Integrated Concept Engineering Framework

Peter Korfiatis, Dr. Robert Cloutier
Stevens Institute of Technology

Research Need

There is a need to quickly and graphically articulate a concept of operations for new missions, business processes, and feature sets to realize a shared mental model and understanding of the mission, and potential solutions across a set of diverse stakeholders

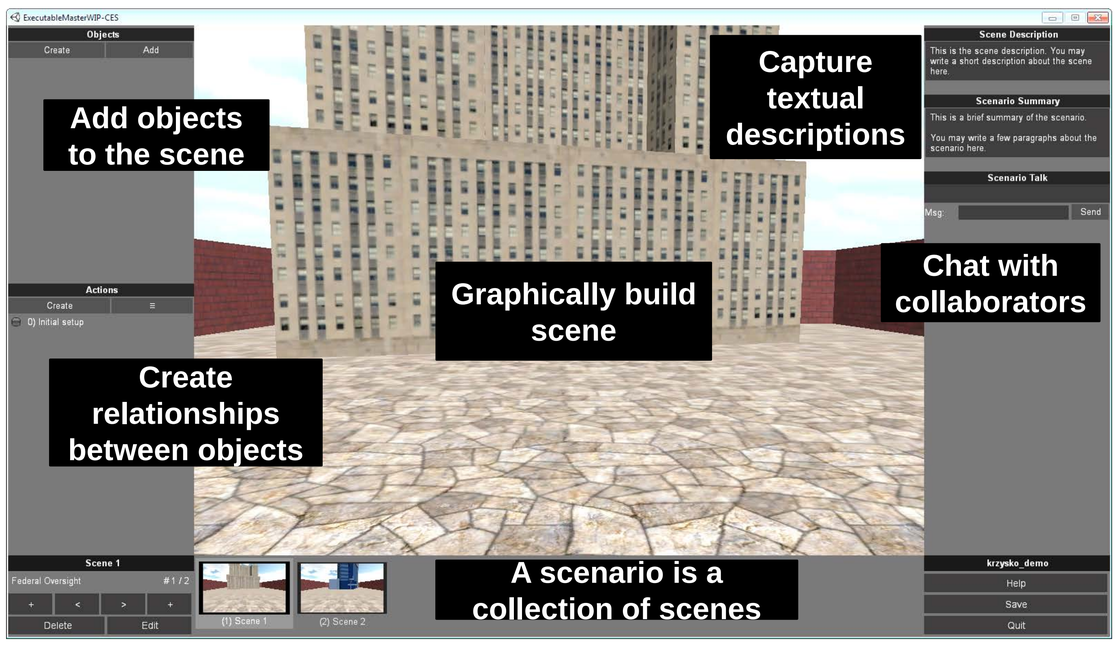
Traditional CONOPS

- Takes too long to create textual documents
- Many times the customer is not involved
- The CONOPS is static and not interactive
- Cannot perform “what if” analysis
- Static text, static graphics, difficult
- No human roles represented
- Difficult to visualize

ICEF Software Development

Developing the Integrated Concept Engineering Framework (ICEF) to:

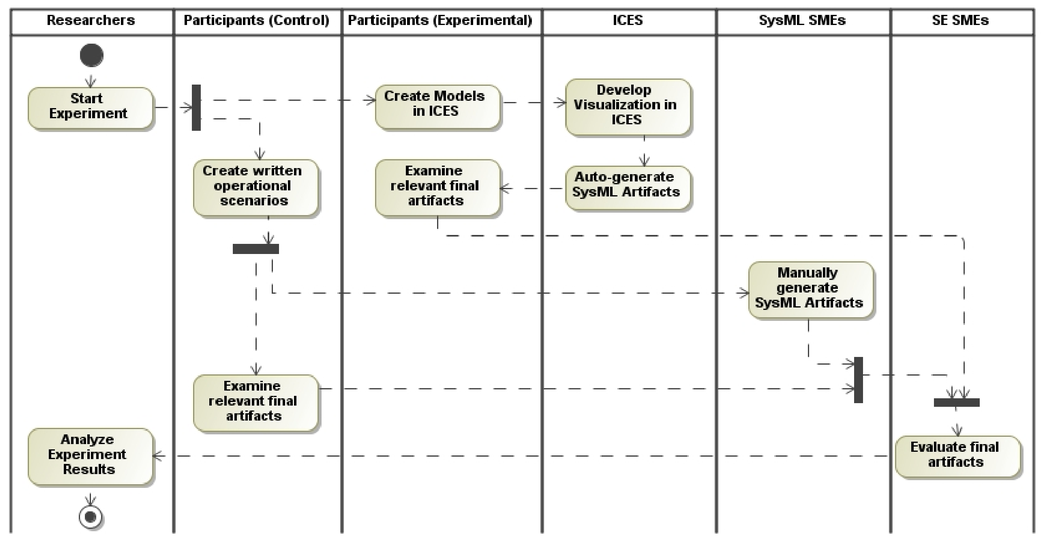
- Improve concept engineering process through use of gaming and visualization technologies to enable team of end-users to quickly agree on a common vision for new system
- Enable an integration framework for visualizing new concepts using analysis tools to generate an improved concept of operations and operational architecture
- Provide a research tool to assess the effectiveness of gaming and visualization during Concept Engineering



Research

Two structured, controlled experiments are planned with two sets of users to assess the effectiveness and applicability of ICEF, gaming and visualization to Concept Engineering

Experimental Plan



Metrics to be collected will include

Time to complete operational scenario modeling
Total time spent modeling by individual participant roles
Total time spent negotiating
Complexity of resulting models; Clarity of resulting artifacts
Evaluation of final SysML artifacts using model comparison tool
Direct feedback from participants concerning collaboration, level of satisfaction and ease of use
Quality of the artifacts by systems engineering SMEs

Research Questions

1. Can the process of Concept Engineering improve the understanding and development of a concept of operations using gaming technologies along with an interactive, collaborative, and graphical environment?
2. Can real-time collaboration between distributed stakeholders improve the CONOPS development and consensus
3. Does a mental model improve the communication among stakeholders? Do visual models allow domain-specific stakeholders to better communicate the needed operational needs?
4. Does 4D (3D + time) provide deeper insights into the operational concepts of a proposed system than traditional textual documents or static 2D story boarding?

Contacts/References

This research has been conducted through RTs 03, 30 and 31. Universities that have contributed to this research include Stevens Institute, Texas A&M, Purdue University, and Auburn University.

Current Research Team:

Stevens: Dr. Robert Cloutier, Dr. Teresa Zigh, Peter Korfiatis, Behnam Esfahbod, Peizhu Zhang, John Santanello

Auburn: Dr. Drew Hamilton, Christopher Perr, Patrick Pape, Sarah Weeks

For more information contact:

Dr. Robert Clouter (robert.cloutier@stevens.edu)