

I Can See the Future

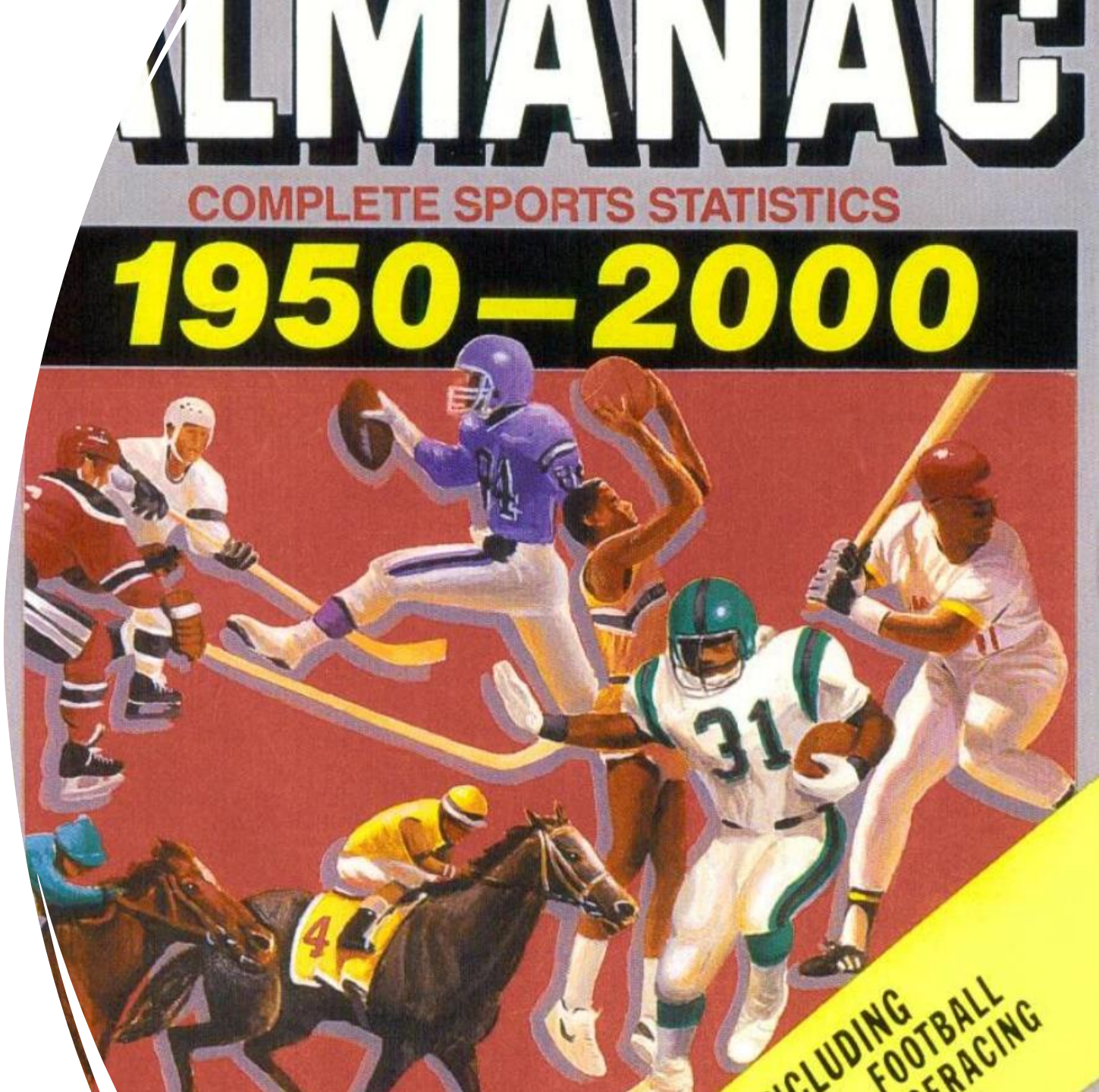
So Can You!

Travis Hartman – Oct 2, 2026

Background

- PhD in Artificial Intelligence
- Former FORSCOM CTO
- Retired Cyber Warfare officer
- 10+ years as a Joint Planner
  - JPSE and deployments
- Active research to address Decision Dominance
- Career spanning to millenia

- Owns a cocktail bar
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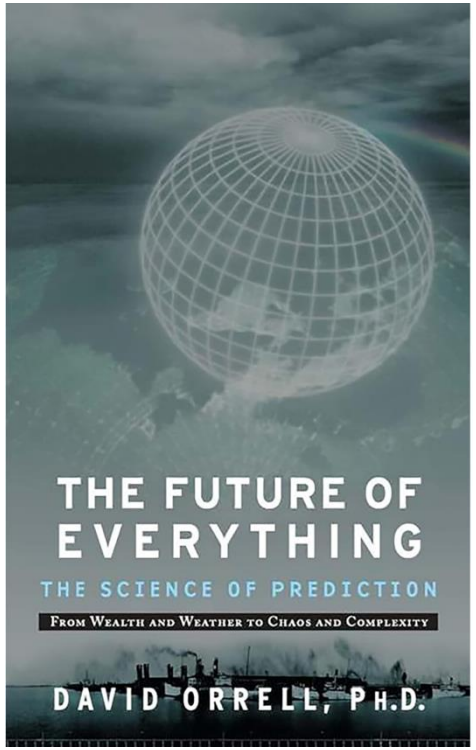


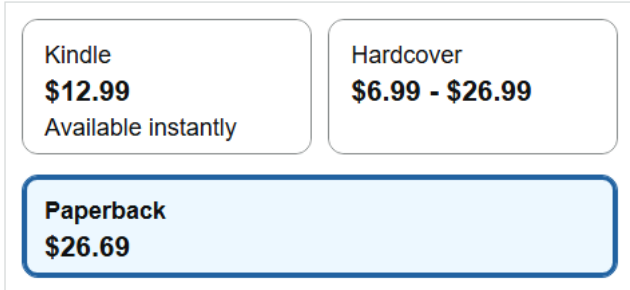
The Future of Everything: The Science of Prediction

- Everything you need to know
- Only $6.99 for a used hard copy

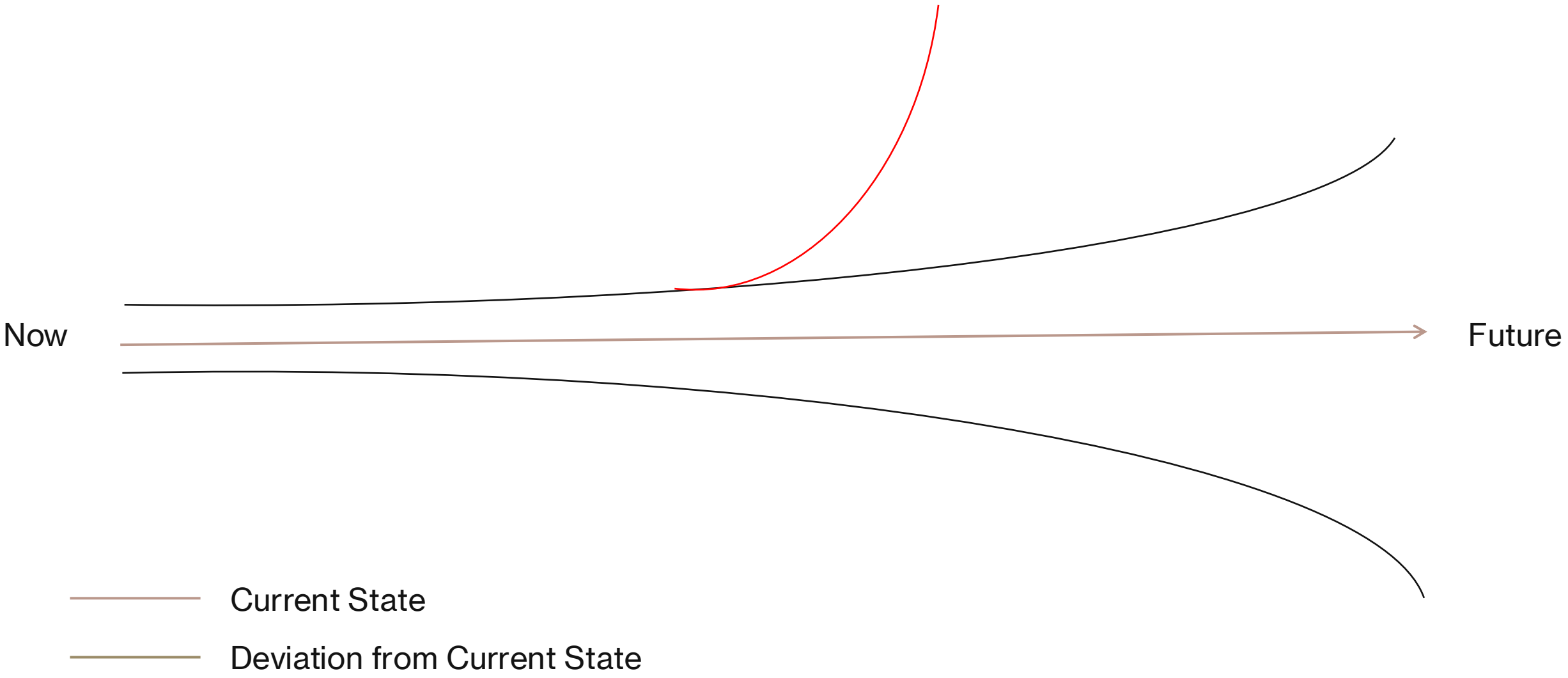
- We can all see A Future
- Not everyone sees The Future

...it turns out seeing the Future isn't the challenge, tracing causality is





Trumpet of Doom



Causality – Chain of Events Through Time

Butterfly Effect

Dependence on initial conditions in which a small change in one state of a deterministic nonlinear system can result in large differences in a later state.

Military Version

For want of a nail the shoe was lost;
for want of a shoe the horse was lost;
and for want of a horse the rider was lost,
being overtaken and slain by the enemy,
all for want of care about a horse-shoe nail.

Military View on the Future

- Commander’s Intent - A clear, concise statement defining the operation’s purpose, key tasks, and desired end state.

Division Level Operations

- Army division’s 72-hour focus revolves around proactive, long-range planning (72-96 hours out) to shape the future battlefield, focusing on intelligence, protection, and setting conditions for subordinate brigade combat teams.
- Significant planning with assigned resources.





What if we look further ahead?

- 96-hour Air Tasking Order (ATO)
  - Issued at multiple levels
  - COCOM, theater
  - TRANSCOM issues ATO for global strategic airlift
- 100+ hours
  - Requests to JTF or COCOM for altered resources
  - Requests for national level or coalition resources
  - Leverage the O-8 weapon system

Self Driving Cars



Trained using digital twins by creating high-fidelity, virtual replicas of real-world environments, traffic, and vehicle sensors.



AI algorithms safely experience thousands of edge-case scenarios – like rare accidents or poor weather – that are too dangerous or costly to test in reality.

Military Planning

Viewing and choosing causality

Staff Planning Elements

G33 – Current Operations (CUOPS) – up to 72 hours

G35 – Future Operations (FUOPS) – bridges G33 horizon to G5

G5 – Future Plans (FUPLANS) – 90 days +

Time horizons for the planning groups vary based on operational necessity

Planning Challenges



Adversary Capabilities and Actions



Intel – “I assess with moderate confidence that there is a low probability…”



60+ assessment methodologies

Weather and Terrain insights

Tyranny of Time

Plan for Most Dangerous enemy course of action first

2025 Transformation Mandate

1. **AI-Driven C2:** Enable at Theater, Corps, and Division Headquarters by 2027.
2. **Power Synchronization:** Kinetic/non-kinetic fires, space, and unmanned systems.
3. **Technical Data Access:** Reform contracts to access critical system technical data.
4. **Industrial Emulation:** Moving military movement toward industry-standard decision optimization.

Changing the Causality Lens

CURRENT



Unit Capabilities



Enemy, Weather, and Terrain



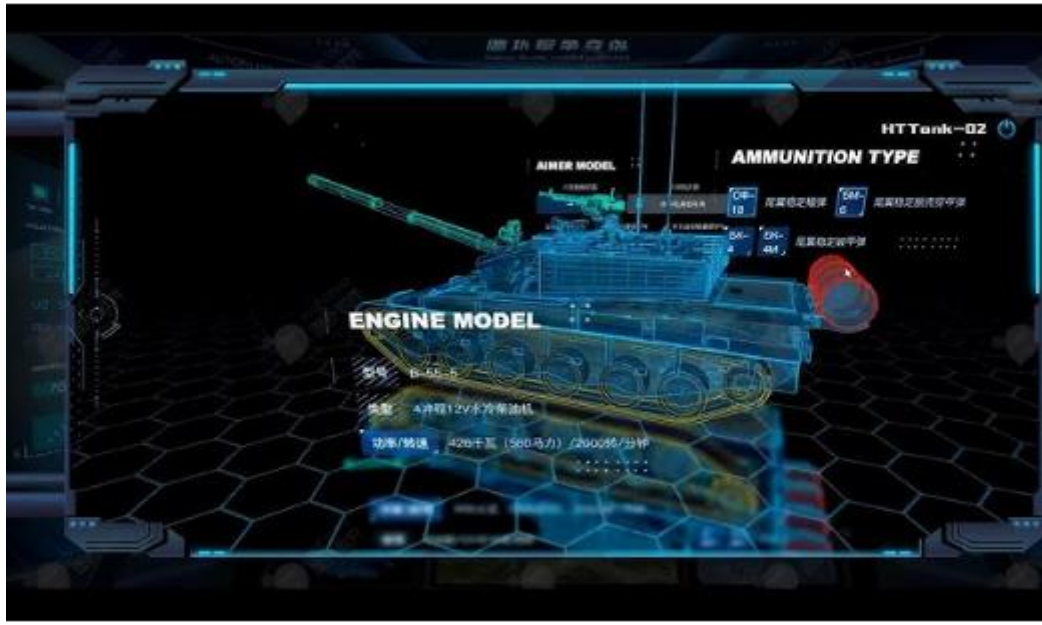
Tyranny of Time

FUTURE

1. Digital Twins
2. Virtual Environments
3. Multi-Agent Deep Reinforcement Learning (MADRL)

1 - Digital Twins

- **Scalability:** From a single circuit to a complete vehicle or division.
- **MBSE Integration:** Enables testing components while maintaining system connections.
- **Scenario Readiness:** Enables rapid "What-If" examination for Eastern Seaboard storms or battlefields.
- **Fidelity Balance:** Tailoring model detail to processing costs and memory requirements.



Scaling Twins

Armor Unit Element	# of Tanks	Onboard Systems
Armor Company	14	56
Armor Platoon	4	16
Armor Section	2	8
Individual Tank	1	4

*Selection balances analytic time, accuracy, and processor costs for LSCO planning.



The algorithms – MARL and MADRL

- **Cooperative Driving Strategies:** MARL enables AVs to learn *cooperative policies for tasks* like highway lane changes, on-ramp merging, and navigating unsignalized intersections, which improves overall traffic flow, safety, and efficiency compared to single-agent systems or rule-based methods.
- **Modeling Human Behavior:** To *function effectively* in mixed-traffic scenarios (with *both AVs and human-driven* vehicles), MARL models are being developed with "personality parameters" or diverse driving styles to better predict and adapt to unpredictable human behaviors, enhancing the ego vehicle's generalization capabilities.
- **Simulation-Based Training:** Due to the risks and complexities of real-world training, AVs are primarily trained in advanced simulators like CARLA or MetaDrive. These simulators *generate vast amounts of high-quality, diverse data and allow for parallelized testing and training*, which is crucial for the development process.

Twins – More than Machine

Recent work extends Digital Twins to emulate **individual human agents**, changing generic doctrine-driven behavior to specific commander personality performance.

- **Commander Profiling:** Performance characteristics inform agent configuration.
- **Behavioral Realism:** Agents no longer act as generic entities.
- **Doctrine Overlay:** Performance guided by institutional rules but influenced by personal bias.

Human-AI

Collaboration

"Digital Commanders"

Multi-Agent Reinforcement Learning (MARL Multi-Agent Deep Reinforcement Learning (MADRL)



Strategic Gaming

Agents control competing forces in a complex strategy environment.



Iterative Learning

Constant refinement through thousands of competitive permutations.



Decision Optimization

Reveals the most successful COAs and their related sequels.

MARL allows for the examination of how changing timing, employment, or augmentation shifts mission outcomes.

MARL Operational Modes

Mode Type	Rewards Type	Unit Representation
Pure Competition	Opposite of others	Adversary Units
Pure Cooperation	Aligned with others	Friendly Forces
Mixed Sum	Combination of above	Sister Units / Echelons

For the **Business Mission Area (BMA)**, MARL supports resource allocation optimization across different unit echelons and resource categories.

What if?

- A LOC was impassable?
- We had access to this other unit/resource?
- A specific adversary unit was delayed?
- We changed the load-out for specific weapon systems?

The Value of Accelerated Testing

100x

Testing Speed

Run scenarios faster than real-time

1000s

Permutations

Analyze variants in minutes, not days

High

Fidelity

Causal connections preserved

Industry Example: A physical trip from DC to Tampa takes 13 hours. In a Digital Twin environment, full evaluation including weather, traffic, and mechanical failure occurs in **minutes**.

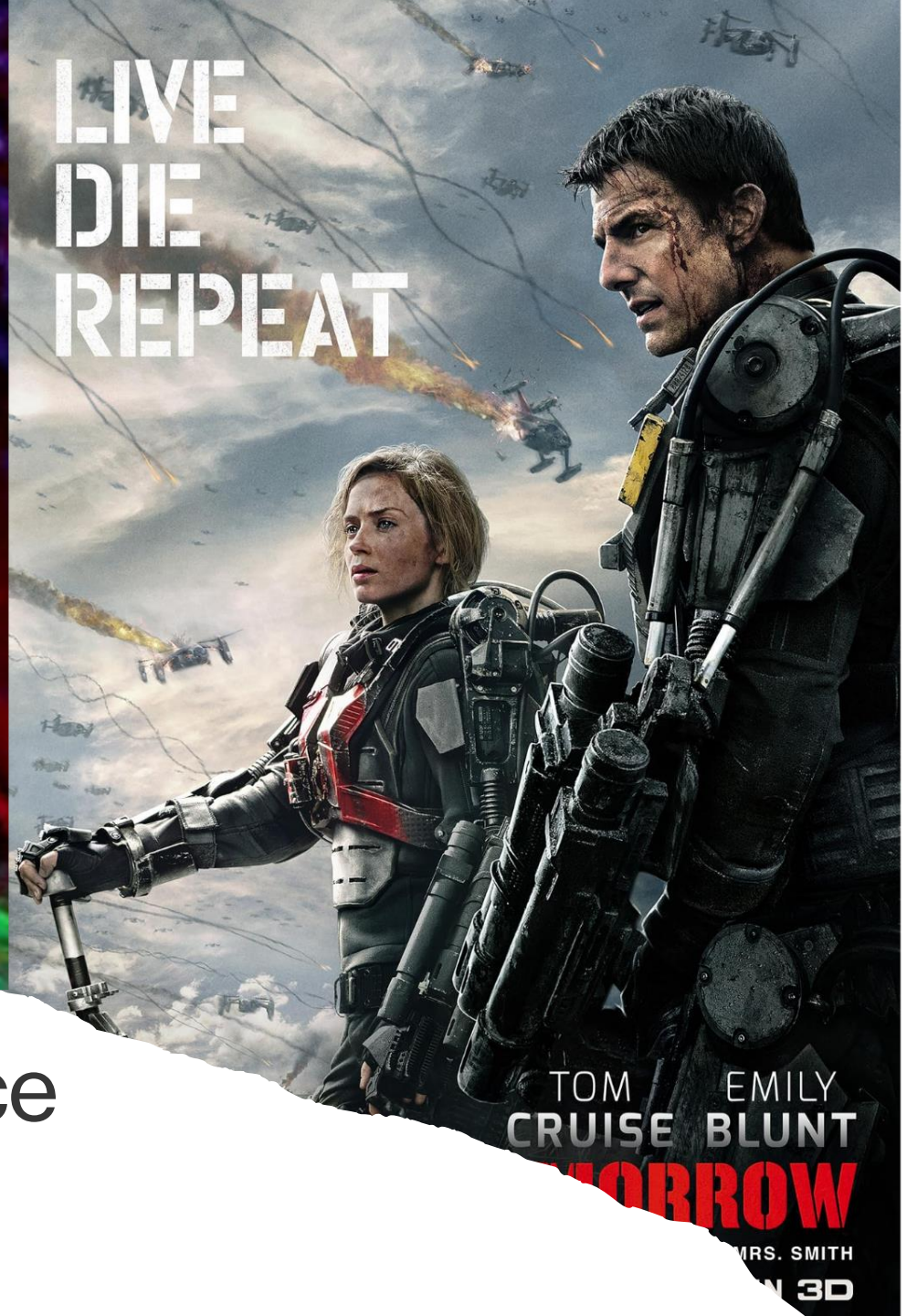
Mandatory Sports Reference

- **“You wake up at 3, train at 4. 4-6. Come home, eat breakfast, relax.**
- **Now you're back at it again 9-11. Relax**
- **... Back at it again, 2-4.**
- **Now you're back at it again, 7-9.**

- **By year 5 & 6, it doesn't matter what kind of work they do in the summer - they're never gonna catch up.”**







Mandatory Movie Reference

COA Success Probabilities



Example - Iteration Findings: 1,000 tests identify key decisions resulting in success – key factor appeared in 716 iterations

- Identifies **Branches and Sequels** derived from high-probability COAs.
- Reveals optimal **Resource Allocation** for Division-level constraints.

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Strategic Roadmap

Acquisition Reform

Digital Twins must be **program deliverables** for all new equipment procurement (ASA(ALT) oversight).

Digital Repositories

Designate common repositories for Digital Twin libraries to enable rapid, cross-domain scenario examination.

Leveraging existing programs like NSA's Golden Galleon to build U.S. weapon system twins.

Three Components to Trace Causality

- Digital Twins
  - Automated Modeling
  - Scalable Fidelity
  - Maneuver units and operational environments
- Iterative testing
  - Model structuring
  - Operational environment manipulation
- MARL/MADRL
  - Competitive or Cooperative variants

?

Questions & Discussion

"By enabling greater detail through Digital Twins and MARL, we identify decisions that deliver our outcomes while limiting our adversaries."



USAWC Wargaming

- The U.S. Army War College (USAWC) utilizes a hybrid, evolving system for wargaming that combines modern AI-driven digital simulations with traditional "Free Kriegsspiel" tabletop exercises. Through its Department of Strategic Wargaming (DSW), the college focuses on strategic-level scenarios, utilizing tools like the HDGAI system and AI-enabled models to enhance decision-making in curricula and exercises like Pacific Overmatch.
- Key Wargaming Systems and Approaches
- AI-Enabled Wargaming: As of late 2025/early 2026, the USAWC is integrating AI to simulate complex, realistic responses to student inputs, moving away from rigid, rule-heavy models to focus on strategic planning.
- Free Kriegsspiel (Free Game): A 19th-century, umpire-driven style of wargaming that is being revived with AI to provide realistic adjudication without the need for complex, predefined rulesets.
- Digital Tools (e.g., HDGAI): The college uses digital scenarios like Flashpoint 2042: Taiwan Strait and Ascendancy 2050: The AI Uprising to simulate, for example, high-end conflict in the Pacific theater.
- Tabletop & Board Games: The Strategic Wargame Program (SWP) uses professional, in-depth wargames to test concepts and develop strategic thinking.
- Operational & Strategic Simulation: The DSW, established in 2021, uses custom simulations to help students analyze large-scale, multi-domain operations and theater-level strategies.

Image Sources



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