International Council on Systems Engineering
A better world through a systems approach

Enhancing the Future of Decision-Making

INCOSE DADM v1.0 Implementation

Jared Smith

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Jared Smith

Manager at Deloitte Consulting

Professional experience

Jared Smith brings nearly a decade of expertise in Model-Based Systems Engineering (MBSE) and Digital Engineering for aerospace and defense. As Co-Chair of INCOSE's Decision Analysis Working Group, he drives innovation and best practices, helping organizations advance and scale their digital engineering initiatives.

Expertise

- MBSE
- Digital Engineering
- Decision Analysis
- Generative AI
- US DoD

Introduction

Making good decisions is getting more difficult and must be done in less time.

The Challenge

- ↑ System complexity
- ↑ Decision complexity
- ↑ Consequences of bad decisions
- ↑ Sources and Volume of Data
- ↑ Regulatory/Compliance Demands
- ↓ Time to make decisions

The Opportunity

Decision Analysis Data Model v.1.0

- Digitally captured the process
- Documented the needed data
- We understand what makes a good decision

My Thesis

- AI is disrupting engineering
- But engineering fundamentals remain
- Engineering is simply a series of decisions

Organizations that master disciplined decision-making will thrive in the AI Decade

- The DAWG is leading that charge

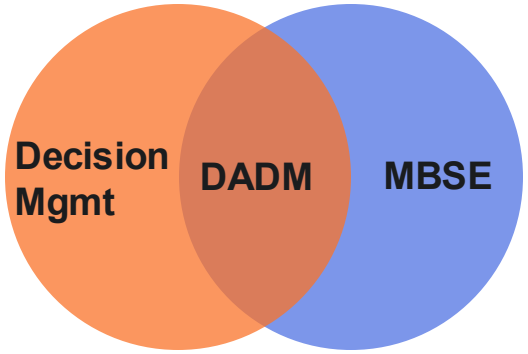
What We'll Cover

The Decision Analysis Working Group (DAWG) has developed a Decision Analysis Data Model (DADM) to help realize INCOSE Vision 2035 and is now exploring digital and generative AI integrations to bring that Vision to reality

1

What is the DADM

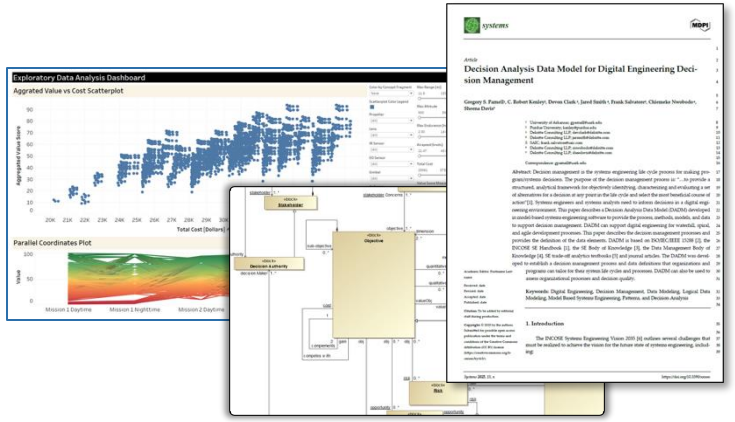
Describe the DADM, what it is for, and why it matters.



2

Who We Want

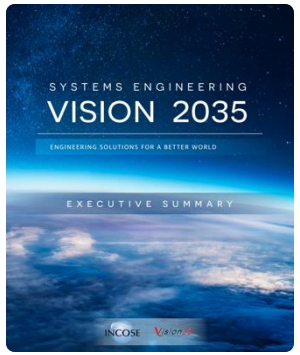
Describe our pilot projects and the types of organizations and participants we're looking for.



3

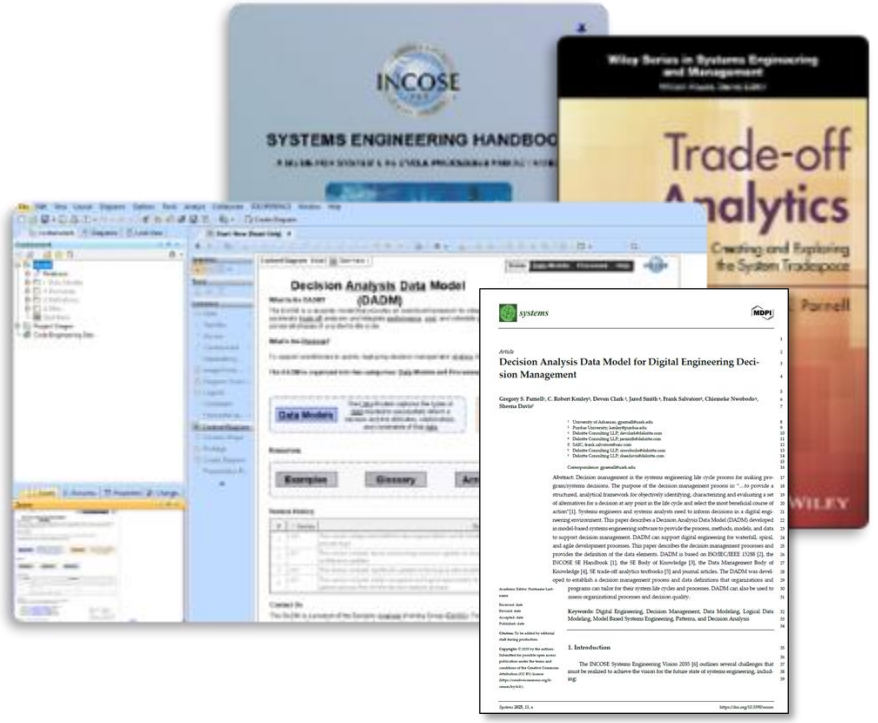
How to Get Involved

Provide actionable steps for participants to get involved and improve the decision quality of their organizations.



Decision Analysis Working Group (DAWG)

- **Purpose:** to advance the state of practice, education and theory of Decision Analysis and its relationship to other systems engineering disciplines.
- **Products:**
  - SE Handbook's Decision Management content
  - Trade-off Analytics Textbook
  - Journal Articles
  - Decision Analysis Data Model v.1.0
- **People:**
  - 150+ Members
  - Chair: Frank Salvatore
  - Co-Chairs: Dr. Greg Parnell, Dr. Bob Kenley, Devon Clark, Jared Smith, Drake Nwobodo



What is the DADM?

Legacy of Decision Analysis

- Decision analysis best practices are captured in textbooks and written descriptions.
- Data inputs and output artifacts aren't consistently documented.
- Execution occurs as One-off analyses in spreadsheets and written reports.

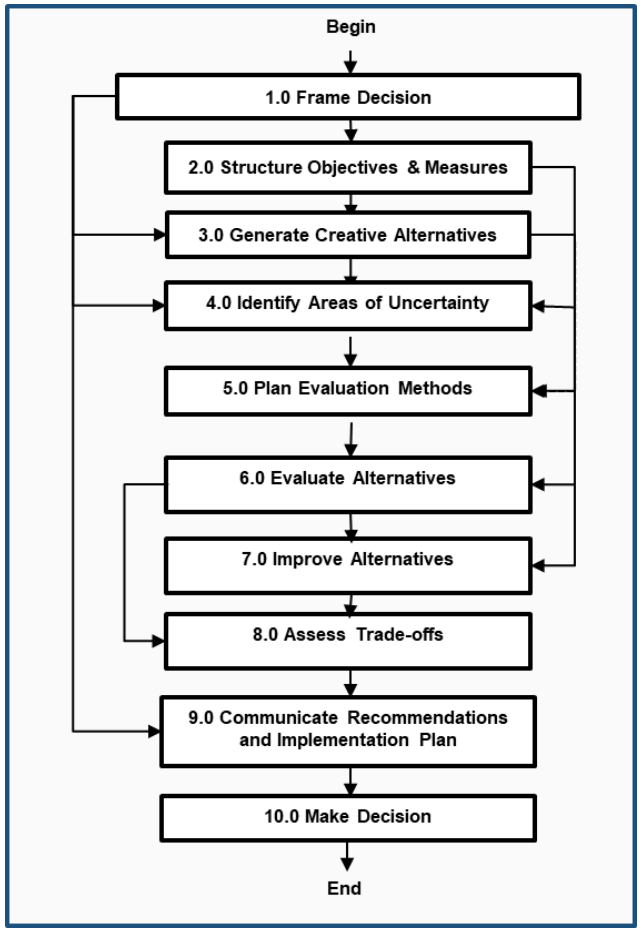
What's Missing?

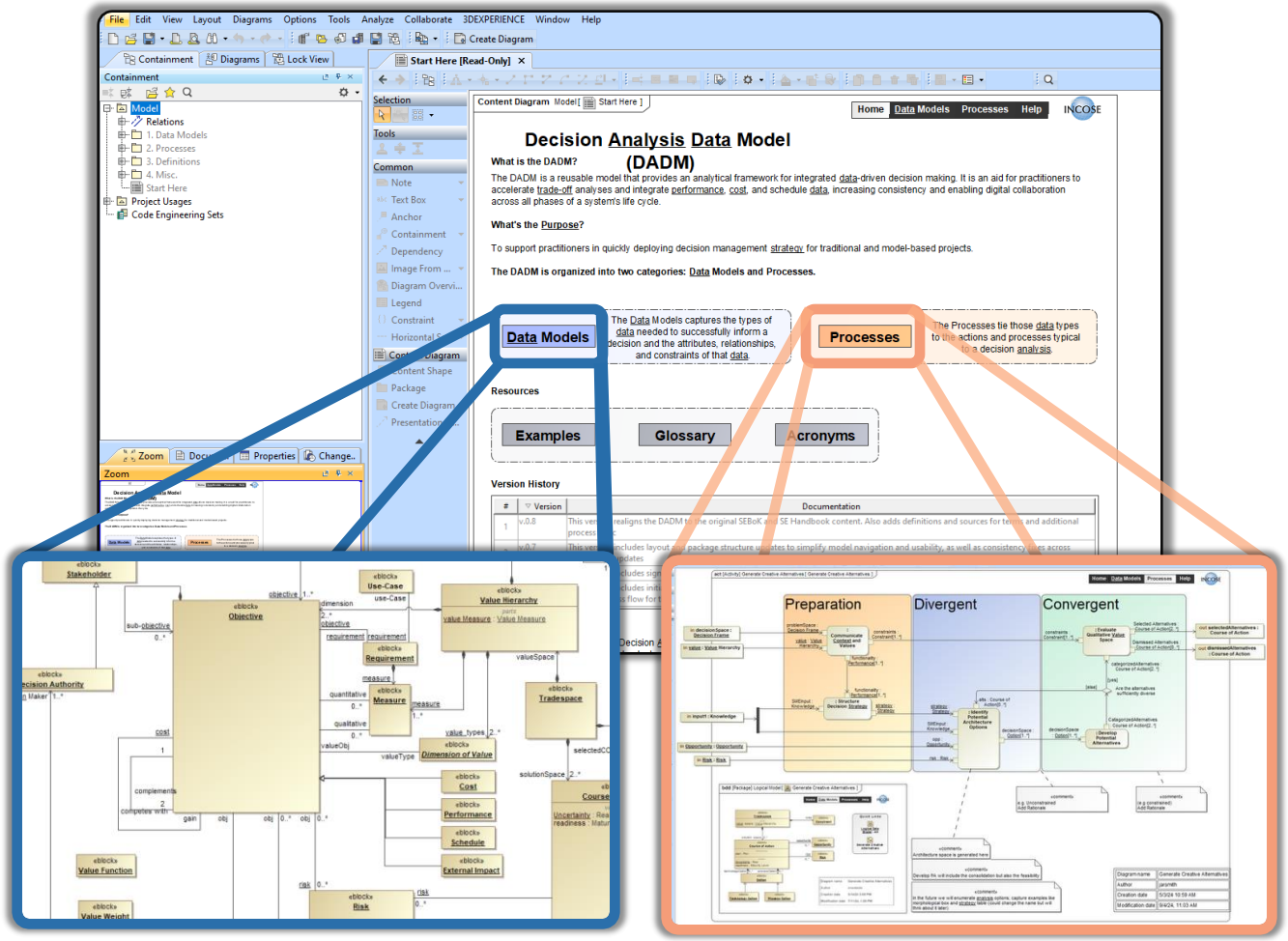
- Complete list of the data input and output artifacts.
- Explicit linking of data to process.
- Digital format to support most interesting emerging use cases

DADM: A Digital, Unified Model

- Refined Process Model captured in SysML
- Comprehensive Data model
- Instruction and ingredients in one recipe

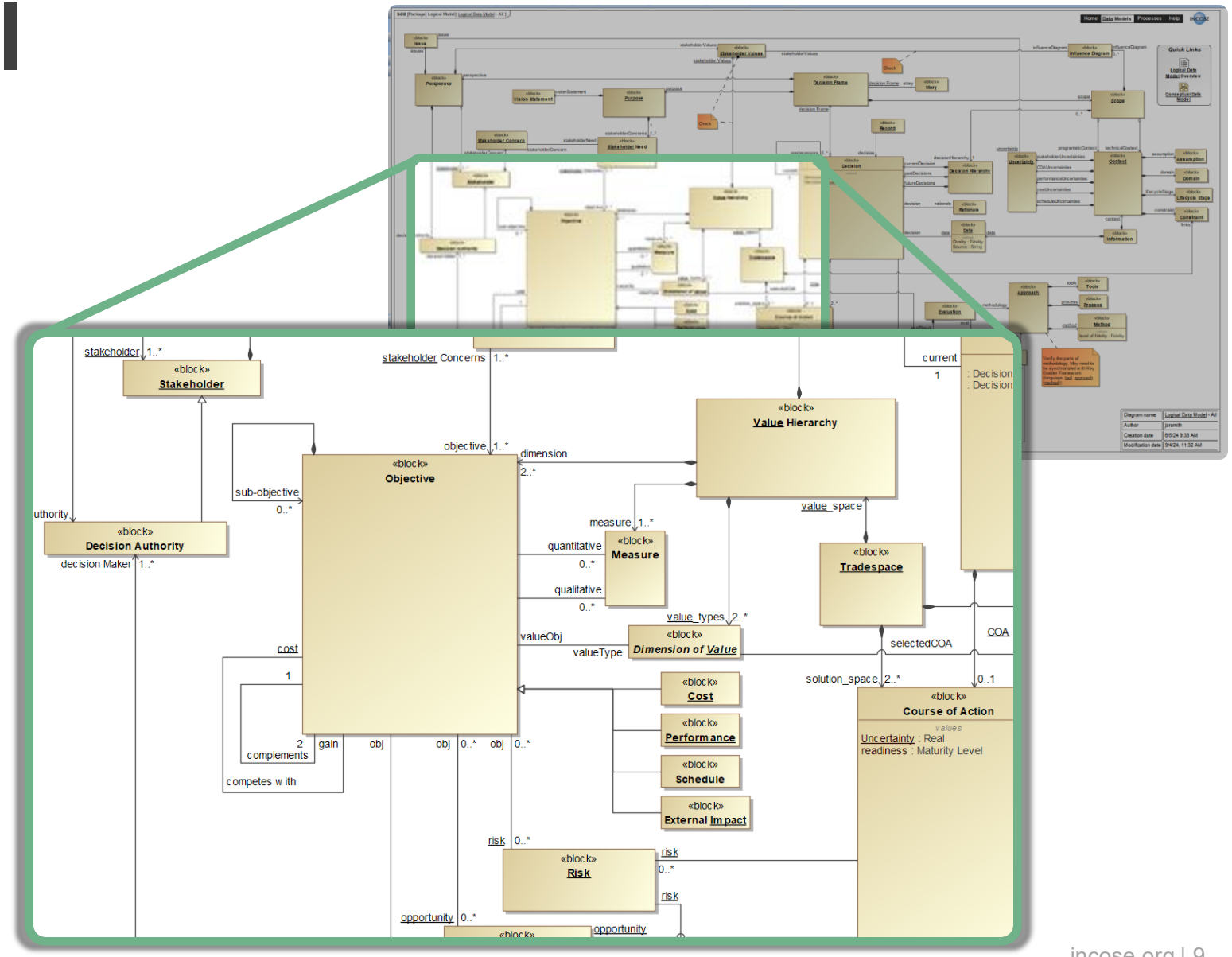
What is the DADM?



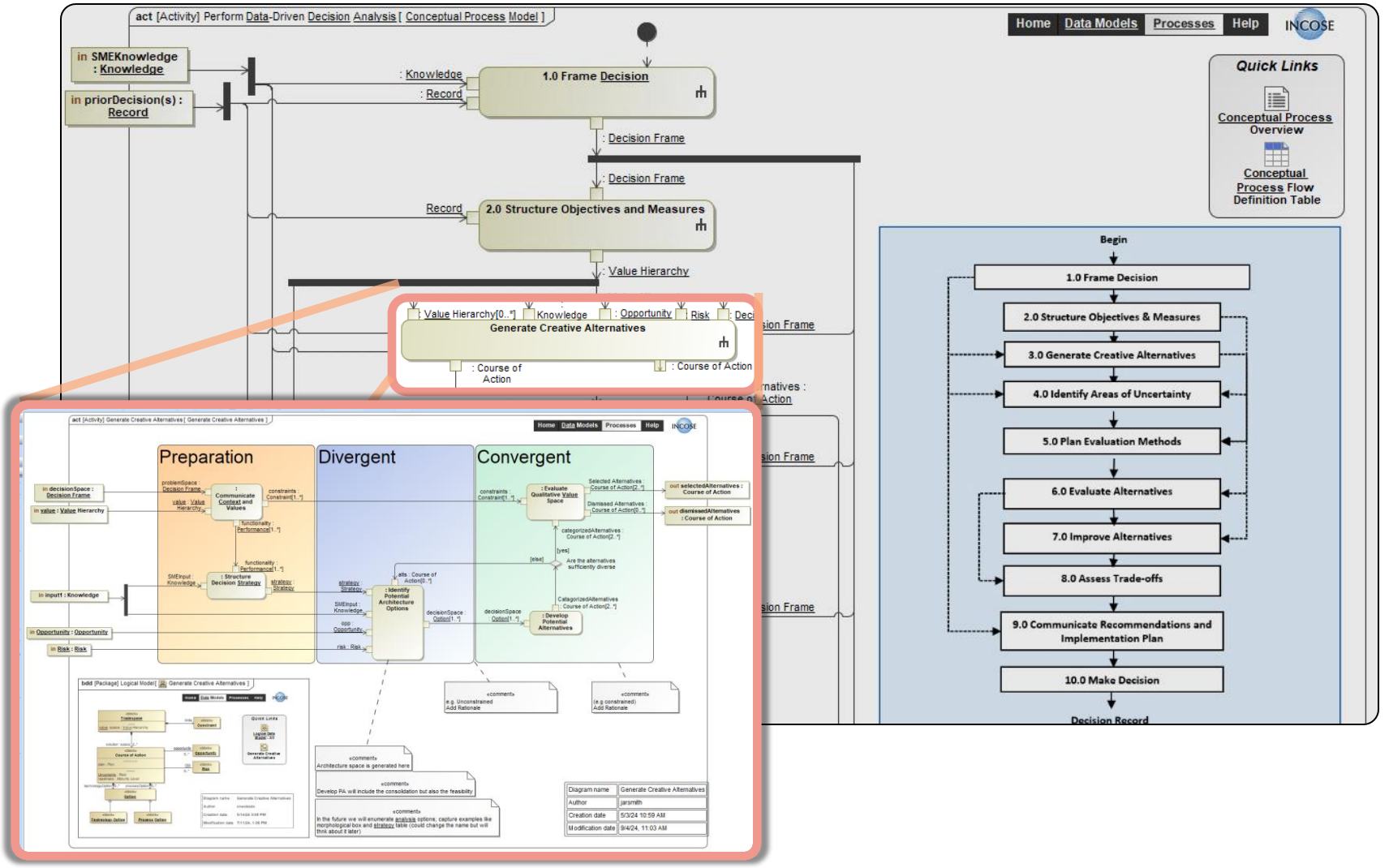


The Data Model

- **Explicitly define the data** needed for a quality decision
- This definition **enables consistency** across decisions
- This consistency **enables the reuse of past decisions** in future decisions
- This chain of decisions **enables real analytics on decision quality and program outcomes** for an organization



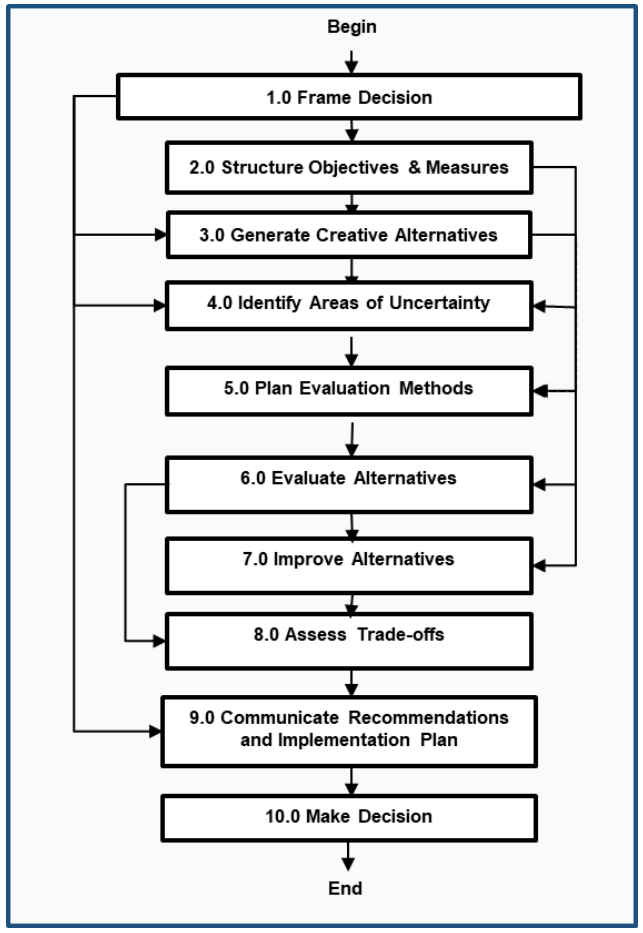
The Process Model

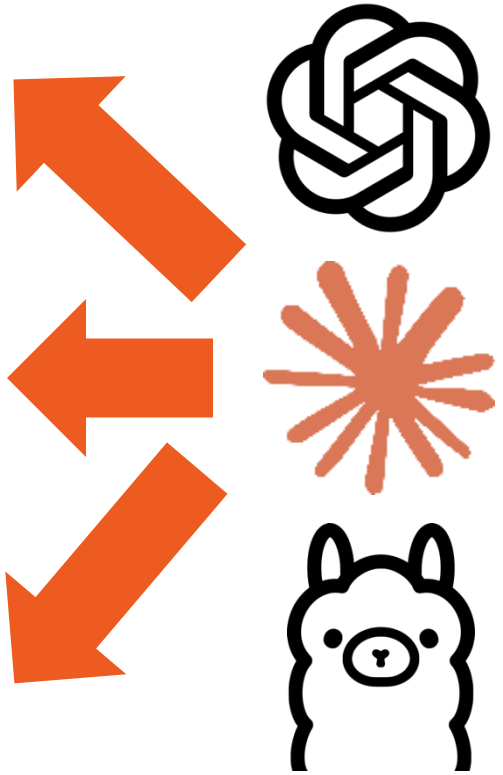


- Leverages DAWG expert experience to **definitively capture the decision analysis** process
- **Validates the data model** by describing the data exchanged between all activities
- Aids users in **performing consistent decision analyses** and serves as the **foundation for decision automation**

Why this Matters

- Refined by the experts
- Enables clear, consistent, repeatable execution
- AI Enabler
  - AI Decision Making
  - AI Decision Audits



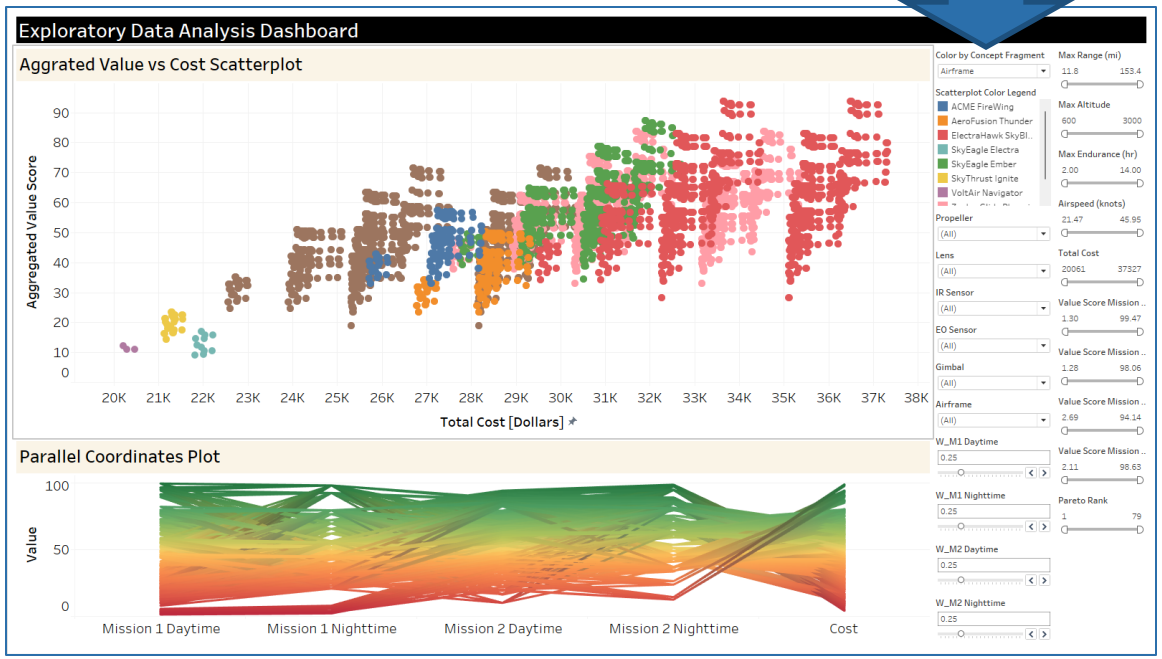


Why We Need You

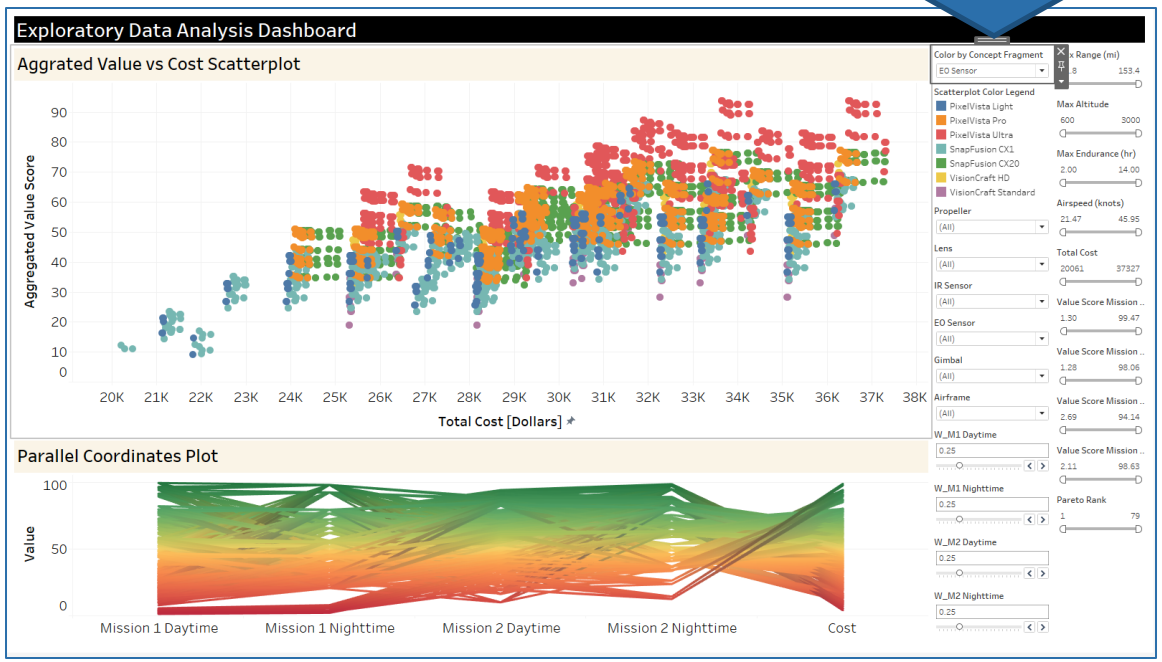
- Decision Makers
- Process Developers
- Practicing Systems Engineers
- Researchers
- Early-Career Professionals
- Tool Integrators and Developers

Case Study Development

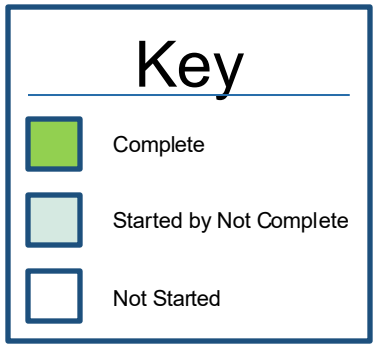
Color by Airframe



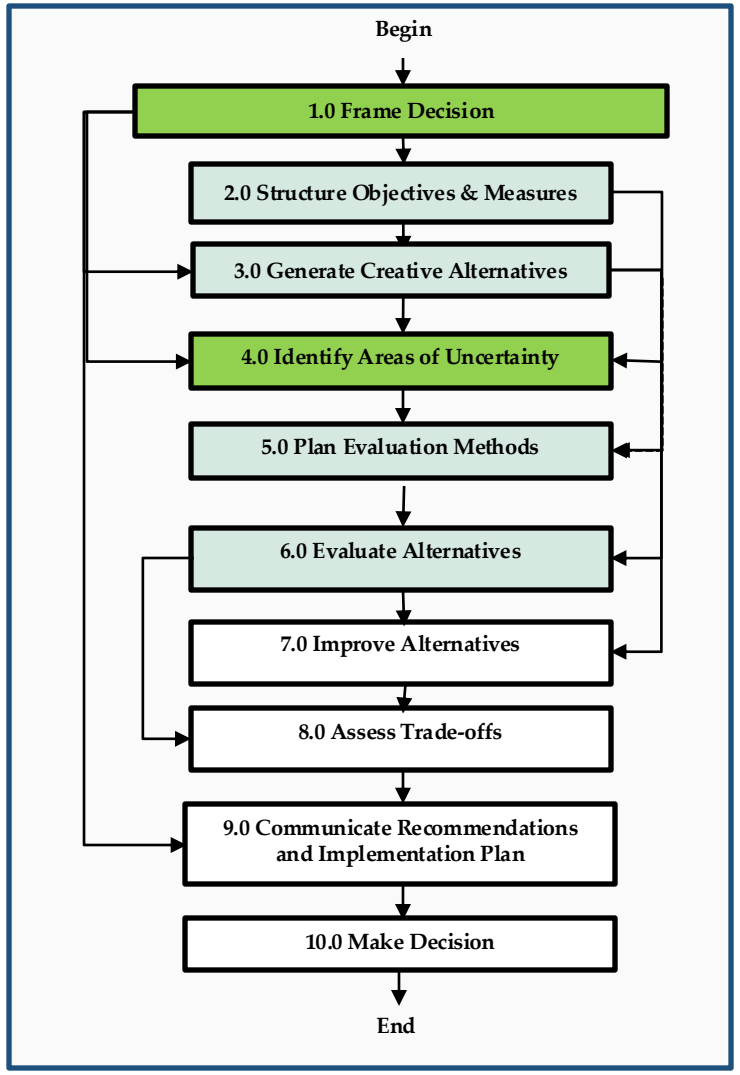
Color by EO Sensor



Case Study Status



Process Model



Value-Added Data Artifacts

Stakeholders, **Stakeholder Need**, **Decision Context**, **Scenarios**, Use Cases, Vision, Issues, Decision Hierarchy, **Influence Diagram**, **Uncertainty**, **Decision Frame**

Values, Decision Objectives, **Value Measures ((Performance, Cost, and Schedule)**, Value Hierarchy, Requirements

Context, **Value Hierarchy**, Qualitative Value Space, **Options**, **Potential Alternatives**

Decision Frame, **Value Hierarchy**, **Scenarios**, Use Cases, **Uncertainties** (Stakeholder, Performance, Cost, Schedule, Other, Courses of Action, Previous)

Previous Systems Analysis Plan, Value Hierarchy, Courses of Action, **Data**, **Models**, **Simulations**, **Assessment Flow Diagram**

Assessment Flow Diagram, **Quantitative Value Model**, **Alternative Values**, **Deterministic Analysis**, and **Probabilistic Analysis**

Risk Treatments, **Opportunity Treatments**, **Revised Courses of Action**, Reevaluate Alternatives

Value Hierarchy, Courses of Action, **Tradespace Analysis** (Deterministic, Probabilistic), **Trade-offs**

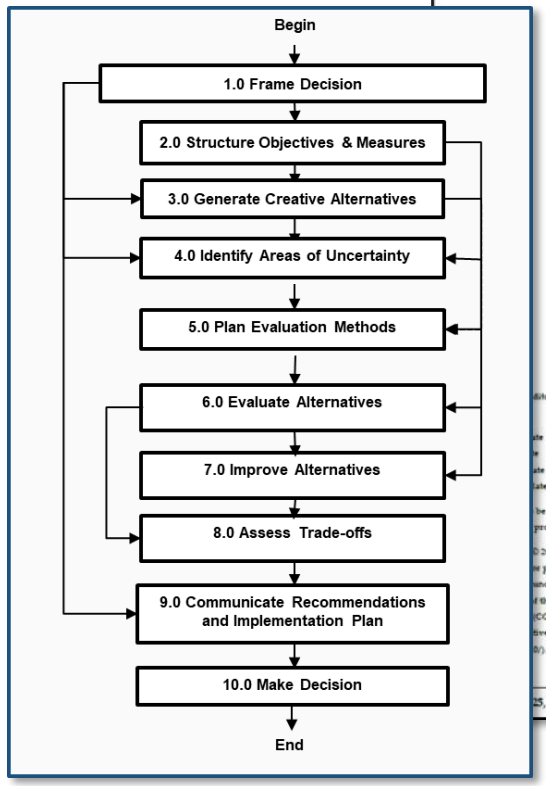
Decision Frame, Value Hierarchy, Courses of Action, Requirements, **Decision Story**, **Recommendation**, **Risks**, **Implementation Plan**

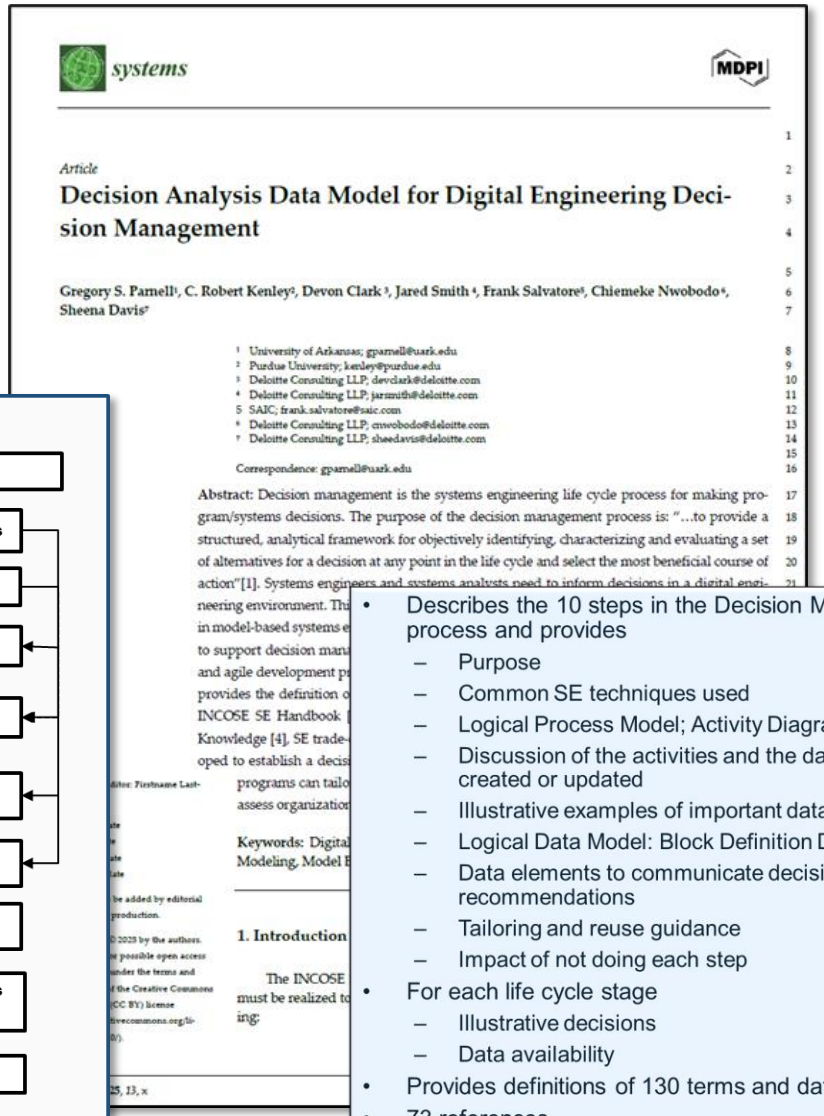
Decision Hierarchy, Value Hierarchy, Tradespace, Course of Action, Rationale, Implementation Plan, **Decision Record**

Where We Are

Systems Journal Paper

A team of DAWG authors have produced a detailed paper that documents the development of the DADM, describing the data it contains and why a model like this is needed





systems

MDPI

Article

Decision Analysis Data Model for Digital Engineering Decision Management

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5 SAIC; frank.salvatore@saic.com
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Correspondence: gparnell@uark.edu

Abstract: Decision management is the systems engineering life cycle process for making program/systems decisions. The purpose of the decision management process is: "…to provide a structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives for a decision at any point in the life cycle and select the most beneficial course of action"[1]. Systems engineers and systems analysts need to inform decisions in a digital engineering environment. Th
in model-based systems e
to support decision mana
and agile development p
provides the definition o
INCOSE SE Handbook
Knowledge [4], SE trade-
oped to establish a decis
programs can tailo
assess organizatio

Keywords: Digital
Modeling, Model

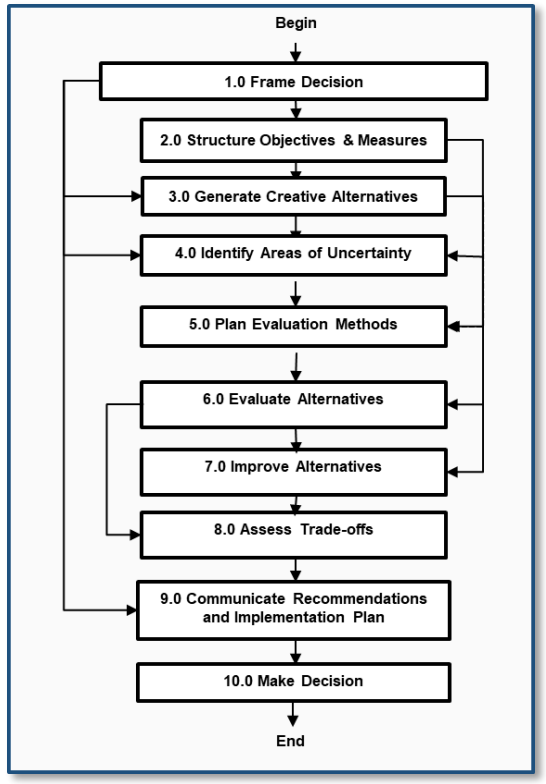
1. Introduction

The INCOSE
must be realized t
ing:

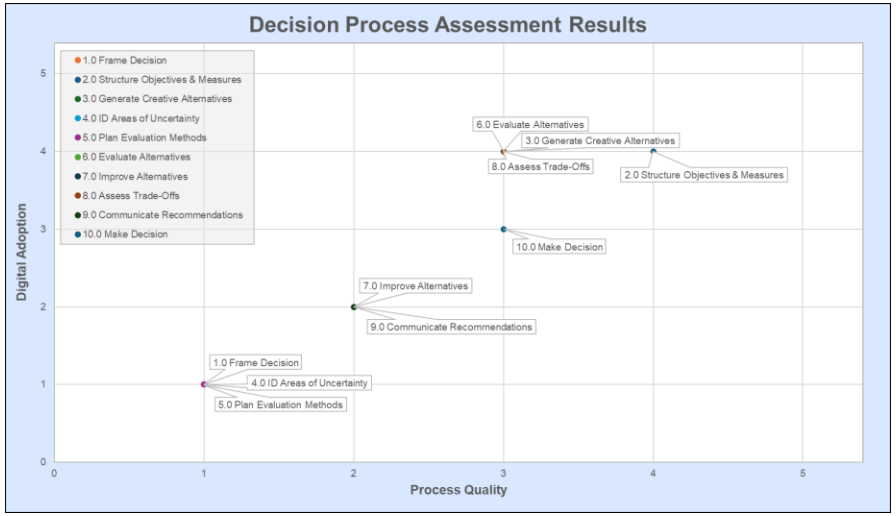
- Describes the 10 steps in the Decision Management process and provides
  - Purpose
  - Common SE techniques used
  - Logical Process Model; Activity Diagram
  - Discussion of the activities and the data artifacts created or updated
  - Illustrative examples of important data artifacts
  - Logical Data Model: Block Definition Diagram
  - Data elements to communicate decision recommendations
  - Tailoring and reuse guidance
  - Impact of not doing each step
- For each life cycle stage
  - Illustrative decisions
  - Data availability
- Provides definitions of 130 terms and data items
- 73 references

Decision Process Assessment

Evaluate your organizations decision making capability



Scale	Quality of Process	State of Digitization
5	100% of Value-Added Data Artifacts	Not Performed
4	75% of Value-Added Data Artifacts	Informal/Ad Hoc
3	50% of Value-Added Data Artifacts	Repeatable/ Documented
2	25% of Value-Added Data Artifacts	Digitally Captured
1	Step not used	Digitally Captured/ Informs Analytics



How to Get Involved

Your constraints are the point

- Decision Makers
- Process Developers
- Practicing Systems Engineers
- Researchers
- Early-Career Professionals
- Tool Integrators and Developers

Future Roadmap

- Case Studies/Example Implementations
  - Process Tailoring
  - Auditable AI Use Case
- BPMN Translation
- Update Existing Process Definitions
  - SEBoK
  - INCOSE SE Handbook
  - …
- Refine Data Descriptions
- Pursue Formal Definition/Standard…

How to Get Involved

- Got a potential case study? **Be in our Pilot program**
- Want to assess your decision process? **Download our Assessment Guide**
- Want to learn more? **Visit our Working Group intranet site**
- Want to be a part of this work? **Join our Working Group sessions**

Contact Me

Jared Smith

DAWG Co-Chair
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Thank You

Questions?

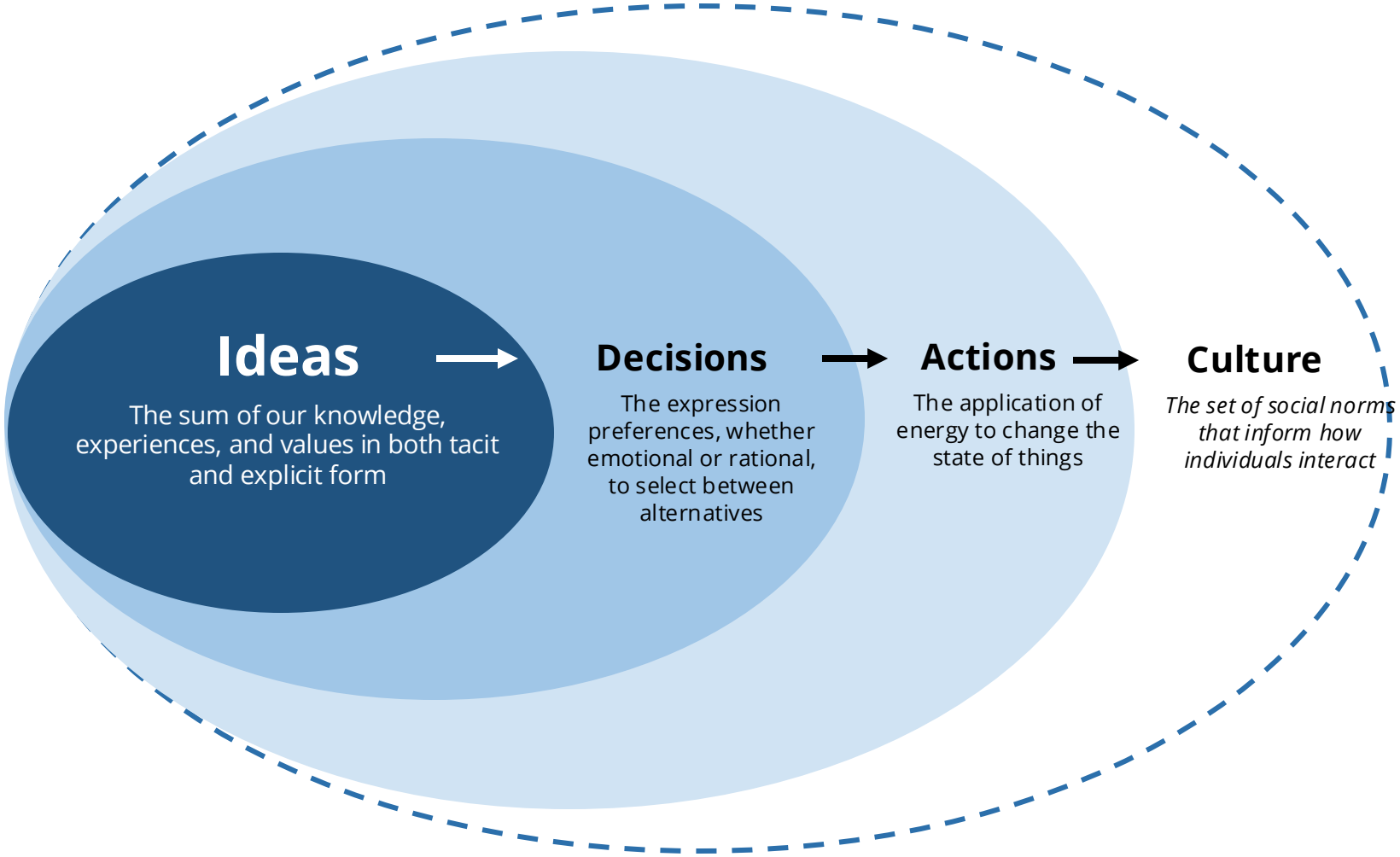
35th Annual INCOSE international symposium

hybrid event

Ottawa, Canada
July 26 - 31, 2025

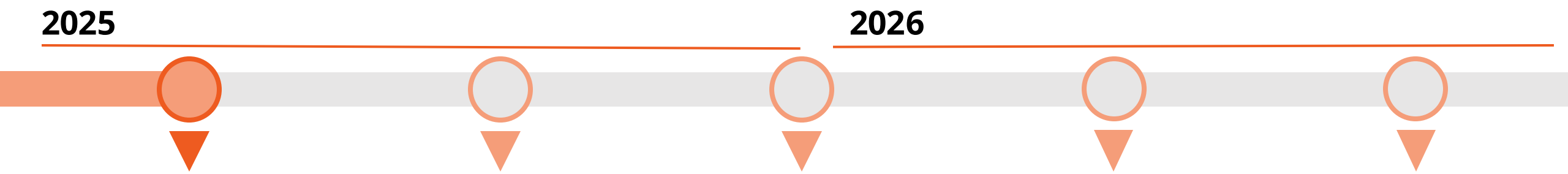
Devon Egg Chart

Ideas necessitate Decisions. Decisions enable Actions. Actions influence Culture



DADM Example Implementation

A major request from users and early reviewers is an example of the DADM being applied. Here is our roadmap for developing and releasing this example in SysML.



Capture/Refine Case Study

Engage stakeholders to clarify needs and expected outcomes; define decision context, boundaries, and success criteria to guide solution development.

Functionally Decompose & Define Physical Design

Break down system functions and map them to logical components; specify technologies, interfaces, and data flows for physical implementation.

Build & Integrate DAS Prototype

Develop and assemble system components; iteratively test, validate, and refine the prototype with sample data and stakeholder feedback.

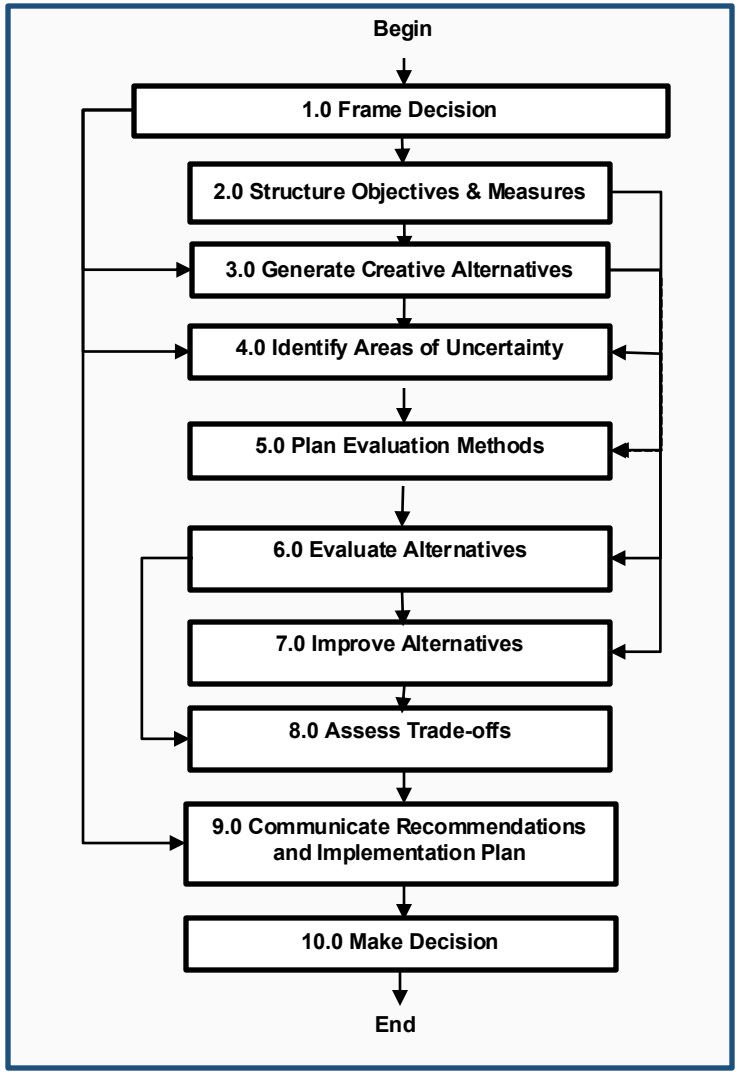
Demonstrate Initial Prototype

Showcase end-to-end prototype use; gather feedback, validate requirements, and assess system usability and effectiveness.

Refine, Document, and Release

Incorporate feedback; finalize design, prepare documentation, reusable templates, and guidance for broader practitioner adoption.

Assessing Your Decision Process



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