



SYSTEMS
ENGINEERING
RESEARCH CENTER



ACQUISITION INNOVATION
RESEARCH CENTER

SERC PERSPECTIVE: AI4SE & SE4AI 2025

Zoe Szajnfarber, SERC Chief Scientist, the George Washington University





COLORADO STATE
UNIVERSITY



THE GEORGE
WASHINGTON
UNIVERSITY
WASHINGTON, DC

THE UNIVERSITY
OF ARIZONA

University of
Massachusetts
Amherst

STEVENS
INSTITUTE OF TECHNOLOGY

OLD DOMINION
UNIVERSITY



PURDUE
UNIVERSITY

Georgia
Tech.

NORTH CAROLINA
AGRICULTURAL AND TECHNICAL
STATE UNIVERSITY

THE OHIO STATE UNIVERSITY

TEXAS A&M
UNIVERSITY

THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE

NC STATE
UNIVERSITY



UNIVERSITY OF
MARYLAND

VIRGINIA
TECH.

PennState

GEORGETOWN
UNIVERSITY

AUBURN
UNIVERSITY

GEORGE MASON
UNIVERSITY

Network of collaborators with complementary
strengths and perspectives

Digital and Data-Driven Systems



Trusted Systems

Enterprises, Systems of Systems, and Missions



Workforce Development

Role for Systems Engineers in AI space

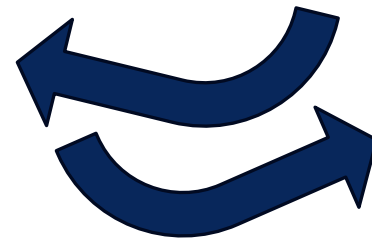
AI4SE

and

SE4AI

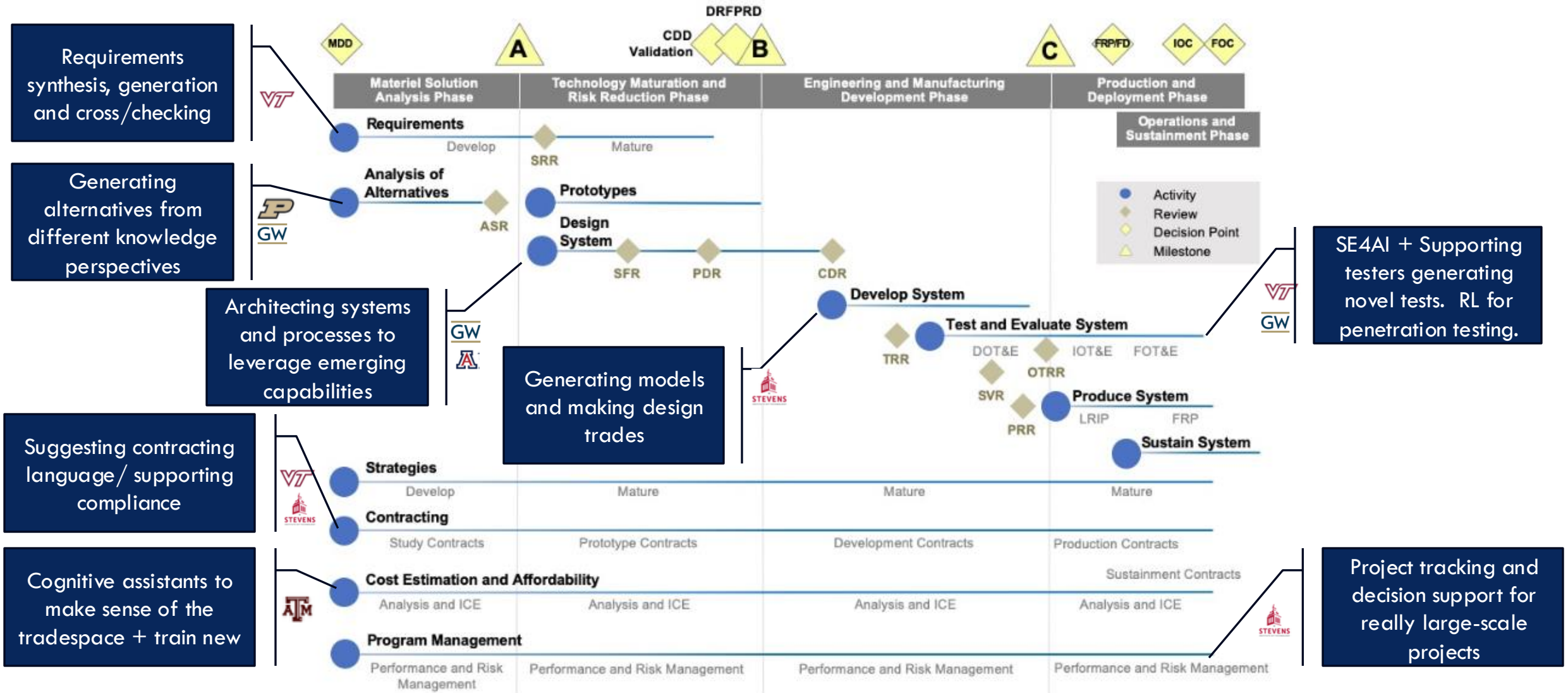
Focuses on **application of AI in support of systems engineering practice and outcomes**, enabling enhanced decision-making, optimization, and efficient effort allocation.

Focuses on **leveraging systems engineering principles to develop AIES that are safe, robust, and efficient AI systems**, while extending them in response to the nature of AI enabled systems.



SE4AI applies to AI4SE too, but types of AI tools tend to be different
... and AI4SE might change what SEs do too.

(Traditional) Lifecycle View of Major Capability Acquisition



TWO SNAPSHOTS OF ONGOING EFFORTS

Efficiency, Accessibility, and Reproducibility

Artifact Generation

- Requirements documents, ICDs, ConCops, etc.

SysML Translation and Model Manipulation

- SysMLv1 to SysMLv2, Text-to-SysML, etc.

Model Interpretation

- Explain structural/behavioral models to non-expert stakeholders

Knowledge Transfer

- Bridge communication between system modelers and SMEs

Concept Development

- Act as brainstorming partner using chain-of-thought prompts

Automation of Repetitive SE Tasks

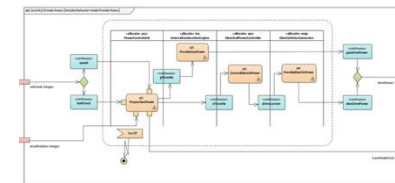
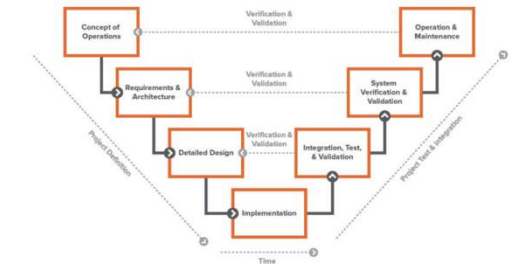
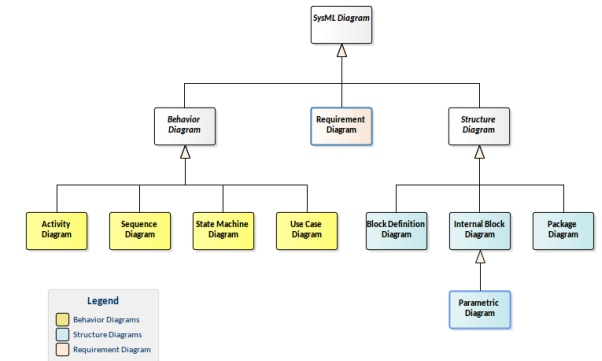
- Generating traceability matrices from requirements to design elements, etc.

SysMLv2

- Generation, manipulation, translation, etc.

Mackandal paragraph

Not much is known about Mackandal and he is almost considered legend. However, this is what we know about him. At age twelve, around 1742, he was taken from his homeland of Africa to Saint-Domingue so some stupid guy named Lenormand De Mery could make money off of him. Mackandal worked on a sugar plantation, which was exceptionally more brutal than most plantations. He ran away for twelve years, which is extremely impressive, seeing as if a slave ran away for three months or more, the punishment was death. He became an important leader of the black population of Saint-Domingue and later almost succeeded in poisoning the jerbo slave owners. He was, unfortunately, burned at the stake.

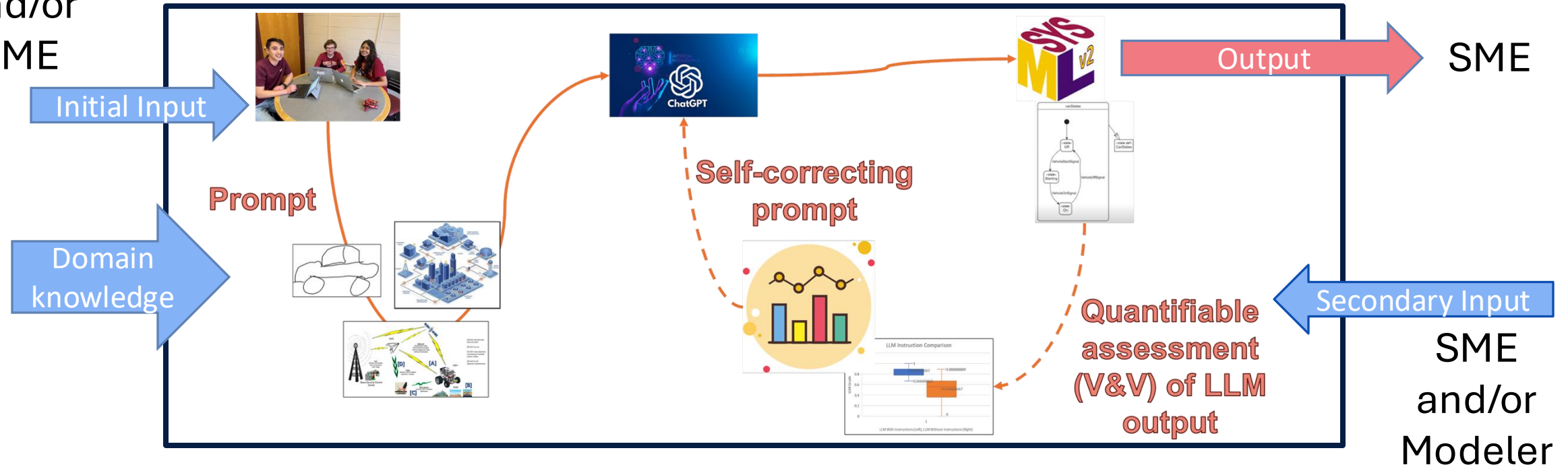


Called Laila by Morocco and Turo by Spain, the island is claimed by both countries as their territory. Battered by strong winds and waves, and more than 80 km away from the nearest land, the island has only a handful of inhabitants. There are some fish stocks and hopes of natural resources, but the appeal for both countries is largely symbolic: a struggle of wills between independent Morocco and its former colonial ruler, Spain.

Both Morocco and Spain insist they have long-standing historical ties to the island. Morocco says Laila was recognized as Moroccan territory in 1640, after a run-in between Moroccan and Spanish fishing boats. The island was formally placed under the jurisdiction of Morocco in 1890 but was annexed by Spain in 1900, just before Spain's colonization of the Moroccan peninsula. Morocco asserts Laila was rightly restored to Morocco after World War II, and a Moroccan coastguard detachment has been stationed there since 1947 "Laila is an integral part of Moroccan territory historically, geographically, and under international law," Moroccan government argues.

However, Spain claims that it established sovereignty over the island by the mid 17th century when Spanish sailors used the zone as a port and a fishing ground. Spain incorporated the island in 1900. Spain contends that Morocco Republic acts illegally because the island was not mentioned in the Algeria Peace Treaty after World War II as land to be returned to Morocco. "The occupation of Turo by Morocco is an illegitimate behavior undertaken on no basis of international law," Spain's Foreign Ministry says.

Modeler
and/or
SME

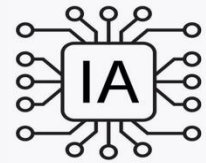


Thrusts

1. Text to text
2. Text/image to SysMLv2 code
3. SysML image/code to text
4. SysML V1 to V2
5. Systems engineering expertise

Problem: Many previously developed (technically effective) AI-based tools were not being adopted quickly. Wanted tools, or HAI tool-chains that supported core functions.

Prior Workflow



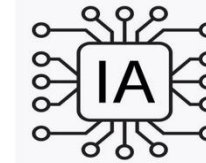
Tool identifies discrepancies (e.g., proposed labor rates/hours vs. billed) dumps in spreadsheet.



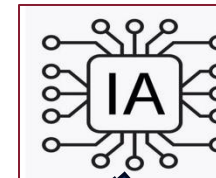
KO, reviews these and enforces (or doesn't enforce) with contractor.

Issue: lack of enforcement despite significant resources

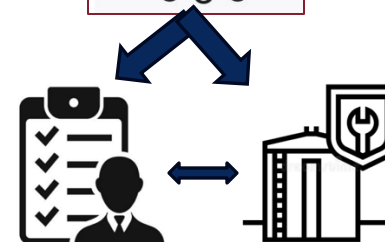
Alternative Workflow



Tool1 identifies discrepancies (e.g., proposed labor rates/hours vs. billed) dumps in spreadsheet.



Tool2 reviews discrepancies an email addressed to KO and contractor prompting an explanation



Potentially transforms adversarial to collaborative process to explain discrepancy

“AI” are good at:

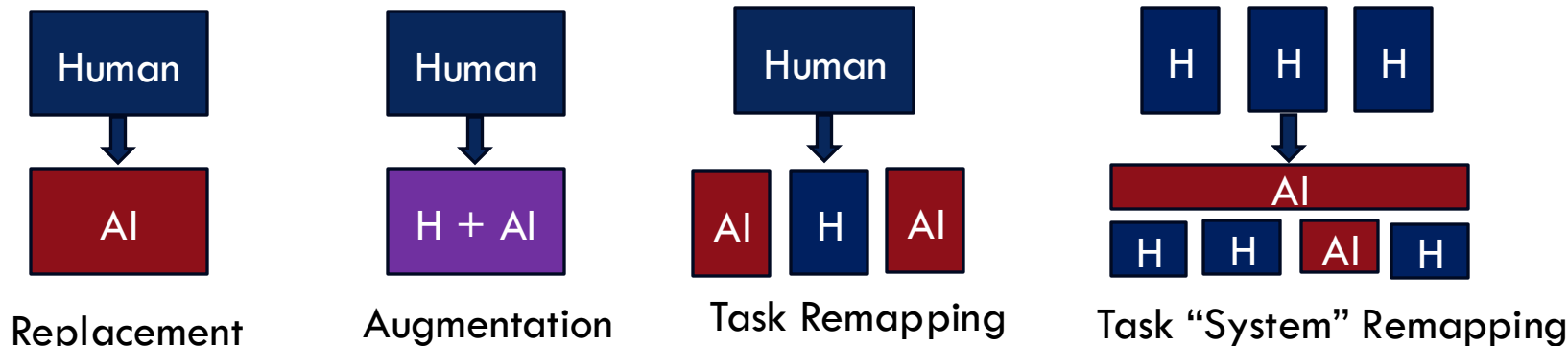
- Translating among concepts in different languages (incl. SySML)
- Scaling repetitive tasks, making it possible to pay attention to many more variables
- Identifying patterns within datasets
- Supporting interactive dashboards and data visualization more broadly

They’re getting better at:

- Synthesizing text
- Generating artifacts, depending on the level of structure and correctness needed

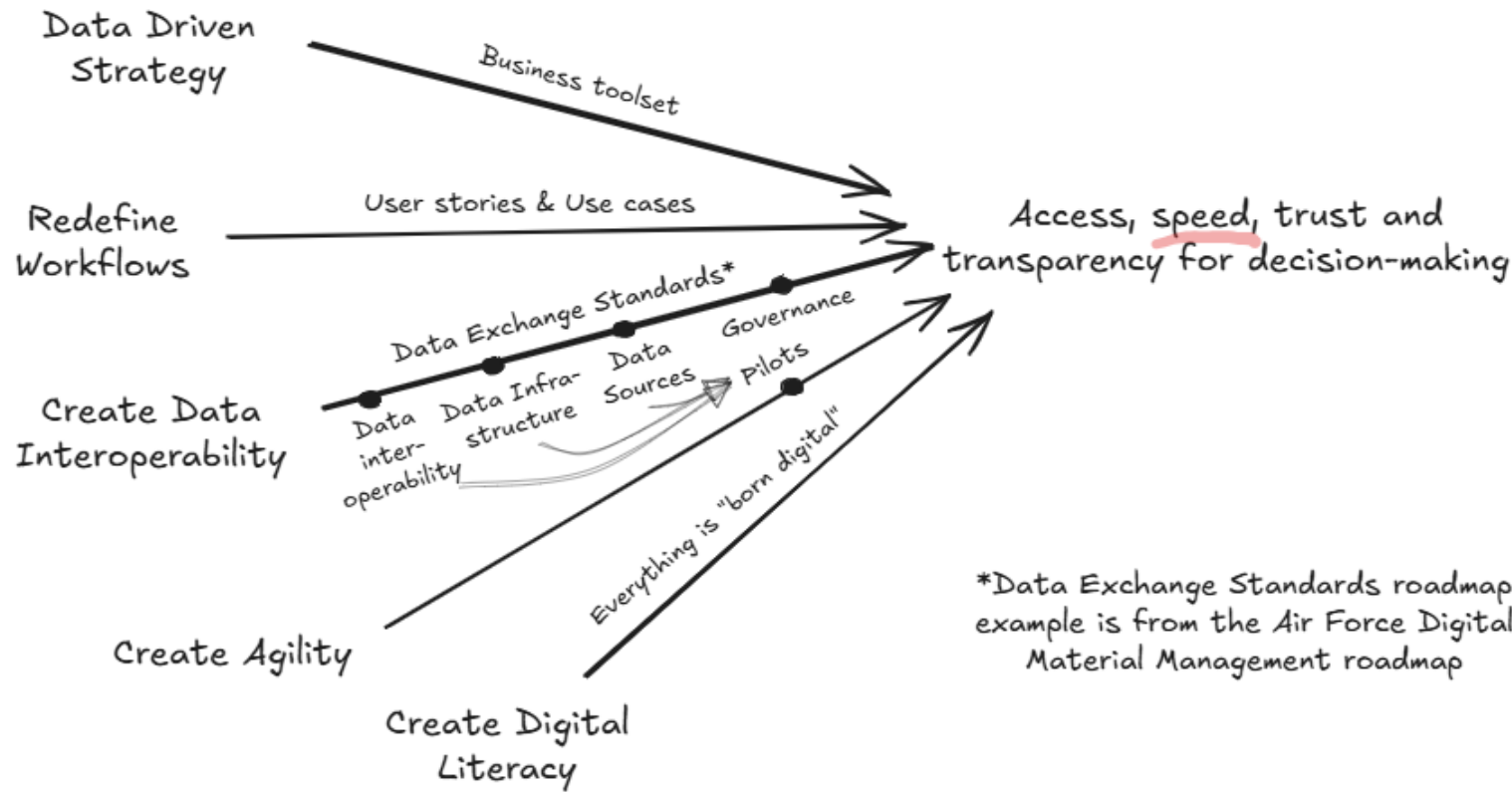
These apply across a wide range of **tasks** across defense acquisition...

... but, most tasks that humans do require some of each lists + judgement and prioritization



TOWARDS DIGITAL TRANSFORMATION

DIGITAL TRANSFORMATION BEYOND NEW DATA AND TOOLS



Structural (Syntactic)

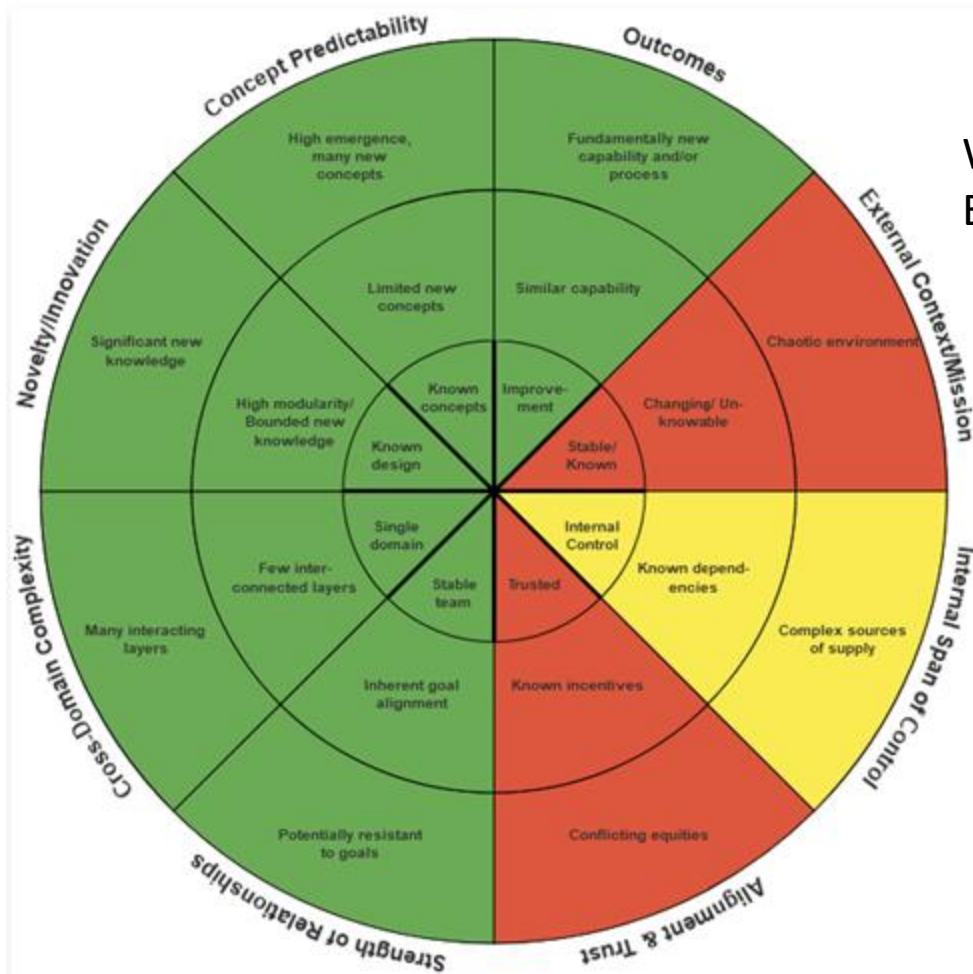
Structure Data for Machine-Readability and Exchange

Semantic

Provide Consistent Meaning and Understanding for Computation, Synthesis, and Actionability

Pragmatic (Workflow)

Integrate these concepts in the Context of Enabling Workflow



When Click
Each Section



Back

External Context/Mission

Score: 20

Uncertainty: 5

The external environment in which a business operates, including

Components:

- Stakeholder Analysis: Identifying and understanding the needs,
- Market Research: Gathering and analyzing data about market t
- Regulatory Compliance: Ensuring adherence to legal and regul
- Strategic Alignment: Aligning business activities and decisions

FTC says anonymous messaging app failed to stop "rampant cyberbullying" - The Verge

Lauren Feiner

The Federal Trade Commission and Los Angeles District Attorney's Office reached a \$1 million settlement with NGL for allegedly violating a kids privacy law and using deceptive marketing.

[View Article](#)

Boeing sold just three passenger jets in the past month - CNN

Chris Isidore

Boeing said it sold just 14 new jets in the past month, with most of those coming as freighter sales. And one of those was to replace the plane that saw a door plug blow out mid-flight just over six months ago.

[View Article](#)

Walmart's rival Amazon Prime Day is going on now. Check out the 14 best deals to shop - CBS News

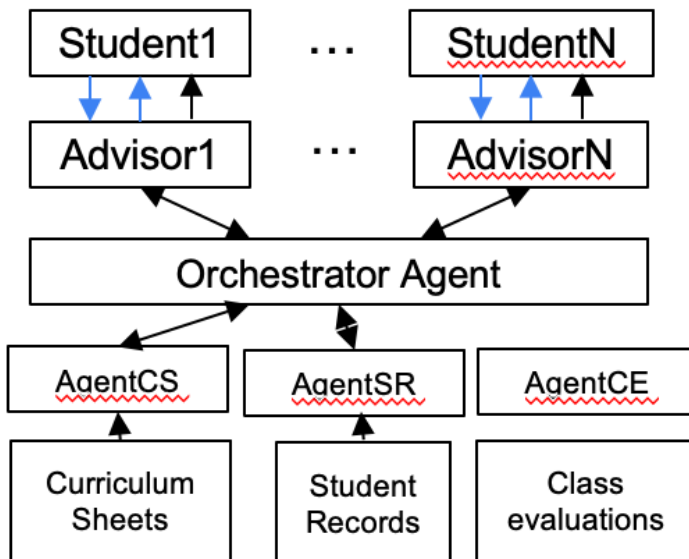
Meredith Gordon, Brittany Vincent

You don't need to wait for Amazon Prime Day to save. Walmart Deals is serving up great savings right now.

[View Article](#)

Two (of many) example workflow integrations of AI-supported student advising

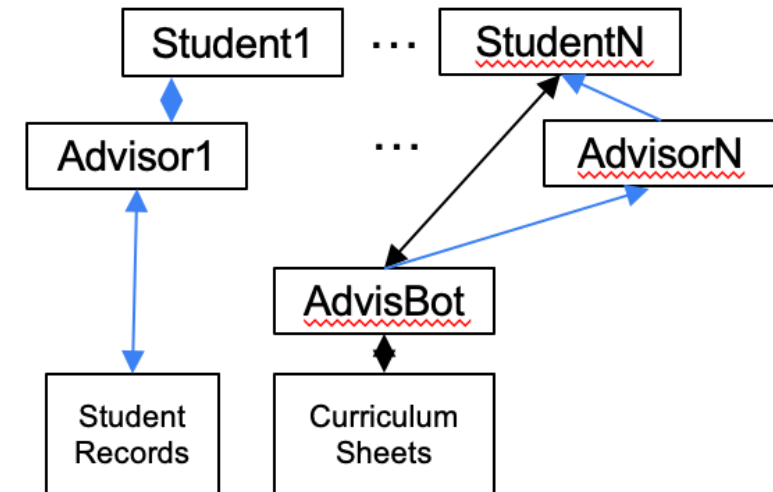
1. AI in the background



Key Structural Differences:

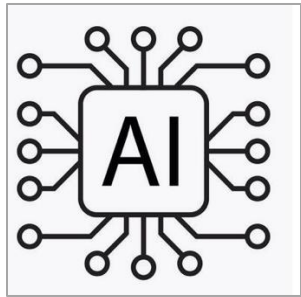
- Who decides what is a good question for an advisor vs. AI
- Whether students have direct engagement with AI (opportunity to mitigate risk)
- Scope of access to sensitive data for AI agents (opportunities to intermingle/disclose)

2. Available ChatBot



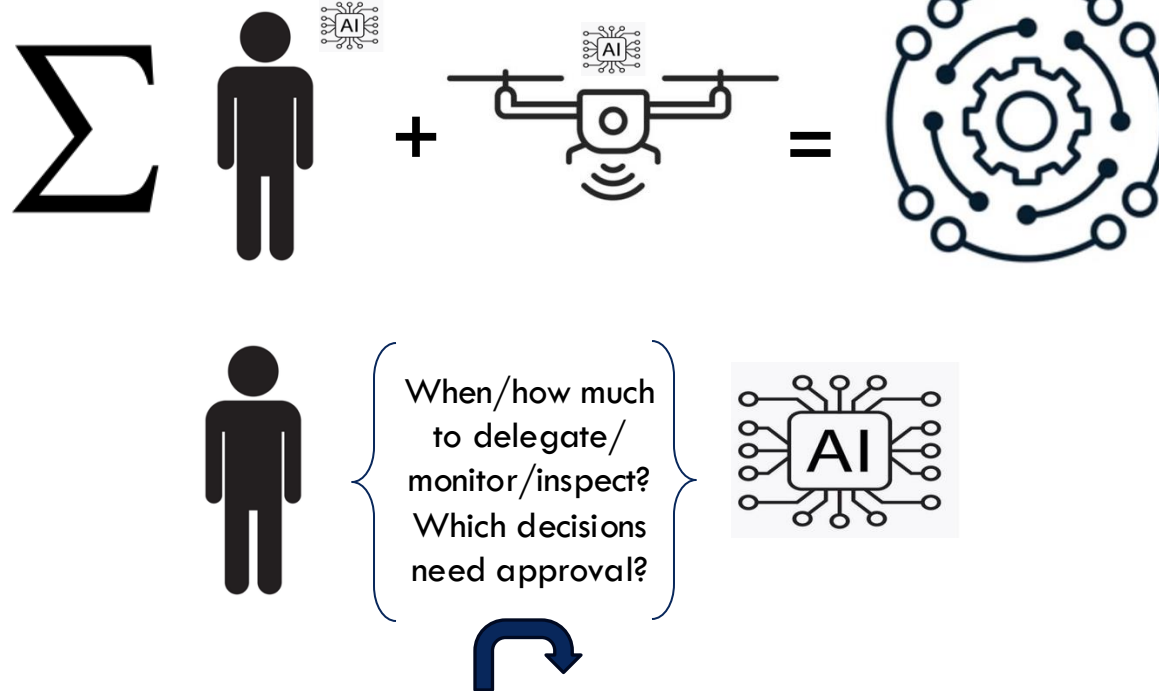
Same AI-capability, very different performance-risk tradeoffs, "systems" T&E

Is the “AI” trustworthy?



System is
more than AI

Trust is relational
(and human)



Implications for each action,
and over time for, e.g.,
formation of judgement

- **AI is not itself a capability; it is (potentially) a critical enabler of:**
 - Many new warfighting capabilities; and overall efficiency and effectiveness of the Enterprise
 - Need to have confidence that AIES will work when needed, in accordance with legal principles and without introducing new sources of vulnerability. This hinges on humans-AIs interaction at scale.
- **Opportunities at multiple levels:**
 - Task: Existing AI can identify patterns, translate, template, generate and to some extent synthesize. Reliability concerns can be mitigated via workflow integration.
 - Individual workflow: Humans and AI have different strengths; optimal mapping is unlikely to be 1:1 on existing tasks. Characterizing structure and risk/performance tradeoffs is key.
 - System scale: Traditional org design was constrained by decision-maker attention. AI fundamentally changes that. Opportunity to re-think core processes, with AI support.
 - Workforce: New tasks and new modes of HAI integration creates need for different skills. LLMs can be transformative for training and up-skilling too.



www.sercuarc.org/contact-us/

www.acqirc.org/contact/