Programmatic Risk Balancing

Dr. DM Tralli
Mission and Systems Architecture Section
Strategic Systems Technology Program
Jet Propulsion Laboratory, California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA 91109
Tel: (818) 354-1835; Fax: (818) 393-3602
tralli@jpl.nasa.gov

A lifecycle risk management decision-support software tool – *Defect Detection and Prevention* (Cornford, SL, MS Feather, KA Hicks, IEEE 2001) developed for NASA space mission systems is used to assess and visualize risk in an R&D program and potentially guide project selection. The tool previously has been applied to assess the maturity of component technologies and subsystems and is being piloted for a complex space mission currently in formulation. This paper presents the first demonstration of the tool for balancing programmatic risk. The approach is shown to help in the design of strategy, execution of a plan that relies on integration of scientific research and technological capabilities, and optimization of project investments to mitigate risk to acceptable levels during the program lifecycle.

The NASA program of case study is intent on developing stakeholder-driven applications of geospatial information leading to self-sustainable operational systems. Program requirements are well documented; and can be weighted and structured in the tool as trees. Risk trees, analogous to fault trees, with a logical structure of "and" and "or" gates are derived and captured as a result of program planning meetings held with stakeholders, and from gaps in underlying science and technology capability, and from factors external to the program. For example, risks may be due to incomplete planning, unavailability of enabling technology or data, the economic and competitive landscapes, and ultimately an unbalanced portfolio of projects. Determining the albeit qualitative impacts of these risk elements on the requirements results in a prioritized set of risk elements with attendant risk-driving requirements. The software tool addresses residual risk as a function of various risk control options. The program manager selects from a set of risk control options for alleviation, detection or mitigation, each with an estimated effectiveness against risk elements.

Risk balancing is achieved by selecting an optimal combination of risk controls, constrained by available program resources – funding, program duration and enterprise organization. For example, risk controls may be planning activities with stakeholders (e.g. data providers, collaborators, product users, sponsors), analyses, research, developments and applications projects in a manner that retires overall programmatic risk to acceptable levels at specific program stages – formulation, implementation and ultimately self-sustainable operations. Projects, linked directly to meeting program requirements, are treated as investment options to mitigate risks to the program, thus yielding the investment return to the enterprise.

The difficulty in applying an analytical software tool lies in numerically assigning the impact of risk elements on program requirements and prescribing quantitatively the effectiveness of potential risk controls. Nonetheless, using a discrete set of values, relative differences in risk element severity provide a visual indication of program risk levels across science, technology and applications – yielding an integrated enterprise perspective. Preliminary results regarding technology needs and program balance from a select project portfolio will be shown, including how the tool is being used to assess program planning and analysis, integration and prioritization.