Proposal for an Integrated Risk Assessment and Management Application

Introduction

Analyzing and controlling risk is one of the most important aspects of the engineering design process. These risks include health and safety, design robustness and reliability, maintainability, marketability, cost, schedule, and performance.

Yet, many of these risks are managed only by the intuition of the project manager or management team. While many are skilled enough to investigate and control most of these risks, the number of projects that fail to meet functional requirements, cost limits, scheduled deadlines, reliability expectations, or other thing, serves as testament to the fact that the complexity of risk management on modern projects is beyond the capabilities of our current system of doing things.

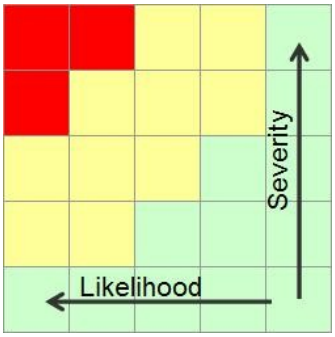
In large organizations, multi-disciplined teams of experts may investigate and score project risks by a standardized methodology, communicate regularly with the entire project team, and evaluate proposed solutions to issues by established criteria, only to see those projects also suffer many of the same problems.

But, what if things did not have to be that way? What if the assessment of risks could happen automatically as the thousands of tiny decisions made by many different project team members began to coalesce towards one of the many possible given outcomes? And then, what if the manager or managers of the project could immediately see the course in which their project was headed, to evaluate the need to make corrections, and could see the kind of correction needed?

This situation is not so far fetched as it once would have been. The growth of collaborative project management, design, and manufacturing tools have put almost all of the data required for this risk assessment and control system in an accessible place. New research on the psychology of decision making has illuminated how people over- and under-estimate risks, enabling an accurate communication of risk information much more possible, no longer relying on one person's interpretation of a vague risk assessment output. With a directed effort, a comprehensive, integrated risk management and control application could be available to transform the project management practices at small and large enterprises greatly improving the success of all types of engineering projects during all phases of the life cycle.

Problem – Evolving Needs during Life Cycle

Many of the processes and tools for evaluating and controlling risk in existence today only operate well at one particular phase of the product life cycle. Many have been developed, for example, to survey products in the field to identify the likelihood and severity of problems through statistical trending analyses. Others are used in the late phases of product design to anticipate problems based on system properties like reliability as determined by engineering analyses or testing programs.
The risk assessment tools must not only work throughout the design process from beginning to end taking into account the appropriate amount of uncertainty, they must also prompt decision makers to select the correct option. If a risk is somehow underestimated or overestimated by the person interpreting the analysis, the risk assessment and control process has not performed properly.

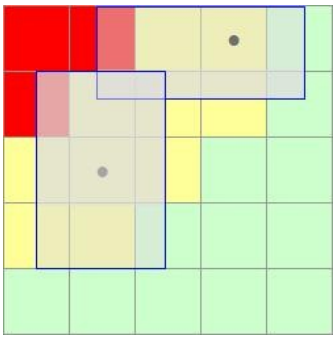


The other problem is that even a conscientious risk mitigation program must switch between tools for different stages of a project losing valuable information each time and a valuable opportunity for feedback for the information collected in each stage to inform the other stages. Additionally, appropriate measures of uncertainty cannot be tracked along the development path when tool changes are made.

First, a statistical method needs to be incorporated to evaluate likelihoods and uncertainties in the early initial concept stage, later evaluating additional information as design detail and intent is added, and then incorporating actual test and use data. Currently, most organizations must tolerate different data input and output content and formatting for each stage of the process, potentially confusing how risks evolve over the course of the project.

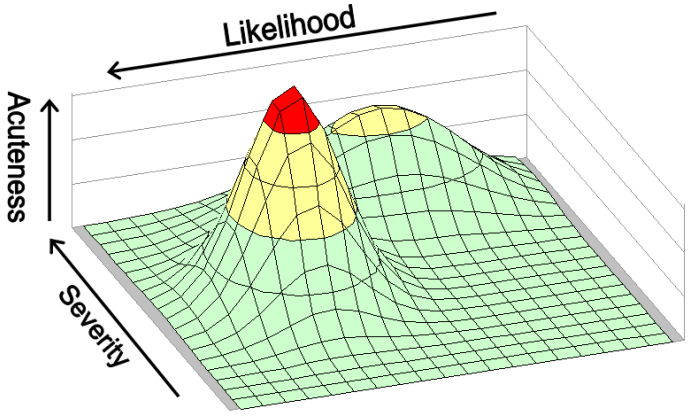
Problem – Ambiguous Results and Responses

A clean, clear choice in each case must be provided to those responsible in a manner appropriate to the risk in question, with all the necessary information visible in an easy to comprehend manner. An equitable process must compare safety and reliability risks, for example, and their interconnections. The entire process and software tool must navigate the path from vague uncertain notions of the design to detailed parts lists and drawings to testing and then field use without requiring conversions, or implementing entirely new ways of doing things.



Second, the data must be presented in a way that is understandable to the technical manager, someone not necessarily highly trained in risk assessment, and it should be presented in a way such that the right decision is most likely to be made. The difficulties of clearly presenting information on likelihood, severity, and uncertainty for different types of risks at the same time must be overcome to accurately inform the decision maker of the risks he or she currently faces.
Third, the data must be usable to make decisions regarding future outcomes at each stage, suggesting a priority, direction,

and magnitude of a potential response to the problem identified. This would include the assessment of various potential solution options, including making available those that have been developed during the normal design process activities. The manager should have the means to be able to appropriately identify the choices, which would most improve the overall project risks.



Problem – Poorly Integrated Risk Analysis Process

Fourth, the software tool must be as seamlessly integrated into the design process as possible using all available data from modeling tools and currently available analyses, so that no new analysts or practitioners are required; it should also draw on previous experience as recorded with the risk assessment tool from other projects and programs. System architects and designers will provide the majority of the initial data moving risk analysis further upstream in the design process as other forms of engineering analysis have recently moved in that direction since the integration of stress analysis and fluid mechanics analysis capabilities with solid modeling applications.

Proposed Solution

A single process and assessment software tool should be developed to track, identify, analyze, and evaluate uncertainty on all kinds of risks from conception of a project to fielding and finally decommissioning. This software application and process should not require the creation of new technicians and analysts, but use the knowledge already contained within an organization, and be as seamless as possible with the design process.

Beyond the capabilities of procedures and software tools available today, the implementation and realization of this new application will involve these main capabilities:

- All risks will be included within a common assessment system
- All project members will directly have access to inform the assessment of project risks with real factual information as up to date as possible.
- Only very limited additional interaction will be required by each team member as most data will be harvested from other existing collaborative engineering design tools.
- From idea sketches of solutions to detailed proposals, the application will enable a common assessment of which solutions could have the best impact on the overall risk posture of the project.
- Risk information and solution assessments will be presented to decision makers in a manner such that the actual situation can be easily and correctly determined.

Conclusion

This solution is potentially a very broadly applicable method and application for improving any system design and implementation. More specifically, it would initially be developed for the engineering system design process, where it could replace several separate methods and tools including preliminary hazard analysis, reliability prediction analysis, design and management risk analysis, and failure surveillance analysis and problem reporting systems.

An effective, integrated, software-assisted approach could make risk assessment and management processes more routine beyond the largest corporations and organizations, who are currently the primary practitioners. This expansion and standardization could significantly increase engineering systems and business efficiency in the most important properties of overall life cycle costs, resources consumed, and benefits obtained.

Development Plan

The development plan for this integrated application is focused on 4 areas as described below:

- Quantitative Risk Assessment Mathematics – a set of statistical and other quantitative procedures to accurately evaluate severity and probability of risks from early data through surveillance of field performance. These procedures would also evaluate the effectiveness of proposed solutions.
- Effective Analysis and Display of Risk Information – a set of visual data interpretation aids that get past the innate human biases and accurately reflect risks to decision makers.
- Engineering Database Leveraging – pulling risk information from collaborative engineering design and planning tools to eliminate the separate and parallel risk assessment process.
- Process Streamlining – to integrate risk management with the project planning and design and operation process

Support this Work

If you our your organization would like to be a part of this research and development effort, please contact Jeremy Gernand at jeremy . gernand @ true – progress . com .