

Air Combat Simulation and Training: Challenges and Opportunities for AI in the Cockpit

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Trusted, scalable, human-level, AI-driven autonomy for air combat simulation and training

NDIA National Security AI Conference and Exhibition

AI for Flight Simulation and Training

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Source: U.S. Navy

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Navy Makes History With Integrated Unmanned-Manned Carrier Ops

 Tyler Rogoway
8/17/14 1:56PM

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The US Navy just announced that it has successfully integrated unmanned and manned carrier operations for the first time. This is huge, as it's pretty much the first step in how the Navy will work not for the next few years, but probably for



Future U.S. combat success requires AI-capable aircraft



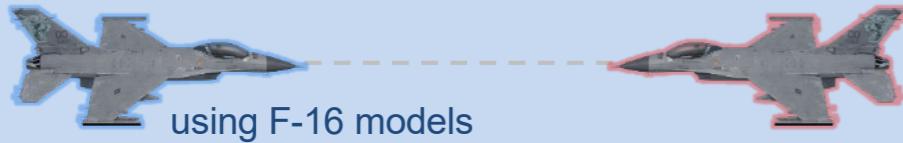
“In the future, it is desirable to have each operator control multiple unmanned systems, thus shifting the human’s role from operator towards mission manager.”

Unmanned Systems
Roadmap, 2018



Use existing methods designed for humans to mature autonomy and build trust

1v1 within visual range air-to-air combat (aka dogfighting) in Sim



game				
AI				
year	<input checked="" type="checkbox"/> 1997	<input checked="" type="checkbox"/> 2016	<input checked="" type="checkbox"/> 2019	<input type="checkbox"/> 2020+

8 teams developing & competing combat autonomy against:

gov't provided AI each other human pilots



August 18th

Performer AI
VS
Government AI

August 19th

Performer AI
VS
Performer AI

	Aurora	EpiSci	GTRI	Heron	Lockheed	Perspecta	PhysicsAI	SoarTech
Aurora	█	5	6	7	1	4	3	2
EpiSci	5	█	7	6	2	1	4	3
GTRI	6	7	█	5	3	2	1	4
Heron	7	6	5	█	4	3	2	1
Lockheed	1	2	3	4	█	5	6	7
Perspecta	4	1	2	3	5	█	7	6
PhysicsAI	3	4	1	2	6	7	█	5
SoarTech	2	3	4	1	7	6	5	█

August 20th

Top Performer AI
VS
Human Pilot



AlphaDogfight Virtual Finals on YouTube



<https://youtu.be/NzdhlA2S35w?t=10927>

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Heron vs Banger, Engagement #1



Case **LIVE** System Live Streaming Service Time: 0.0 s

Distance: 2,921 ft
Closure: -4 kts
Heading: 360 deg
Alt: 16038 ft
Speed: 300 kts
Climb: -1 fps
Track Ang: 90 deg

0 0

Heading: 180 deg
Alt: 16038 ft
Speed: 300 kts
Climb: -1 fps
Track Ang: 90 deg

Heron VS Banger

ADT Webinar

Test Case 1

zoom

<https://youtu.be/NzdhlA2S35w?t=16808>

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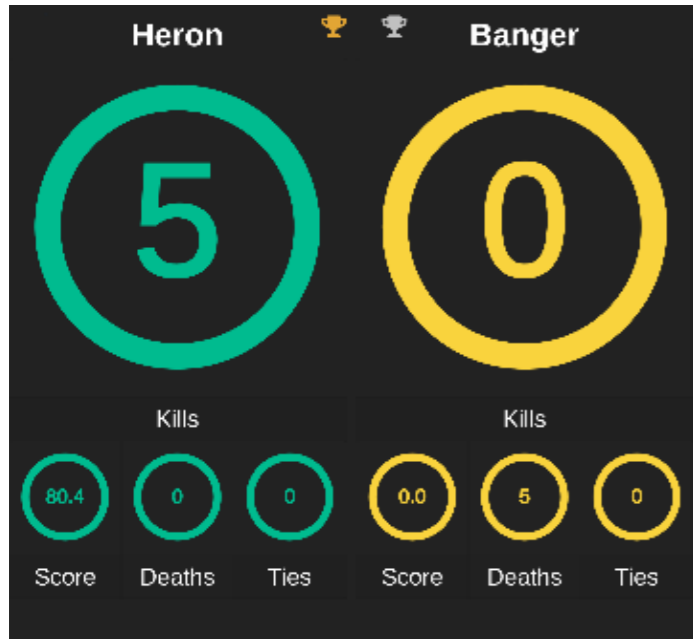
AI is coming to the cockpit

AlphaDogfight competition proves AI outperforms human in aspects of air combat



AlphaDogfight combat autonomy beat human pilot 5-0 in simulated air combat in August 2020

“The demonstrated success of AlphaGo, and more recently, AlphaStar, in defeating all competitors in one of the world’s most complex real-time strategy video games suggests that in any structured contest between offense and defense, AI will dominate humans.” – Allison/Schmidt



- Able to develop Top Gun pilot beating AI in months
- Without commercial titans of AI
- Without break through technical advances (mostly applied)
- Debatable: where the human sits on the loop
- Not debatable: without AI assistance human pilots will lose to AI assisted adversary

“The AI agent’s resounding victory demonstrated the ability of advanced algorithms to outperform humans in virtual dogfights. These simulations will culminate in a real-world competition involving full-scale tactical aircraft in 2024.” -- SecDef Esper Sept2020



Build and maintain the custody of trust through increasingly realistic experimentation

AlphaMosaic

AlphaDogfight



Modeling & Simulation



Commercial UAVs



Combat Aircraft



- Challenges

- Performance
- Interfaces
- Infrastructure
- Validation & Verification
- Safety/Novelty

- Opportunities

- Reframe the current emphasis on routine procedures
- Modeling & Simulation will continue to lead
- Constructive, Virtual, Live simulation & training

