



# SOARTECH

Modeling human reasoning.  
Enhancing human performance.

## SoarTech AI Capabilities for *IARPA HAYSTAC*

Dr. Roger Smith  
Senior Scientist  
[roger.smith@soartech.com](mailto:roger.smith@soartech.com)  
[www.soartech.com](http://www.soartech.com)



# Quick Introduction to SoarTech

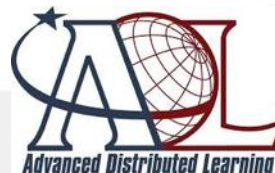
**SoarTech Mission: We develop human-centered artificial intelligence solutions for the military's toughest problems**

- Small-Business spin-off of University of Michigan's, Computer Science, AI - Soar Lab
- 1<sup>st</sup> Project was DARPA's Synthetic Theater of War (STOW) in 1998

~120 employees  
26+ PhDs, 32+ Masters

Orlando & Ann Arbor Hubs  
with 6 Other States

~70 Active Research  
Contracts



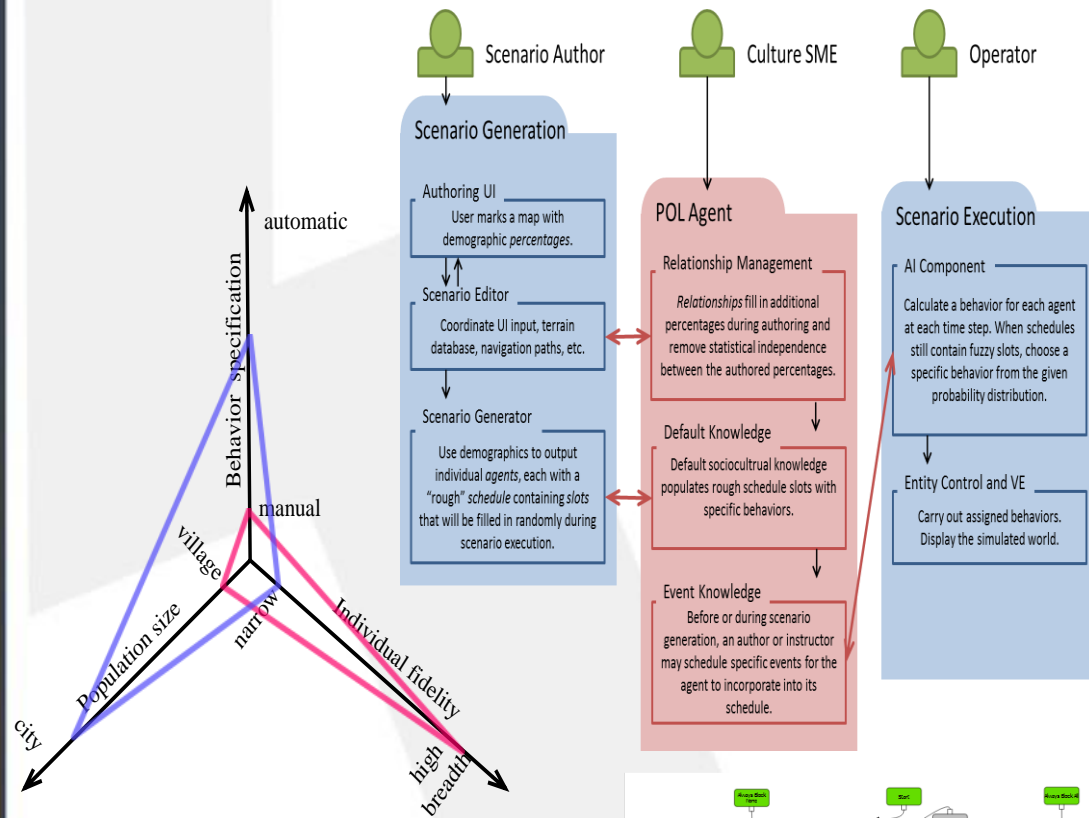
# Mapping HAYSTAC Expertise to SoarTech Projects

## HAYSTAC Expertise Areas

## SoarTech Projects

Agent-based modeling	★	Alpha Dogfight, INSIGHT, NGTS
Anomaly Detection		DyAdeM
Behavioral Science	★	Alpha Dogfight, GRIOT
Cloud Engineering		Trafalgar, Twiner
Computational Science		DyAdeM
Deep Learning	★	DeepAgent, DeepSwarm, DeepCounter, SSEIGE
Generative Machine Learning		GRIOT
Graph Analytics		CCAT, XAI
Human Mobility Modeling		ANSRS, DyAdeM
Microsimulation	★	INSIGHT, ANSERS, DyAdeM, NGTS
Sequence Modeling		GRIOT
Software Engineering		Dozens of Projects
Statistics		Alpha Dogfight, NGTS
Systems Engineering		Dozens of Projects
Systems Integration		NGTS
Trajectory Analytics		INSIGHT, ANSRS, DyAdeM
Transportation Science		DyAdeM

# TA-1: Microsimulation



**Multi-scale Agent Generation**

## Scalable agent generation

- Pattern Recognition
- Representational Abstraction
- Behavior Generation

**POL Modeling Architecture**

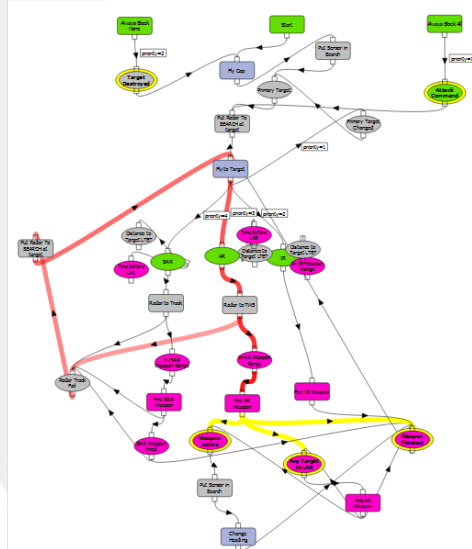
## Structured architecture for scalable POL

- Scenario Generation – POL Agent – Scenario Execution
- Primitive Actions
- Goal Hierarchies
- Schedules

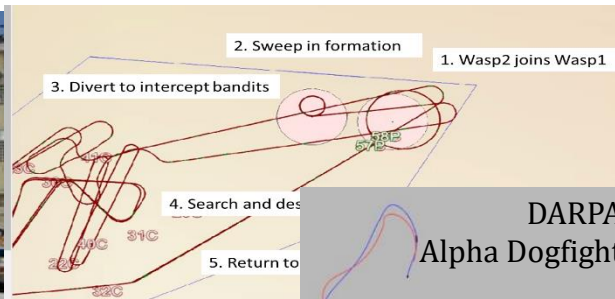
**Validation of Synthetic Intelligent Behaviors**

## Formal knowledge representation

- Behavior Envelopes
- Goal Constraint System & Language
- Constraints specified for agents and for the environmental context



# TA-2: Pattern Classification



## Deep Reinforcement Learning

Train agents to compete and collaborate with humans

- DARPA: Alpha Dogfight F-16 pilot
- Army: Infantry Fire Teams
- Navy: UAS swarm behaviors

## Convolutional Neural Networks

Pattern recognition and classification

- USAF: Unexploded Ordinance and Debris
- Army: Infantry Team Arm Gestures
- Intel: Satellite imagery analysis for target identification

## Abductive Reasoning

Reverse temporal stochastic causality models

- Given massive sequential data, identify causality leading to current entity activities
- Powerful complement to forward reasoning models

