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Unlocking the Military Potential of the Metaverse

MSG 197 Symposium on Emerging and Disruptive Modelling and Simulation Technologies to Transform Future Defence Capabilities

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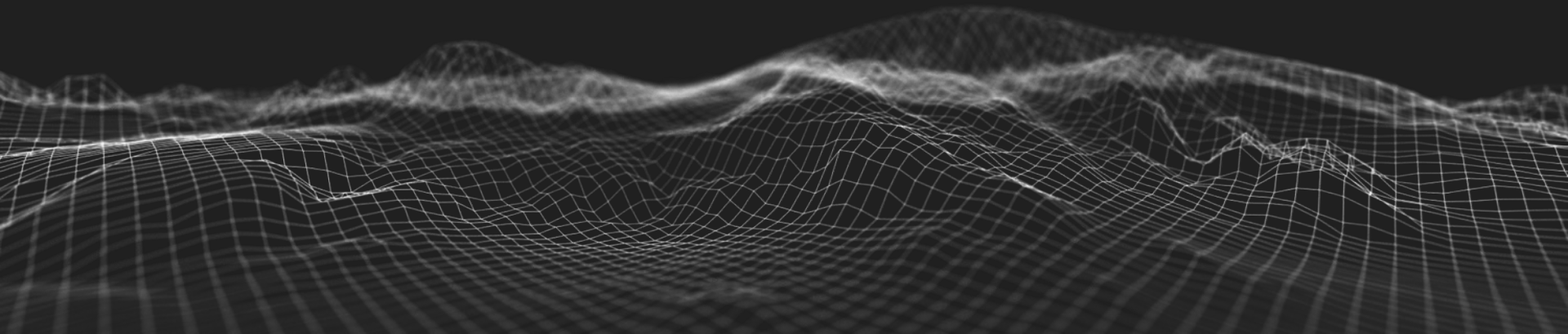
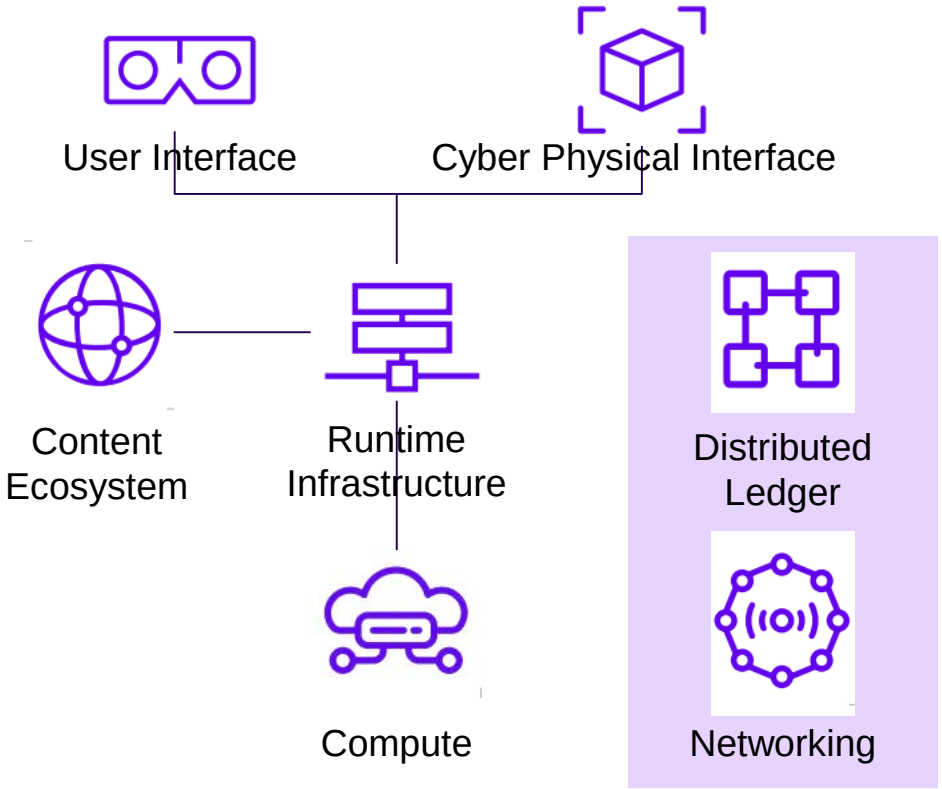
The Metaverse Today is the Internet of 1995

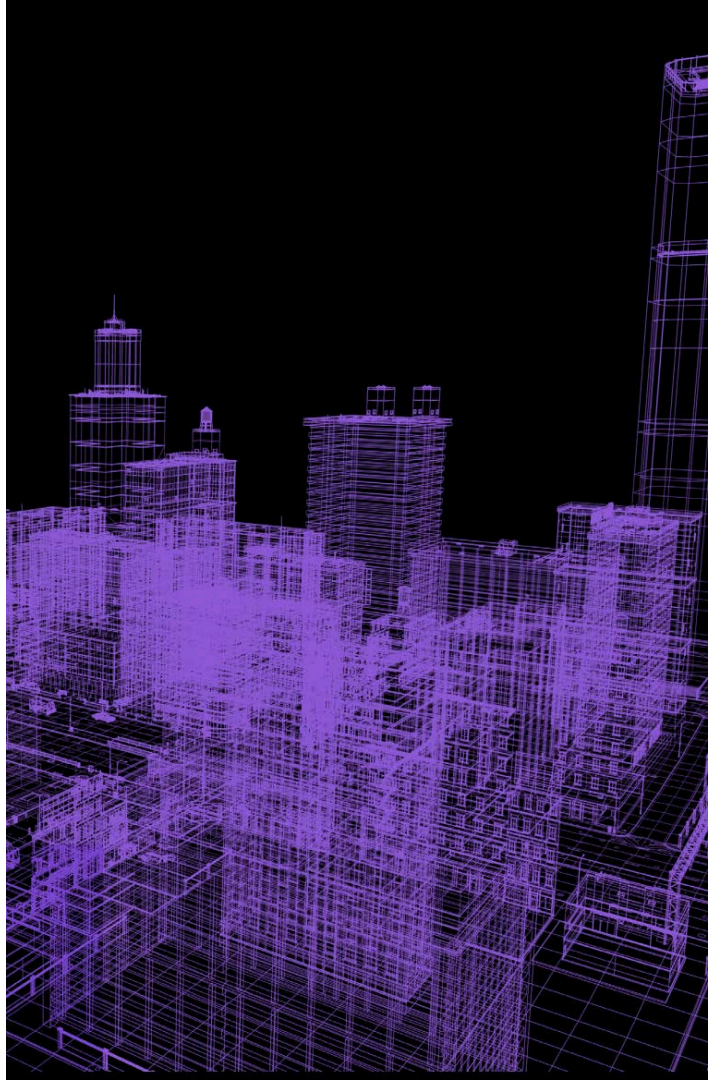
Three Main Parts:

1. Technology Stack Behind the Metaverse
2. How the Metaverse Will Change M&S
3. How the Metaverse Will Change Defence



The Technology Stack Behind the Metaverse



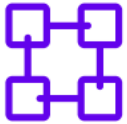


The User Interface: Much like how warfighters and training providers need a means to “enter” a simulation, users will also require one or more mechanisms to partake in a metaverse.

Cyber Physical Interface: Just as an interface will exist into the metaverse for human participants, a cyber-physical interface will also exist for technology-based systems, such as a military platform or system, or even a complex socio-technical system, like critical infrastructure.

Content Ecosystem: The content that undergirds a metaverse includes all the data and models that make up that virtual world. Two trends driving content creation are worth noting– and theoretically emulating– in defence M&S: the proliferation of non-fungible tokens and the no-code and low-code platforms for content development.

Runtime Infrastructure : The middleware that allows for a simulation to be quickly composed and run, while also ensuring interoperability when implementing a distributed simulation.



Distributed Ledger Technologies: A databased or a record of consensus with a cryptographic audit trail that is maintained and validated by various nodes within a network. While not required for a metaverse, distributed ledger technologies are often included as they enable virtual ecosystems.

Networking: Technologies that allow simulated environments to be distributed to users as shared experiences, regardless of their physical location. For the metaverse to be a shared experience, every user will require a fast a high-bandwidth, low latency connection.

Compute: A simulated environment, like a metaverse, will need to be hosted from a compute standpoint. The metaverse requires we grapple with several key issues: persistence, real-time rendering, and user-concurrency.

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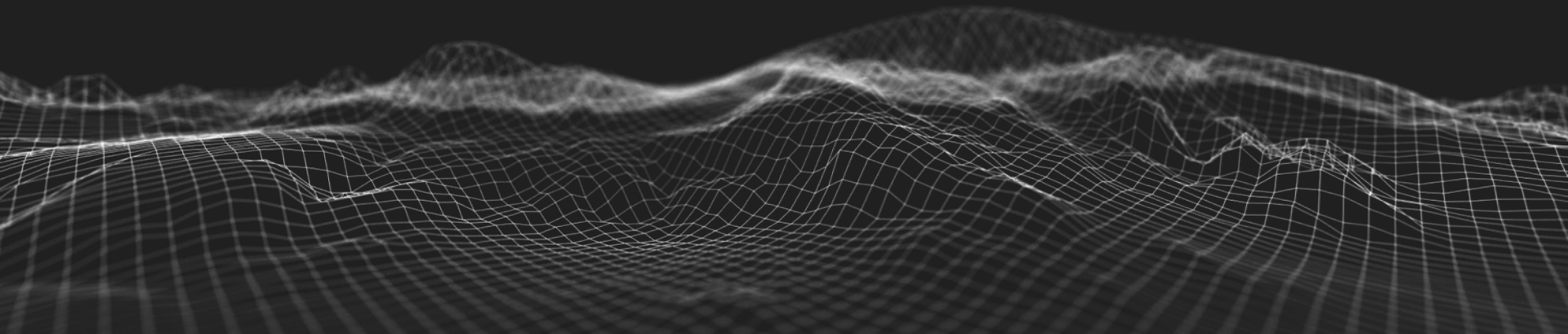
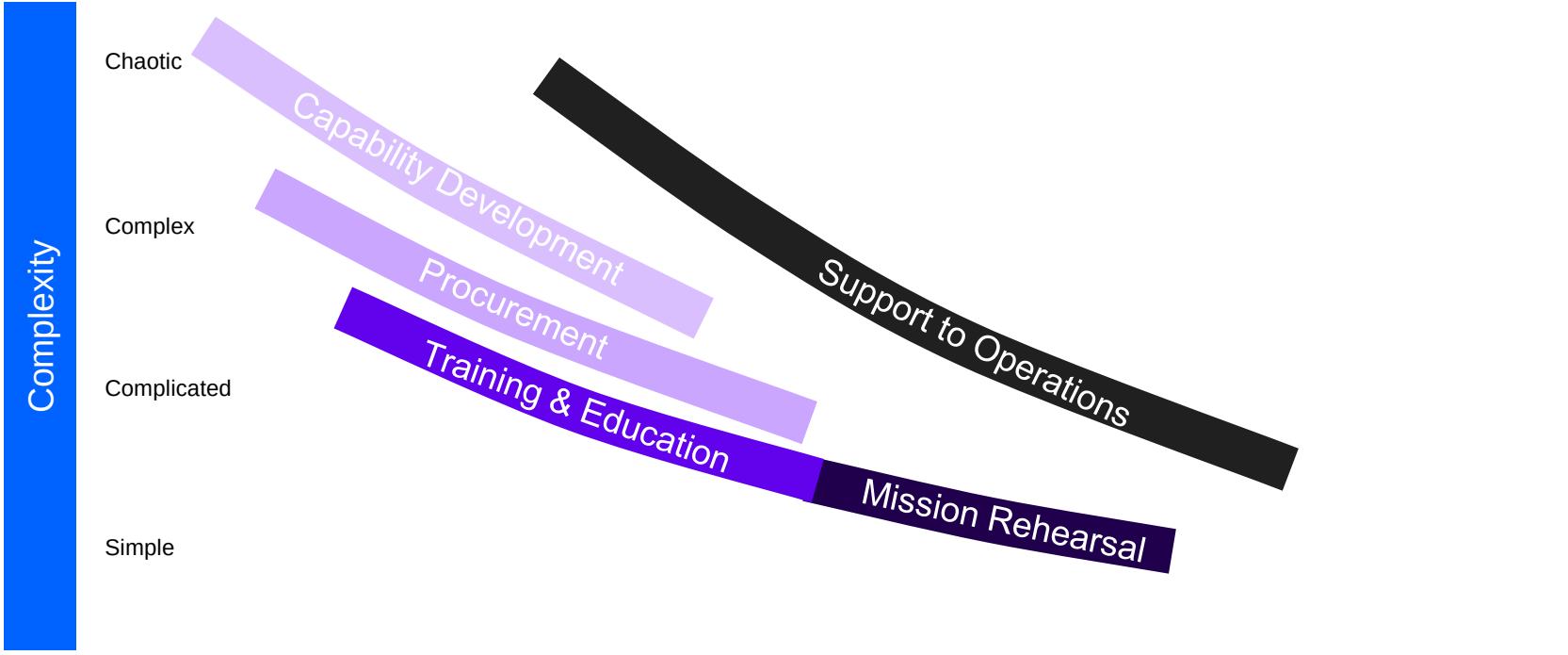
Applying Metaverse Technologies to NATO M&S Domains and Beyond



Plotting the Traditional Domains of M&S Against Complexity and Urgency



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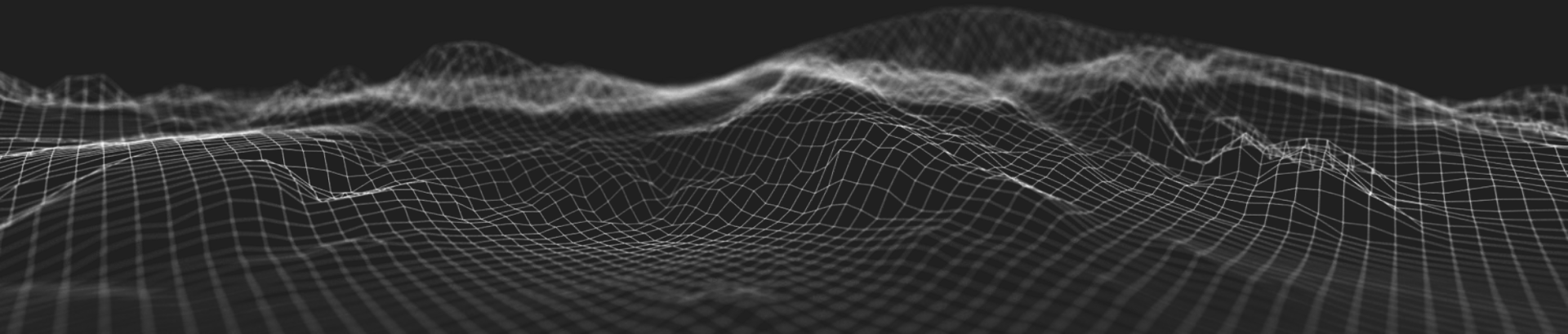
How the Metaverse Will Change M&S

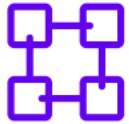


Collaboration through M&S

Networking

User Interface

Content Ecosystem


Distributed Ledger

Changes:

- Multiple users able to view, collaborate and explore models together
- Customers and suppliers, companies that are normally competitors, collective education & training
- Models as contracts

Benefits:

- Simultaneous development of parallel elements of capability or designs
- Cheaper and faster design, test and evaluation, and production of defence equipment
- Development of more complex and integrated systems of systems
- Development of more integrated teams
- Greater depth of learning and confidence in training

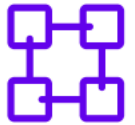
Bringing the Real World into the Virtual World

Cyber Physical Interface

Runtime Infrastructure

Compute

Content Ecosystem


Distributed Ledger

Changes:

- A synthetic process to find design flaws before building and trialling the system in live ranges
- Real time monitoring and optimisation of the production process through digital twins
- Direct transfer of intelligence into M&S
- Secure real-world data updating and calibrating M&S in real-time

Benefits:

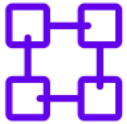
- Cheaper and faster design, test and evaluation of defence equipment
- Cheaper and faster production of defence equipment
- Faster translation of intelligence into plans
- Greater confidence in decisions and plans through more secure, auditable, explainable data pathways from content, through composition to outputs

Bringing the Virtual World into the Real World

User Interface

Cyber Physical Interface

Content Ecosystem


Distributed Ledger

Changes:

- AI advisers through the convergence of AI, data science and simulation content
- Connecting M&S to command and control systems enables direct transfer of plans into autonomous systems
- Connecting digital twins to real systems for training
- Realistic immersive interfaces bridging the sim-to-real gap and instilling belief in the trainee
- Distributed ledgers enabling tailored training against individual needs through life.

Benefits:

- Greater confidence in plans
- Faster translation of plans into actions
- Greater depth and confidence in training through increasing validity
- Improved inoculation to combat stress
- Cheaper and faster training

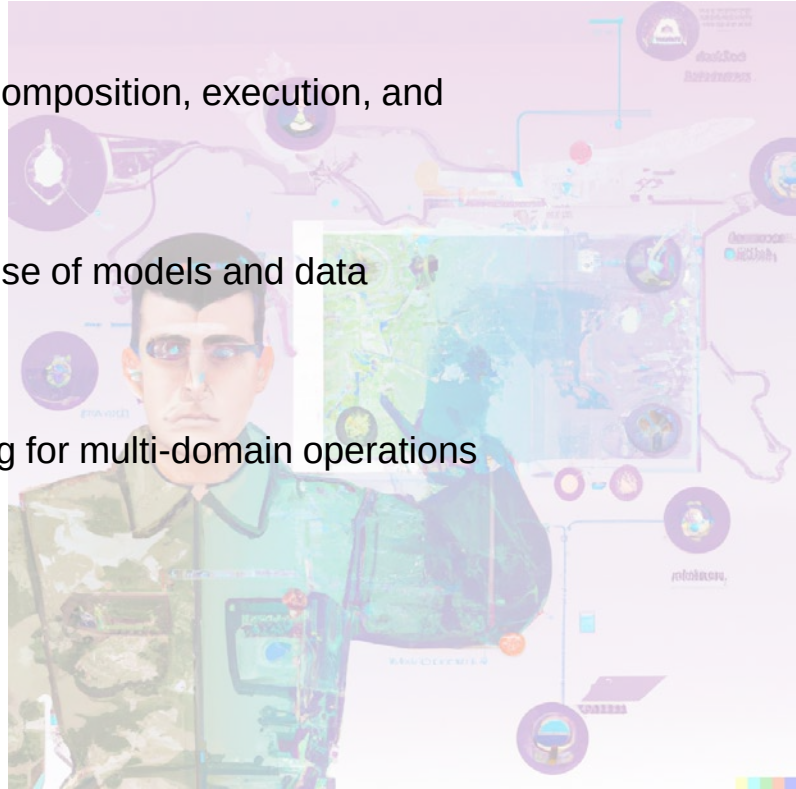
Accelerating and Democratising M&S

Changes:

- Tools to accelerate content development and discovery, composition, execution, and understanding the outputs of M&S
- Models that simulate greater complexity
- Greater exploration of the problem-space
- A rich content ecosystem that would allow for greater re-use of models and data

Benefits:

- Faster decisions, plans and rapidly tailored training
- More complex and integrated decision making and training for multi-domain operations
- Greater confidence in decisions, plans and processes
- Development of more integrated teams
- Cheaper M&S



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How the Metaverse Will Change Defence

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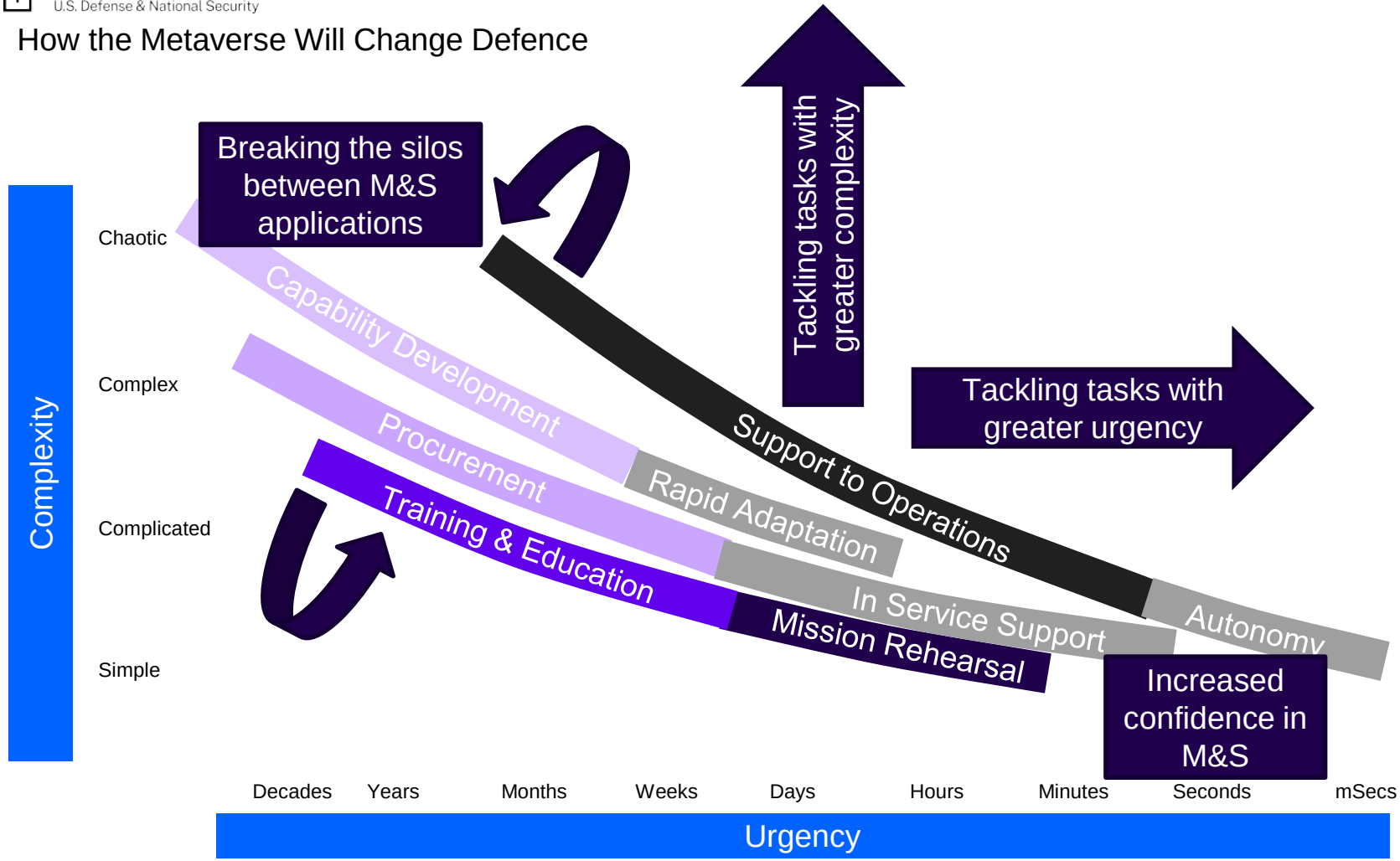
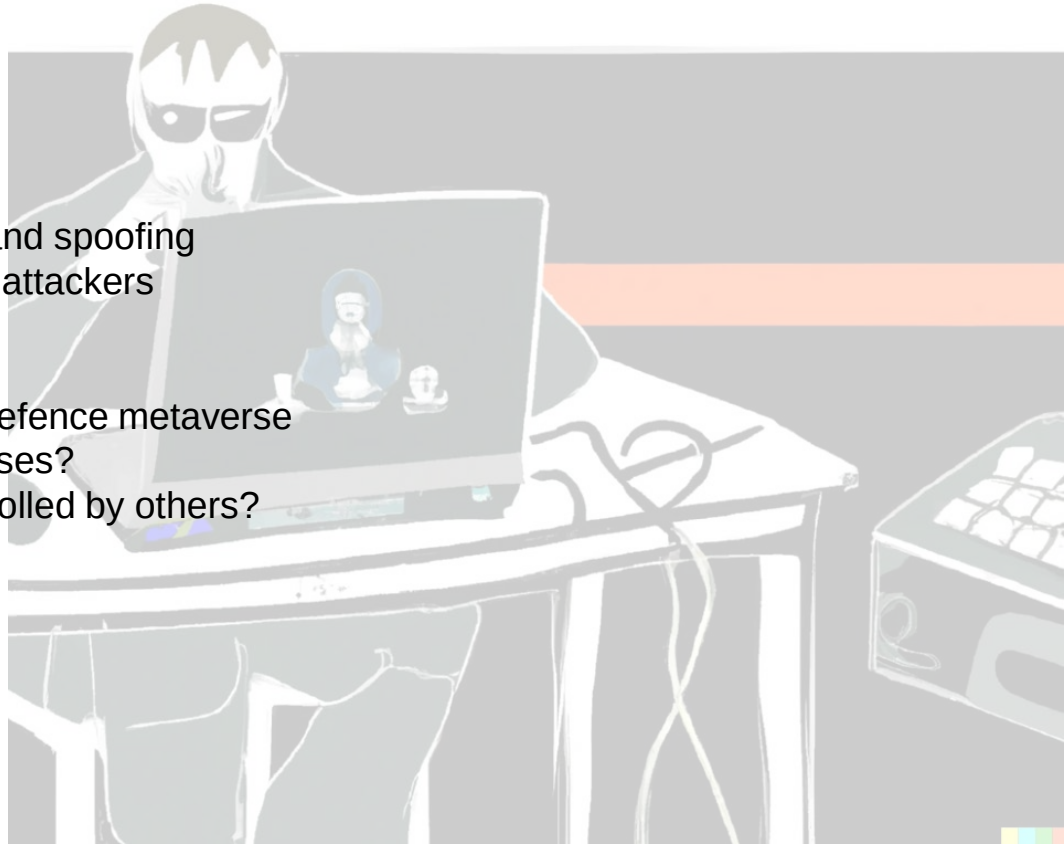


New Risks Require New Ways of Thinking

Risks:
- Health and safety
- Human fallibility
- Greater attack surface for cyber attacks and spoofing
- Greater value information and access for attackers

New Tasks:
- Defending, securing and making safe a defence metaverse
- Defend NATO citizens in civilian metaverses?
- Offensive operations in metaverses controlled by others?



How the Metaverse Will Change Defence

- Increased Urgency, Transformed M&S, Improved Defence Outcomes
- Benefits from Top to Bottom
- Increased Confidence but Increased Risk
- Opportunities for M&S of Greater Complexity to Increase Collaboration and Integration

Q&A

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