INCOSE

Research Question: How can Humans and Al Form Effective Engineering Teams?

INCOSE Augmented Intelligence for **Systems Engineering**

International Council on Systems Engineering (INCOSE) Challenge Team, Chartered 2018

Purpose: Effectively pair human and machine intelligence to improve systems engineering

The goal of the Augmented Intelligence for Systems Engineering challenge team is to further the understanding of how computational approaches, such as artificial intelligence, machine learning, and data science, can collaborate with human systems engineers to measurably improve the system engineering effort. The challenge team will seek out approaches that enhance human capabilities in systems engineering.

What is Augmented Intelligence for SE?

A complement, not a replacement, to human intelligence

Helping humans become faster and smarter at the tasks they're performing

> AuI = Human + AI> Human > AI

Team:

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Cited:

(1) Schindel and Dove, "Introduction to the ASELCM Pattern", in Proc. of INCOSE 2016 International Symposium, Edinburg, UK, July, 2016. (2) Why is Human-Model Interactivity Important to the Future of Model-Centric Engineering?, NASA/JPL Symposium & Workshop on Model-Based Systems Engineering, Dr. Donna H. Rhodes



What cognitive challenges exist for model-informed decisionmaking?



Acquisition Process Supply Process NAC-14 **Organization Project-**Enabling

Agreement

Life Cycle Model Management Proces Infrastructure Management

Management Human Resource Management

Project Portfolio

Quality Management

Knowledge Management

How do humans interact with models and model-generated information?

How do humans interact with each other using models?

What are essential human roles in model-centric environments?

How can interactivity of humans and models be made more effective?

The ISO/IEC 15288 is a systems engineering standard covering processes and lifecycle stages

Measurement Process

Maintenance Process

Project Planning Process

Risk Management

Business or Mission

Analysis Process

Architecture

Development Process

mplementation Process

Transition Process

Technical Management

Project Assessment and

Control Process

Configuration

Management Process

Technical

Stakeholder Needs &

Requirements Definitions

Process

Design Definition

Process

Integration Process

alidation Process

Quality Process

Disposal Process

Decision Managemen

Information Management

System Requirement

Definition Process

System Analysis Process

Verification Process

Operation Process

System 3: Al as a **co-manager** for cross-domain efficiency, effectiveness and innovation for System 2



Trust Relationship: AI will enhance understanding and discovery to better communicate, collaborate, and share critical information about engineering processes in timely manner .

Open Questions: How to maintain trust relationships in a Digital Engineering environment with Model to Model interactions? Must "through-person" be human? How does conceptual model nge if not?

Through Person Trust User without technical insight into model may rely on "through person" as basis for trusting

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System 2: Al as a collaborator in the system lifecycle processes for System 1



Trust Relationship: Models & AI will provide unbiased insights into patterns expressed by data, and assist the engineering team in applying learned patterns, in a manner than improves the technical and operational aspects of systems engineering.

Conceptual Model for "Through-Person" Trust:

Social Dimensions of Trust

System 1: Al embedded in target system / target environment



Trust Relationship: AI will perform reliably and predictably under anticipated conditions, and will gracefully degrade when unable to perform tasks.

Technical Trust: Transparency Code / Data Inspection Traceability Visualization

Social Trust: Credibility Relationships Origin Reputation