Systems Integration & Optimization

Pacific Northwest National Laboratory

Engineered Systems

The Engineered Systems Group utilizes the systems engineering approach to analyze, characterize, and present information to decision-makers at all levels of the organization to optimize problem solving and action.

System integration and optimization provide the perspective to develop solutions that minimize costs, increase system performance, and minimize risk and uncertainty. Questions to be addressed include:

- How do system components interact with one another?
- What is the range of conditions for system application and use?
- How do the components impact system performance?

An integrated understanding of project requirements is critical to the translation of those requirements into successful deliverables. The level of requirements management needed is directly proportional to complexity. Coordination must be established across organizational and functional lines. Interface and common understanding must be developed between diverse disciplines involved in the activity. Baseline is established based on clarification of scenarios for system use and operations. Identification of key criteria is established to evaluate alternatives and select optimum solutions based on clients' needs. The level of expectation between client and project participants must be visually articulated.

Model integration similarly delivers sufficient understanding regarding available tools and modeling domains to integrate a set(s) of models into integrated systems. These systems maintain flexibility and expandability to serve changes in client needs. Successful model integration requires experience in a number of areas:

- Teaming of multidisciplinary expertise
- Data integration between linked models
- Knowledge of available tools and successful techniques
- Cross-discipline application training.

Examples of Our Work

Counter-Drug Interoperability Training Program. This program is intended to develop and implement a computer simulation-based interoperability training system that can improve multiagency operation planning and execution. The simulation system capabilities and training infrastructure will then be extended to provide capabilities for:

- Analysis and promulgation of lessons learned
- Mission rehearsal
- Operations research and technology assessment.

Teaming with Fluor Hanford, Inc. (prime) and General Dynamics Corporation, PNNL is providing technical support in requirements development, technology management, program development, and client/user interface. The current operational requirements document was developed based on intensive PNNL staff interaction with field agencies conducting drug interdiction activities along the southwest border. From those findings, an exercise-driver simulation was developed to create interoperability scenarios for training.

The National Counterdrug Center is envisioned to become a principal law enforcement agency resource for training, information, and research that will reduce the effects of the existing barriers to cross-agency communication and cooperation.

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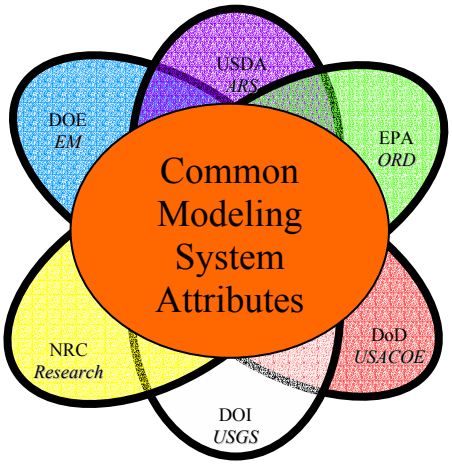
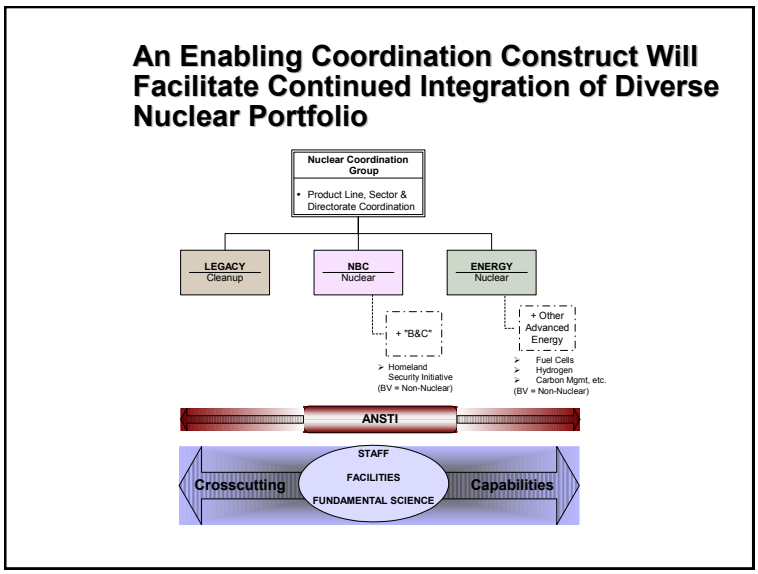
Development of Framework for Risk Analysis in Multimedia Environmental Systems. An integrated modeling system was developed to allow model developers to integrate independent environmental and risk codes together for a specific application or approach. This activity led to the development of an information-sharing group among six government agencies that signed a Memorandum of Understanding in July 2001, agreeing to share scientific work on multimedia environmental modeling development and enhancements that focus on exchange of information related to tools and scientific information of environmental risk assessments.



The resulting merged modeling system best utilizes FRAMES 1.3 and the Multimedia, Multipathway, Multireceptor Risk Assessment as applied to the Hazardous Waste Identification Rule. FRAMES 2.0 maintains the simple user-friendly interface with documented rule sets to allow models to be added to the overall software platform. FRAMES retains model developers' choice of programming environment (languages, styles, tools) when inserting their software model into the FRAMES structure, and provides a common application programming interface (API) (data protocols) to enable data transfer between models using an API, a software developer's kit, and a web-based tools kit. The platform contains other tools such as dynamic link libraries, system editors, database-specific tools, and a data client editor interface.

Integrated Nuclear Strategy Development. A multidisciplinary team of decision analysts provided technical support to the PNNL Energy Directorate in the development of an integrated nuclear strategy. Specifically, the team worked to accomplish the following:



- Coordinate dispersed nuclear business components across product lines, sectors, and directorates
- Formulate a compelling case for increased Laboratory-level investment in the nuclear business
- Facilitate a "coordination construct" to provide ongoing integration of diverse nuclear business elements
- Position nuclear theme areas to perform detailed market assessment of initial opportunities identified.