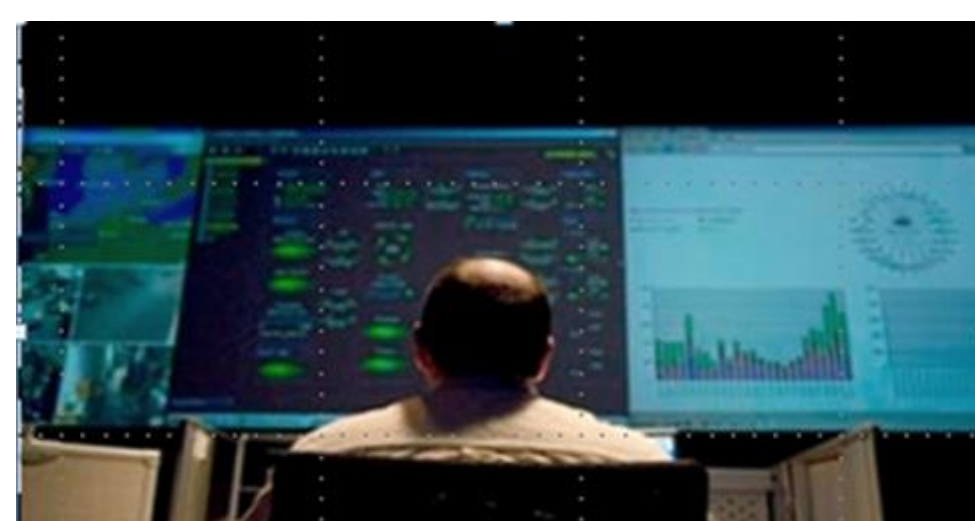


## Research Challenge

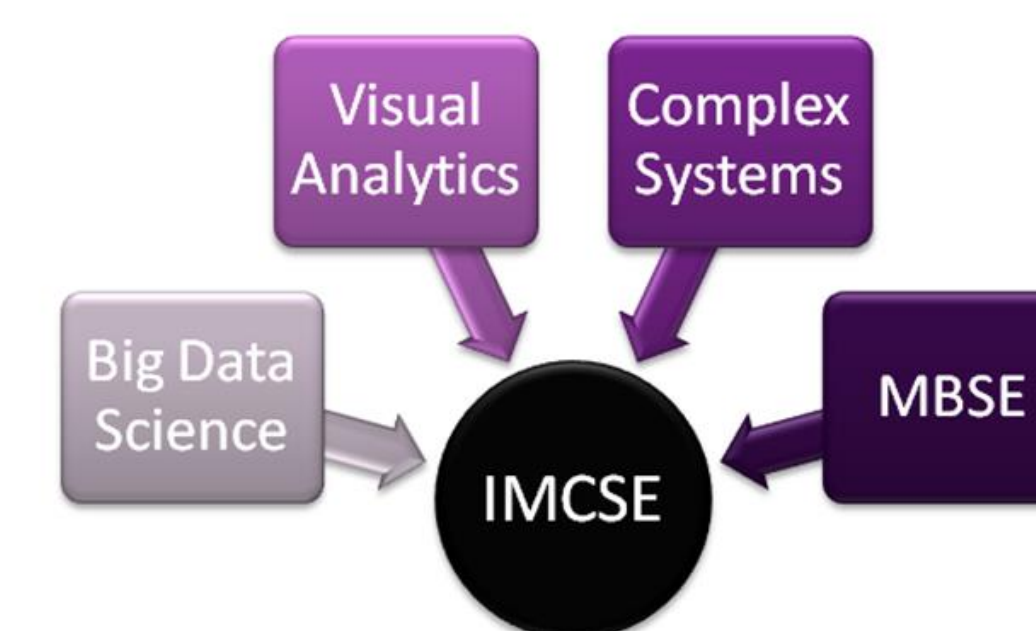
Models have significantly changed systems engineering practice over the past decade and continue to do so...



- Model-based systems engineering (MBSE) methods and tools are increasingly used throughout the entire system lifecycle
- While substantial benefits have been achieved, the most impactful application of models in systems engineering has yet to be realized
- Truly transformative results in methods, processes and tools are necessary to fully achieve a model-centric paradigm

## IMCSE Goal

Develop transformative results through enabling **intense human-model interaction**, to rapidly conceive of systems and interact with models in order to make rapid trades to decide on what is most effective given present knowledge and future uncertainties, as well as what is practical given resources and constraints



## Research Activities

### IMCSE Pathfinder Project

- Investigate current/emerging theory and practice within systems engineering and across multiple domains
- Derive a research roadmap, in collaboration with other SERC researchers and broader systems community
- Build partnerships for research within/external to SERC

### Interactive Epoch-Era Analysis

- Mature a prototype framework with associated supporting tools to a case analysis including various types of uncertainties
- Case application to elicit feedback on relevance, ease of use, feasibility and tractability of data scaling and visualization techniques

### Model Choice and Trading Models

- Develop a model choice and tradeoff framework for trading value models and evaluative models (e.g., performance and cost)
- Apply the framework in a selected demonstration case

### Interactive Schedule Reduction Model

- Transition previously developed modeling methods for an existing prototype model from proprietary tools to browser-based platform
- Demonstrate use of client-server services to compose, query and visualize datasets across model runs

### Cognitive and Perceptual Considerations in Human-Model Interaction

- Investigate key considerations through relevant literature, studies, and lessons from relevant past cases
- Gather and derive preliminary heuristics/design principles, adapted for human-model applicability
- Synthesize knowledge as guidance for model developers, model users, decision makers

### IMCSE Knowledge Transfer

enabled through workshops, teleconferences and meetings, reports, conference and journal papers, collaboration with other SERC activities, online prototypes and demos, MPTs, transition partner applications

## Glimpse of Ongoing Work

### Key Emergent Themes

- Characteristics of Models
- Ease of Interaction
- Enabling Informed Decisions
- Enabling Human-Human Interaction
- Guided Interaction
- Model Re-Usability
- Trusted Models

**Imagine an Ideal World**  
An intuitive experience that generates deep insights across the area of relevant decisions that balances time, resources and the desired confidence in the decision outcome.



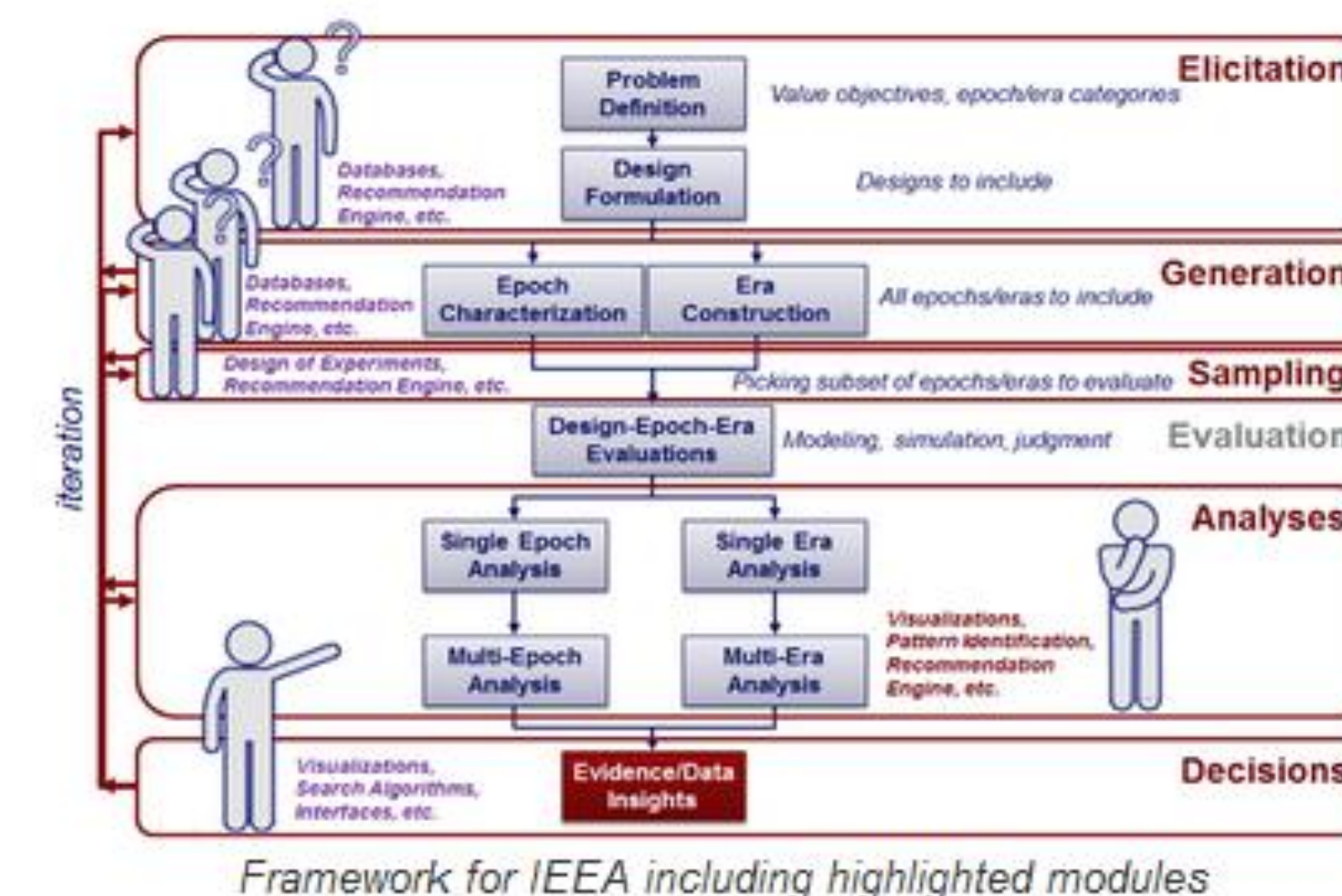
Pathfinder Workshop Report published 28 Feb 2015

### PATHFINDER

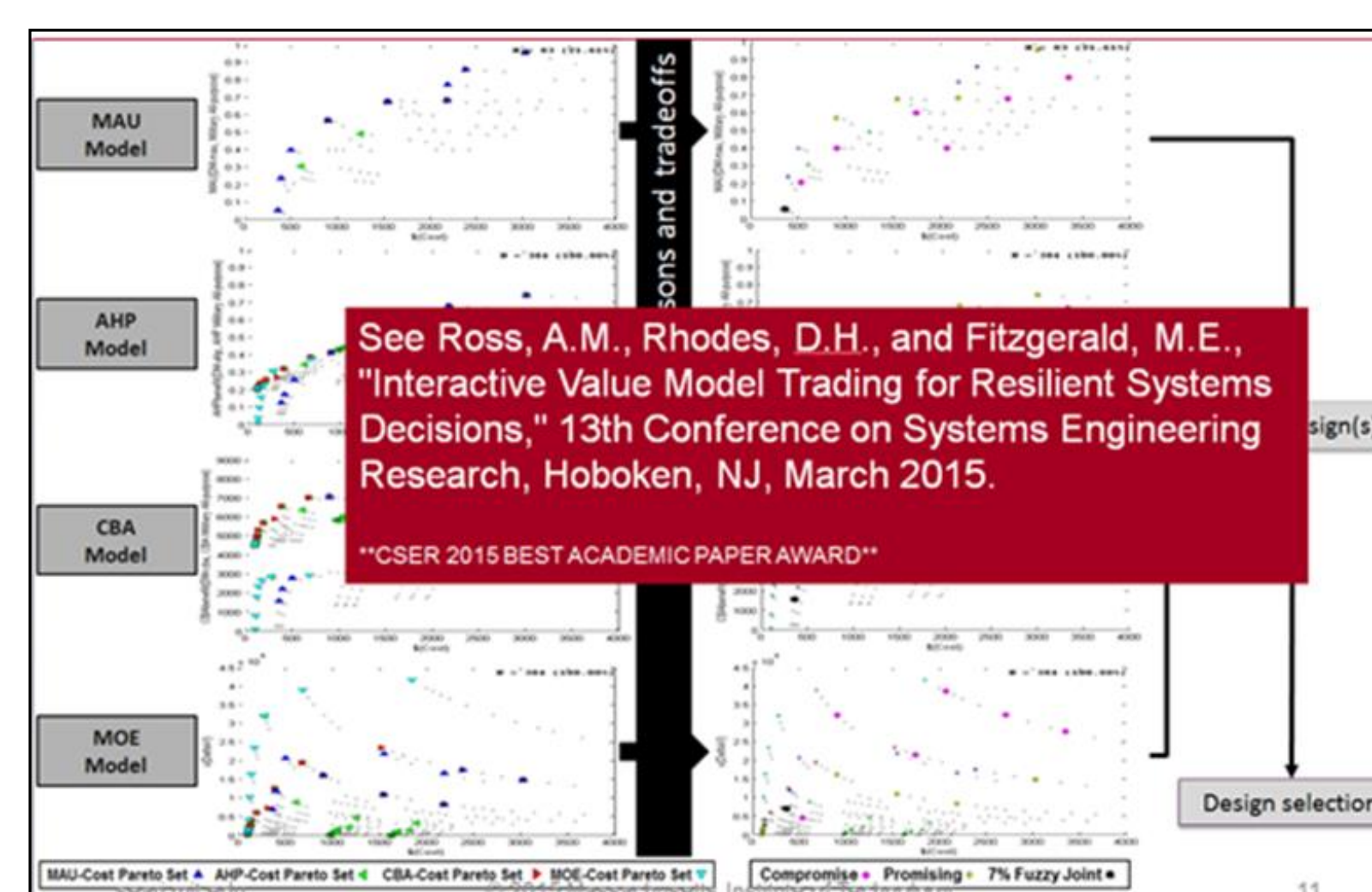
2015 IMCSE Pathfinder Workshop brought together leading researchers to seed the research agenda with identified needs and emergent themes

2016 Research Leadership Summit planned for January with researchers and early adopters to exchange knowledge and discuss transition strategies

**INTERACTIVE EPOCH-ERA ANALYSIS**  
It is hypothesized that the work on augmenting the traditional EEA approach with new analytic and interactive techniques will fundamentally enable new capabilities and insights to be derived from EEA, resulting in superior dynamic strategies for resilient systems.



Framework for IEAA including highlighted modules



**MODEL CHOICE AND TRADEOFFS**  
Explicit consideration of value model choice and tradeoffs, including identification of solutions robust to variation in value model can result in more resilient decisions in the long run

## Continuing the Research

IMCSE will continue to pursue a balanced basic and applied research approach:

- leveraging strengths of academic environment (e.g. fundamentals, rigor, neutral party view of problem)
- keeping the research relevant to the sponsor community
- engaging researchers across disciplines and working with early adopters to test research outcomes
- enabling opportunities and mechanisms for knowledge and MPT transfer

## Contacts/References

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