Strategy to Improve the Trust Between Humans and Artificial Intelligence Enabled Air and Missile Defense (AMD) Systems

Author: MAJ Peh Ming Hui

Thesis advisor: Bonnie W. Johnson | Second Readers: Walter A. Kendall and John M. Green

Thesis Objectives

1. Develop AMD Threat Scenarios.
2. Describe trust and human-machine interactions (HMI) of AI-AMD systems.
3. Conduct an in-depth study of trust factors of AI-AMD systems.
4. Propose a strategy to improve the trust between the operators and AI-AMD systems.

AMD Threats: The Use of Automation Gives Rise to a New Paradigm of Complexity in Military Operations

Conventional Threat Scenarios

1. Single conventional missile threat
2. Multiple conventional missiles and/or fighters
3. Advanced weaponry such as hypersonic missile

Non-Conventional Threat Scenarios

1. Incongruent AI-AMD Decision Aid Recommendations from Operator's CONOPs and TTPs
2. Inadequate Trust Resulting in Under-utilization
3. Over-Trust Resulting in Over-Reliance
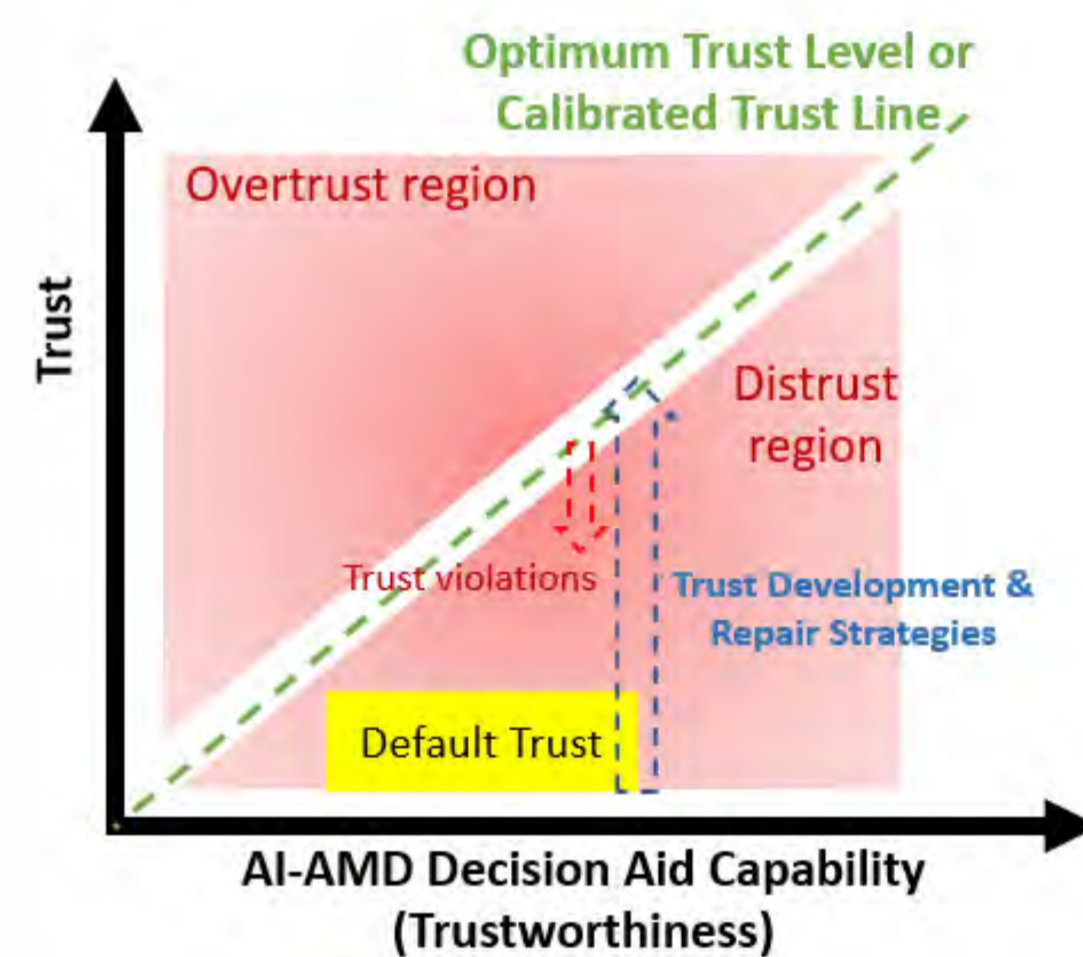
Trust Framework & HMI

System Context. Trust should not be studied in isolation, just between the human and system. The external environment and systems will have to be considered to better characterize trust.

Calibrated Trust. The optimum trust level or calibrated trust occurs when trust corresponds to AI-AMD decision aid capabilities, resulting in proper utilization.
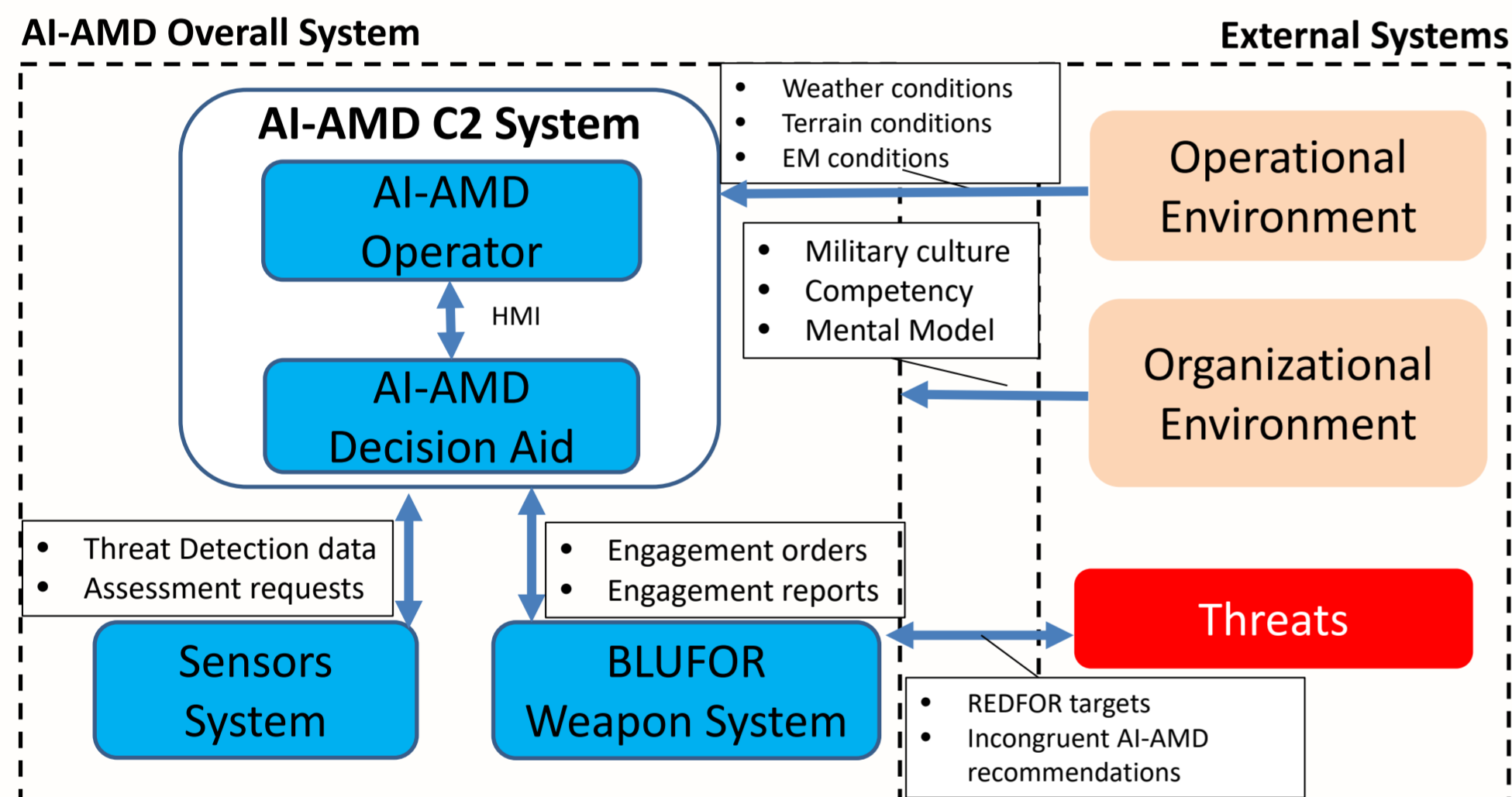

Human-Machine Interactions

1. Deliberate functional allocations between the human and the AI-AMD decision aid based on performance and risks.
2. Each function requires a distinct level of automation.
3. Operators' role has changed from manual controller to supervisory controller.
4. Human and AI-AMD operate as "teammates".

Trust Factors: "Outside-in" Framework with Five Broad Categories

1. External environment that the operator experiences has a considerable effect on trust.
2. Internally, trust is independently influenced by the attributes of the operator and AI-AMD decision aid.
3. The dynamics between the operator and decision aid also have considerable effect on trust.
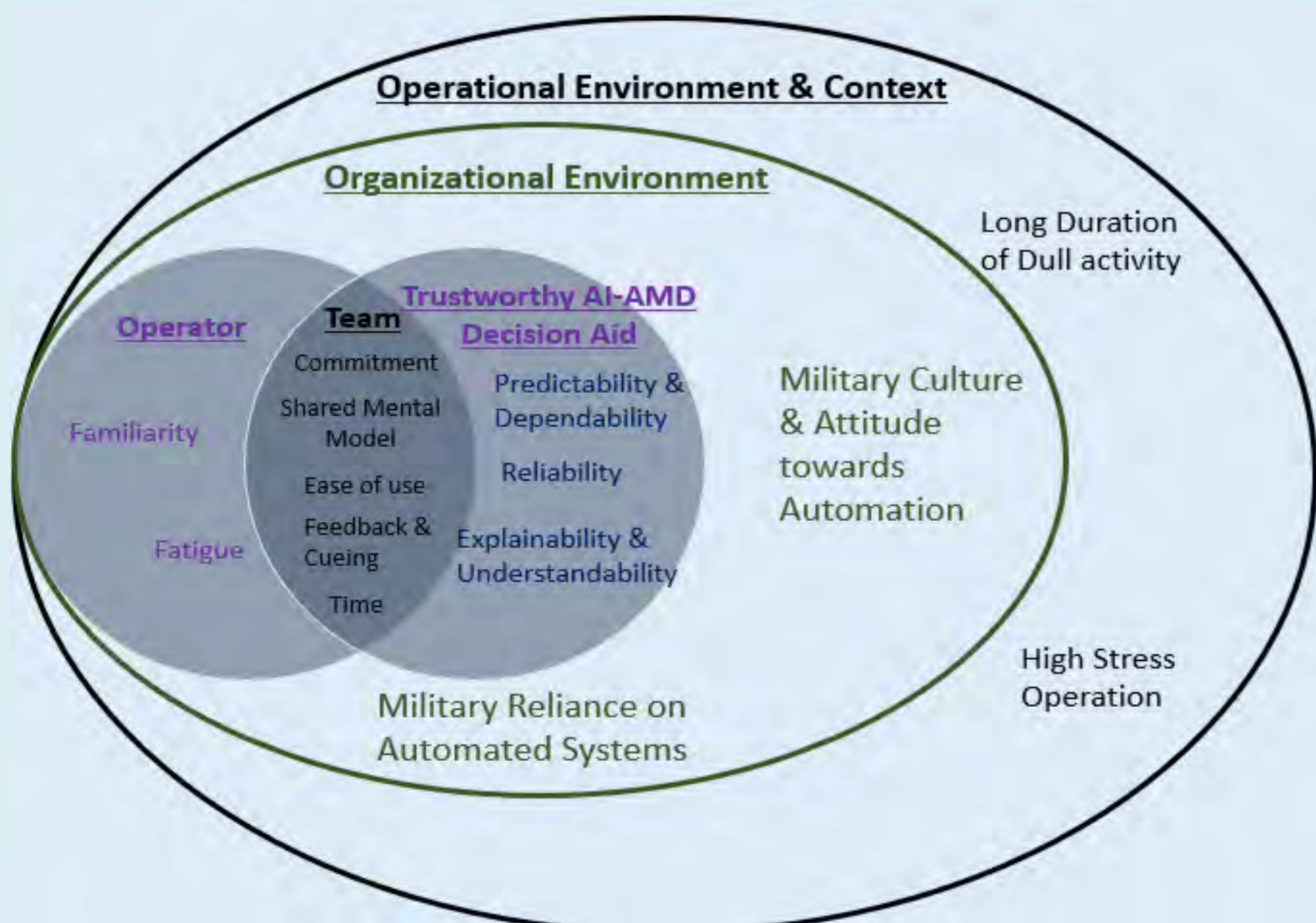
Strategy

1. Three key focus areas to improve (1) humans' perception, (2) AI-AMD decision aid trustworthiness and (3) "team" dynamics.
2. Holistic strategy is needed to achieve calibrated trust, not just on the AI-AMD decision aid attributes.
3. Adopted the U.S. DOTMLPF-P solutioning framework to develop a holistic strategy to improve calibrated trust.

Strategy Articulation Map

Purpose:	Achieve Calibrated Trust between Warfighter Operators & AI-AMD Decision Aid				
Key Focus Areas:	Humans' Perception		"Team" Dynamics		Trustworthiness of AI-AMD Decision Aid
Strategy					
Key Tenets: **DOTM**LPF-P	**Shift in Organizational Paradigm** *Enhance Understanding of Automation*		**Increase in Training Requirements** *Simulate > Live > Refresh*		**Design an Operator-centric AI-AMD Decision Aid**
Supporting Tenets: DOTM**LPF-P**	**Organization** *Set up AMD Institute to Raise-Train-Sustain Operators*	**Leadership** *Increase Automation or AI Literacy*	**Personnel** *Qualified Coaches & Trained Operators*	**Facilities** *Resources & Infrastructural Support*	**Policy** *Review Manpower policy & Acquisition Procedures*

NUS National University of Singapore