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Congressional M&S Leadership Summit 2025

Artificial Intelligence and Modeling, Simulation, and Training:

The Issues and Impacts on our Nation's Security and Resiliency

Panel Discussion

Best Practices in AI within MS&T: Examples for Consideration

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Background

- Personal background:
  - PhD in Cognitive/Experimental Psychology and Cognitive Systems Engineering from The Ohio State University
  - Focus on applications of decision making and communication in real world environments
  - Twenty-one years as an applied research scientist at Aptima focused on Command & Control (C2), performance assessment, and human augmentation
- Aptima, Inc.
  - Defense contractor founded 1995
  - Human centered engineering company
  - Deep expertise in applications of AI in complex systems, development and implementation of advanced training technologies, and methods for human augmentation
- Relevance to the current AI “revolution”
  - Fundamentals haven’t changed: there are still humans doing critical work in complex environments mediated by technology
  - What’s changed: Scale and quality of the mediated technologies

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Human-AI Teaming (HAT) to Build AI

- Best Practice: Adopt a human-AI teaming approach to build AI
  - Employ six fundamental principles for the system engineering and design of hybrid systems and digital sidekicks (see next slide)
  - Be attuned to existing artifact development pipelines when injecting AI into current environments
- Why is this a best practice:
  - Addresses the critical gaps that have systematically been shown to yield poor system performance
- Supportive policy/legislation:
  - Use of Human Readiness Levels (ANSI/HFES 400) as a standard for assessing technology programs (See 2025 NDAA)
  - Use of DODI 5000.95 (Human Systems Integration in Defense Acquisition) and SAE 6906.4 (Standard Practice for Human Systems Integration)
  - Focus on having knowledgeable practitioners within organizations for implementation and best practices
- Guardrails:
  - AI literacy as a non-technical guardrail
  - Legislators, Gov employees, program leaders, and other relevant stakeholders should have (a) formal instruction and (b) direct exposure to AI tools

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Extra: Six fundamental principles for system engineering and design of hybrid Human/AI systems

1. **Automate to remove overhead**– When users' brains are not absolutely needed to perform an activity, task, or workflow successfully, sidekicks do it for them. That way, cognitive burden is reduced, and users can focus on what requires human cognition.
2. **Go with my flow**– Automated support that does not fit the workflow creates impediments rather than solve them. Sidekicks adapt to their users' workflow. They exploit opportunities and augment the work to fit. Ultimately, users remain in control and can decide to turn automated augmentations on or off as they please.
3. **Design for trust**– Working in High Intensity, Vital Environments (HIVEs) is hard, both for humans and machines. Thus, digital sidekicks support transparency, are reliable and forthright with information communicated to users, and know their limits so they can stay within their realm of expertise.
4. **Design for feedback**– Users and sidekicks are in it together, for the long run. Sidekicks are built to collect usage data (automatically) and feedback data (on demand, from users) so they can improve both user experience and system performance.
5. **Simplicity over cleverness**– In critical environments with high volumes of complex data, users must benefit from a clear and understandable experience. Sidekicks avoid overwhelming users with data and features, even if that requires foregoing neat and novel capabilities.
6. **Tailored transparency over uniform power**– Data literacy varies across users. Sidekicks tailor data views to their users and their context, rather than provide all bells and whistles to everyone in all things.

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Compound AI

- Best Practice: Adopt a compound AI approach that integrates multiple specialized AI agents, models and evaluation frameworks.
  - Human-AI teaming (HAT) frameworks
  - Advanced AI models (LLMs like GPT-4/LLaMA-3, multimodal foundation models)
  - Specialized AI agents for different functions (e.g., Twister/Detector/Defender agents)
  - Knowledge graphs and retrieval-augmented generation (RAG)
- Why it's best practice? This approach delivers several key advantages:
  - Enhances capabilities through specialized agents working in concert
  - Provides more robust and trustworthy AI through comprehensive evaluation
  - Integrates more effectively with human operators through proven HAT frameworks
- Guardrails/Considerations:
  - Need for systematic vulnerability assessment (as demonstrated in ART-FM)
  - Importance of measuring both AI reliability and human trust development
  - Value of causal analysis in understanding AI system behavior
  - Critical role of human-AI team evaluation in operational contexts

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Extra: Additional Thoughts

- Think of applications of AI as a *Joint Cognitive System (JCS)*
  - Treat a collection of people and technology as a single unit, one that is capable of performing complex work
  - This holistic approach changes the unit of analysis and the questions you'd ask about the suitability of a solution
- What's changed with the rise of Generative AI?
  - AI is now directly involved in sensemaking activities that previously had been a "humans only" activity
  - T&E of systems that use generative AI must look at the JCS in which it is inserted
- The pendulum is always swinging
  - Be wary of "Move Fast & Break Things" in mission critical environments
  - *Also,* be wary of analysis paralysis, irrelevant garden paths, and a compliance mindset
  - We should be cognizant of risk and understand what is tolerable and what isn't
- There is a trade-off between short-term efficiencies and long-term optimization
  - Companies are naturally focused on the short-term because their incentives are quarterly financial earnings
  - Lawmakers must have the long view in policy, regulation, and legislation development
- Definitions are important
  - Two years ago, when non-AI people said "AI" the typically meant machine learning, signal processing, or maybe computer vision
  - Today, when non-AI people say "AI" they almost always mean GenerativeAI
  - How to approach regulation of AI depends on the technology we're referring to, the data used, and the specific application

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