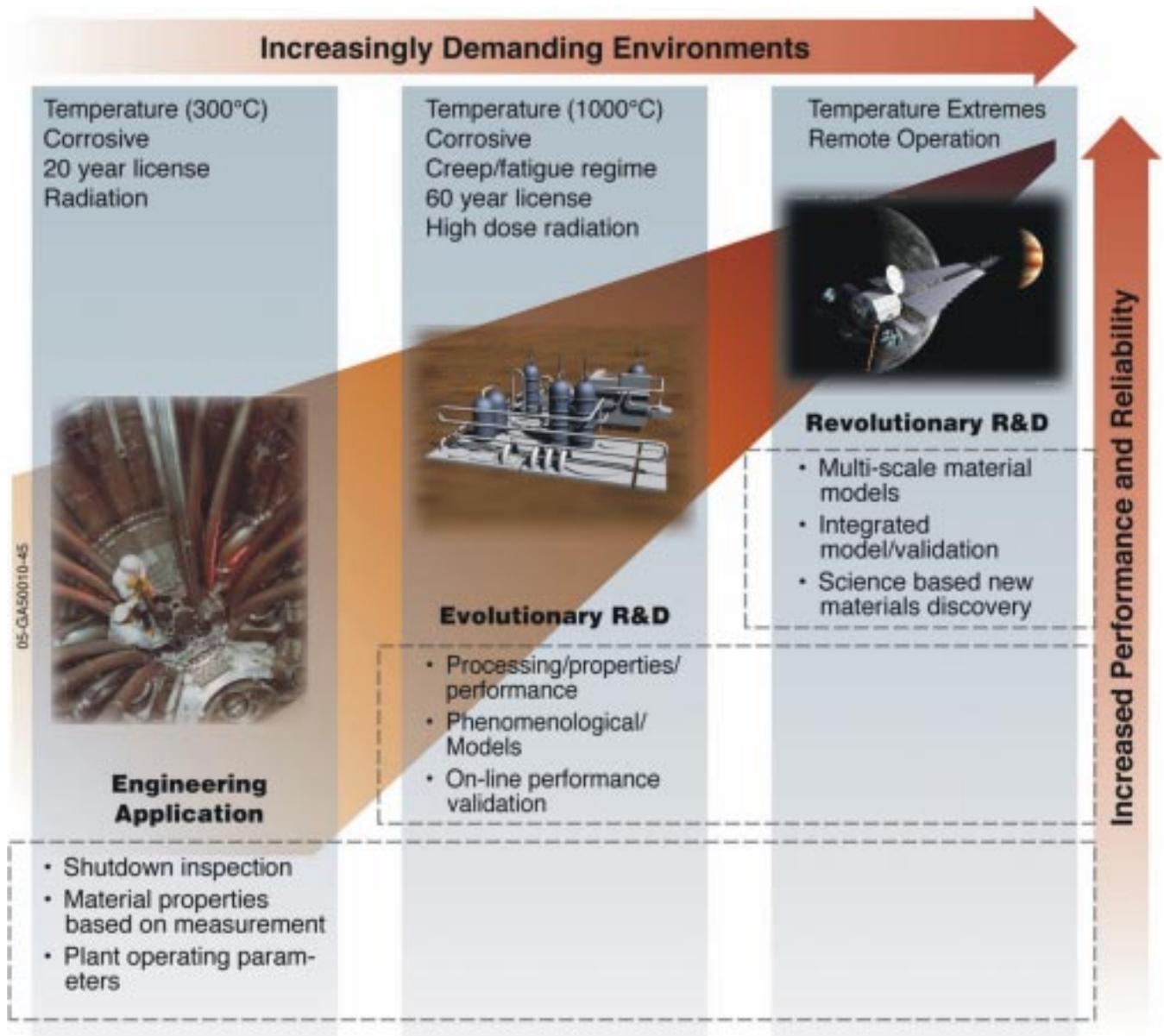S&T contributors – and we've made convincing progress on a number of fronts.

Take for instance, the establishment of the Center for Advanced Modeling and Simulation. The groundwork has already been laid, to advance what was once just a concept. Even now, the search is on to find a director with demonstrated capabilities,

bold determination and the vision to support and keep the Lab's major missions on a technical track to credibility and completion. We'll say more about this endeavor in the next bimonthly issue of S&T Progress.

As you read the articles in this first edition, I invite you to consider making a personal commitment to participate in making this newsletter a valuable communication tool

for all S&T employees specifically – and for other INL employees as well. Even though you may not think others know or care much about your line of research, I think we'll all benefit from seeing and thinking of ways to share the discoveries and knowledge we acquire as we progress toward our common professional goals.

Thanks for your role in advancing science and technology!

**Increasingly Demanding Environments**

Temperature (300°C)
Corrosive
20 year license
Radiation

Temperature (1000°C)
Corrosive
Creep/fatigue regime
60 year license
High dose radiation

Temperature Extremes
Remote Operation

**Revolutionary R&D**

• Multi-scale material models
• Integrated model/validation
• Science based new materials discovery

**Evolutionary R&D**

• Processing/properties/performance
• Phenomenological/Models
• On-line performance validation

**Engineering Application**

• Shutdown inspection
• Material properties based on measurement
• Plant operating parameters

Increased Performance and Reliability

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*Schematic of the Advanced Materials and Nuclear Fuels Roadmap vision for improved performance and reliability in energy systems*

Phase II, supporting geologic sequestration, GIS activities, regulatory compliance and economic risk assessment – and will assist Montana State University with program management and execution. INL's Field Work Proposal for this activity totals $1,765,000. Additionally, INL will benefit from the University of Idaho geologic sequestration funding of $858,000, which will support funding for joint appointments at INL. Program Director Susan Capalbo from MSU, has named David Shropshire as the Deputy Director of Phase II. Funding through MSU will include development of a Regional Energy Analysis that will receive and use support through the Center for Advanced Energy Studies (CAES), and also draw on resources from regional universities associated with the Inland Northwest Research Alliance (INRA). The geologic pilot test in mafic rock involves significant involvement by Battelle Pacific Northwest Division (PNWD), which will receive $2,577,000 for the geologic drilling subcontract and funds for technical support.

With the INL Field Work Proposal (FWP) funding, plus funding from the U of I and MSU – with $500,000 of matching funds for complementary LDRD research – we are looking at about $3 million over the next four years to grow the INL Carbon Management Program. We can also gain from closer ties to Pacific Northwest National Laboratory (PNNL) and leverage for carbon sequestration opportunities in Phase III and FutureGen. We will also be vying for use of the CAES as the nonprofit institution to propose this activity for Phase III.
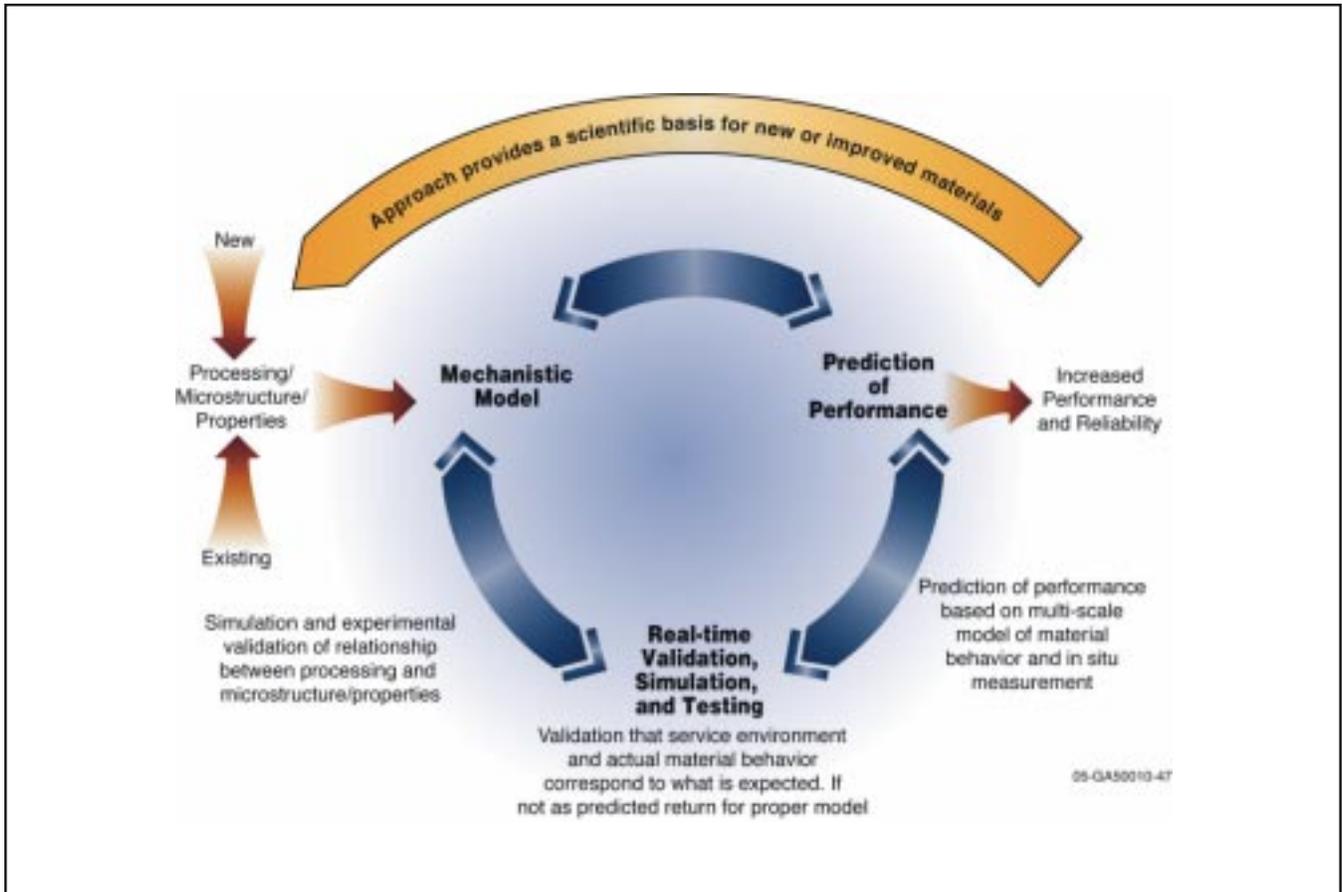
*Schematic representation of the materials prognostics approach to improved materials service performance and reliability*

## New Roadmap Calls for Increased Technical Capability and Performance

The Advanced Materials and Nuclear Fuels Science Signature Roadmap is being developed through a series of workshops with scientists and engineers across the INL. The vision of the Signature Activity, shown schematically on Page 3, is to develop materials and nuclear fuels science and engineering capabilities to deliver improved performance and reliability in advanced energy systems. A materials prognostics approach has been adopted to fulfill this vision. This process integrates physics-based understanding of processing/structure/properties of materials in the service environment with in-situ validation of performance models to deliver enhanced performance and reliability in energy systems. How the prognostics approach is executed is shown in the figure above.

In order to realize this vision, the roadmap calls for increased capabilities at INL in micro-structural characterization, sensors and measurements, structure property characterization, synthesis and processing of materials and multiscale modeling and simulation. While this activity is focused on INL's nuclear mission, it crosscuts major Laboratory activities in fossil energy systems, hydrogen generation and storage and national security. It also has important interfaces with the science signatures in Theory, Modeling and Simulation and Instrumentation and Control.