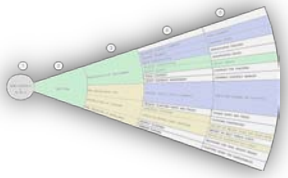
Innovative Systems Engineering Tools

Tools and techniques are an important component in the successful application of any Systems Engineering effort. Systems Engineers at the Idaho National Laboratory (INL) have developed a suite of customized tools and techniques that have proven highly effective in helping programs and projects achieve mission objectives. Summary descriptions of these tools and techniques are provided below.

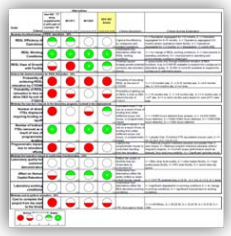
Zoned Analysis



In the 1960s, Dr. Milton E. Larson introduced a curriculum development model to "counteract the aimless evolvement of curriculum programs" in vocational technical education. Using the term Zoned Analysis, INL Systems Engineering has adapted Dr. Larson's model as a means of capturing and analyzing all aspects of the project to enhance the collaboration and planning of project activities.

In practice, Zoned Analysis facilitates a gap analysis for the project and helps management quickly see the "big picture". Similarly, project personnel are better able to see their place and how they fit into the project whole. With this insight, functional requirements can be quickly identified and all deliverables linked back to the requirements. The results of Zoned Analysis become the source data for subsequent SE functions and tools.

QuickCompare



Developed in-house by INL Systems Engineers, *QuickCompare* is a flexible tool that can be applied to a wide range of decision making situations. It follows simple decision making processes (e.g., define the problem, goals, alternatives, criteria, and weights; score alternatives; analyze results) and makes any decision process faster, easier, and more transparent.

QuickCompare contains the capability for performing sensitivity analysis and testing the validity of multiple "what if" scenarios. It also provides graphical outputs to facilitate better understanding of the impact of those scenarios on the decision to be made.

GAP Relationship and Integration Planning (GRIP)

The GAP Relationship and Integration Planning (GRIP) tool was developed for the U.S. Army to support current force fleet modernization planning. GRIP provides system-of-systems qualitative gap assessment and anticipated solution performance improvement using multi-attribute utility theory as a basis, for example:

1. Size of capability gaps relative to each other based on subject matter expert input. Assessments for multiple missions can be maintained separately within the tool.
2. Potential mismatches between capability focus (e.g., requirements) and the size of those gaps.
3. Estimated improvement (gap closure) or degradation to capabilities resulting from the application of one or more solutions.
4. Overall (system-of-systems level) contribution to capability gap closure associated with individual solutions.

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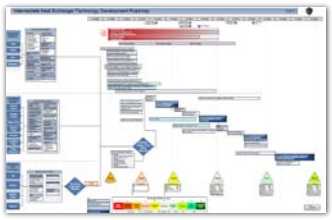
GRIP is configured to provide a variety of data reports, rollup information (e.g., Consumer Reports®-style icons), and graphs for outputting the results of the assessment and can be customized to any business enterprise or system-of-systems to assess capability gaps and potential solutions. Based on the functionality of GRIP, several tailored applications have been developed to meet the specific needs of other projects:

- *Strategic Milestones and Relationships Tracking (SMART)* was developed for the U.S. Army Hit Avoidance System program to manage the complex relationships of program artifacts, evidence, reviews, tasks, status, and relationships to other project elements.
- The *Performance Rollup Tool* (PRT) captures and evaluates a number of variables affecting a system's performance across multiple scenarios. System issues can be evaluated and prioritized for highest value to overall performance across each scenario.
- The *Portfolio Integration and Prioritization* (iPIP) tool provides an ability to easily capture and analyze the interrelationship of organizational elements (called capabilities) that play a role in the overall strategy and tactics of the enterprise. The decision model portion of the iPIP manages the relationship between the programmatic users of the enterprise architecture, the organizations developing and maintaining the enterprise architecture, and the investment decisions made to maximize mission success and minimize programmatic risk to the enterprise.

Planning and Technology Roadmapping

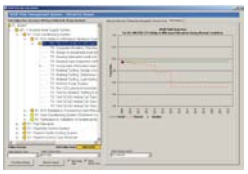


Systems engineers at the INL have developed a specialized planning and technology roadmapping capability that provides the rigor and understanding needed for decision-makers to focus on critical uncertainties and make informed decisions. In short, the advanced roadmapping process provides the means to:

- Measure the relative merit of technologies
- Identify the key selection discriminators for down selecting technologies and designs
- Establish the long-term vision for maturing technologies toward deployment and operations
- Identify risks early in the process and outline the tasks needed to resolve technical risks
- Accelerate the application of new technologies
- Minimize project costs and schedules
- Provide a defensible argument for acquisition choices.

These capabilities combine to form a technical risk reduction strategy, sometimes referred to as a *Focused Roadmap*. The tools can be applied to technical or programmatic risk, including economic, stakeholder, and political risk.

Risk Management System (RMS)



The Risk Management System (RMS) is an analytical tool providing the capability to: establish a risk baseline; document and analyze a risk reduction plan; track the current risk reduction status; organize risks by reference configuration; and inform project level decision making. The tool provides a rollup/drilldown analysis capability that summarizes quantitative risk scores at various levels of granularity. These scores can be displayed for either the baseline, current status or the final projected risk by average or worse case. The RMS provides the capability to outline and status a risk handling strategy for each identified risk. Risk reduction tasks are assigned to each risk item and the magnitude of risk reduction estimated for each associated task can be specified.

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Additional details on the use and adaptability of the tools and techniques described herein are available by contacting the INL Systems Engineering Department.

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