

Systems engineering facilitates program and project success through the application of Systems Analyses and Engineering tools and techniques.



Systems Analyses and Engineering

Systems Analyses and Engineering (SA&E) develops innovative solutions to a wide range of complex challenges. Its unique mix of mission analysis, requirements management, risk management, decision analysis, system integration, technology readiness assessment, and verification and validation expertise ensures:

1. Customer needs are understood and project requirements are identified and validated throughout the project life cycle
2. Viable solutions are developed and integrated to satisfy expectations
3. Potential impacts of technical and program risk are minimized.

SA&E delivers independent, objective results to ensure a system-wide perspective is considered in establishing budgets, planning and executing projects, and increasing the probability of project success.

Core Functions

SA&E has more than 650 years of experience applying

systems principles in the government and private sector.

The seven core SA&E functions applied at INL provide the structured approach and technical analyses necessary to ensure the systematic, risk-informed management of R&D, programmatic, and operations activities. SA&E provides the analysis expertise and related data needed to make defensible, risk-informed decisions.

Mission Analysis & Planning

Mission analysis and planning seeks to establish a clear, understanding and agreement on the problem or challenge being addressed and the gaps to be filled. As a result, a conceptual view of the anticipated solution and the associated technical and programmatic baselines can be established based on identified needs. The resulting problem statement, mission statement, and conceptual approaches form the basis for subsequent project activities.

Requirements Management

Requirements analysis continues during the

conceptual phase of a project to further define stakeholder, technical, and operational requirements. Requirements range from top-level mission needs and functional requirements down to detailed technical specifications for systems, subsystems, or components, and their interrelationships. SA&E identifies requirements by interacting with customers and subject matter experts, and by examining laws, codes, standards, contracts, and other procedural and policy documents. Identified requirements are then documented and tracked to verify that solutions meet customer expectations.

Risk Management

Risk management provides the structured, disciplined approach to identify and mitigate risks to an acceptable level. SA&E uses innovative tools and techniques to identify program, operations, and technical risks before they occur, and then develops a strategy to reduce or eliminate the probability and/or impact of the risks. Efforts to manage risks are documented

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and tracked by SA&E in a project risk register or risk management database.

Alternatives Analysis & Trades Studies

Alternative analyses are performed any time a project needs to select from two or more options. SA&E serves as an honest broker by using a broad base of experience and capabilities and tools to affect these efforts and guide informed decisions. SA&E helps identify the range of viable alternatives; develops decision metrics as a basis for analysis; designs and conducts appropriate analyses and trade studies, including modeling and simulation where needed; and provides analysis data to help projects achieve efficient, effective, defensible solutions.

Technology Readiness Assessment & Roadmapping

Technology Readiness Assessment and Roadmapping processes analyze and focus R&D and technology development efforts on specific mission needs, while minimizing roadblocks and uncertainty. In each case, roadmap development culminates in an integrated path forward focused on providing the needed capabilities consistent with the mission schedule. The SA&E technology roadmapping process stands at the forefront of this growing methodology. It provides a means for projects to measure the relative merit of technologies, accelerate the application of new technologies, minimize project costs and schedules, and provide a defensible argument for

acquisition and/or development choices.

System Integration

System integration focuses on promoting synergy among team members and on ensuring that the technical and operational components of a system work as intended. SA&E integrates the technical resources, system elements, and human capital needed to ensure project success, and enables communication and collaboration between project elements.

Verification & Validation

SA&E verification and validation processes tie developed solutions back to stakeholder and system requirements to (1) verify that system performance and functionality meets customer needs and (2) validate that system specifications and design parameters are evident in the final product. In short, SA&E ensures that the right solution is developed and that it is designed and built in the right way.

Support Functions

In addition to the core functions listed above, SA&E also applies the broader range of systems engineering functions recognized and used throughout government and industry. These include, but are not limited to the following:

- Strategic planning and project integration
- Systems modeling and simulation
- Economic analysis

- Value engineering
- Meeting design and group facilitation
- Interpersonal skills training and group dynamics to build project teams
- Computer-aided decision support.

SA&E uses cutting-edge systems thinking, formal scientific methods, and emerging theories in the science of systems to enhance its ability to address complex challenges. The research aspect of SA&E provides new analysis and integration knowledge through innovative theories and methods that support advanced decision-making, engineering, and science.

Benefits

The application of SA&E functions offers several benefits for INL projects, R&D activities, and operations, such as:

- Clear understanding of customer challenges and requirements
- Analysis and down-selection of preferred solution(s)
- Improved integration and collaboration
- Focused R&D toward technology maturity
- Basis for defensible, risk-informed decisions.

The application of SA&E core and support functions delivers a higher probability of overall project success.

For more information

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