



A Military Training Perspective - Technology and Trends

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Getty/Vassily Maximov

Presentation Overview

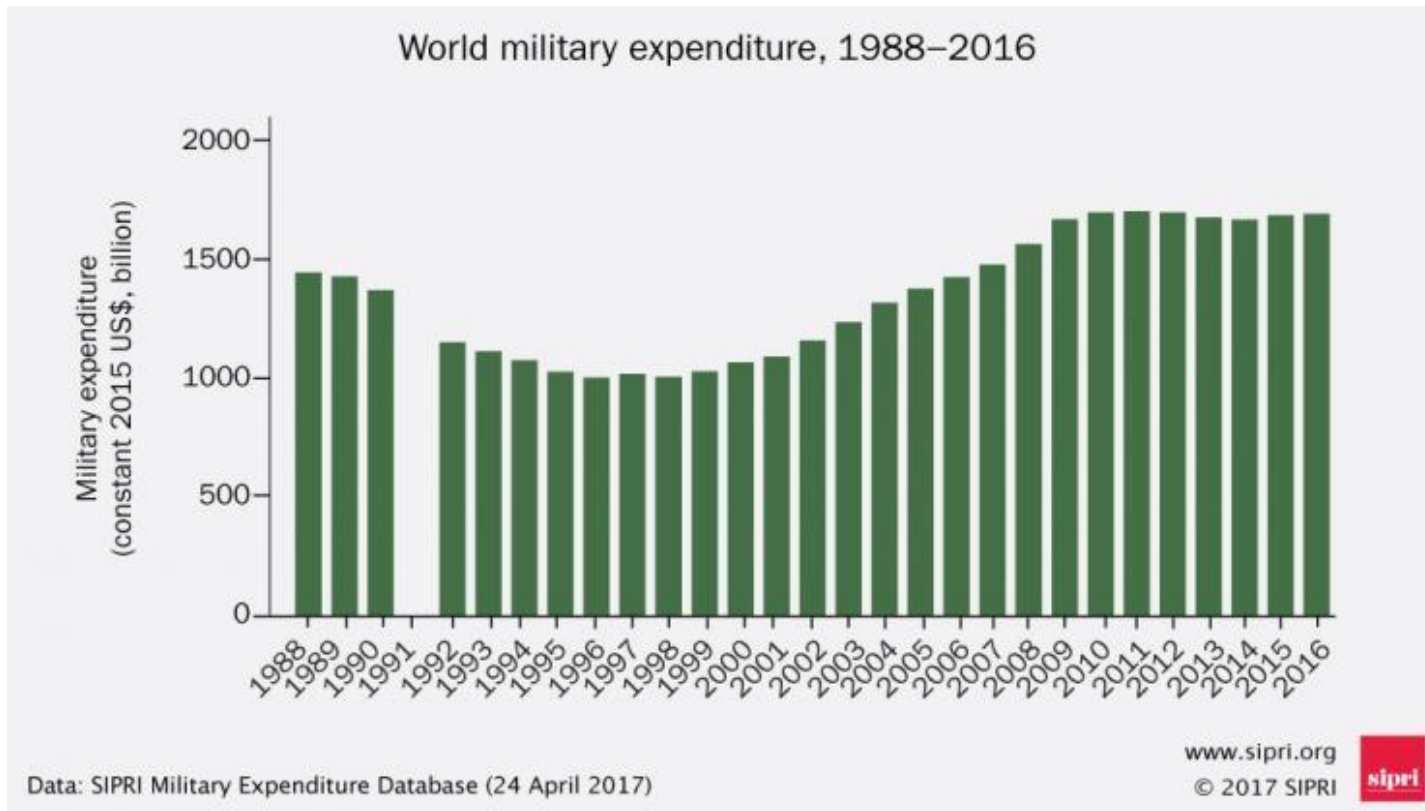
- **Context (Some Statistics)**
- **Military Training Basics**
- **A Very Short History of Military Training Technology**
- **Current Military Training Examples**
- **Military Training Challenges and Opportunities**



Context (some statistics)

Total World Military Expenditure

\$1.69 trillion (2016)



1. USA - \$611bn
2. China - \$219bn
3. Russia - \$69bn

Stockholm International Peace Research Institute (SIPRI)

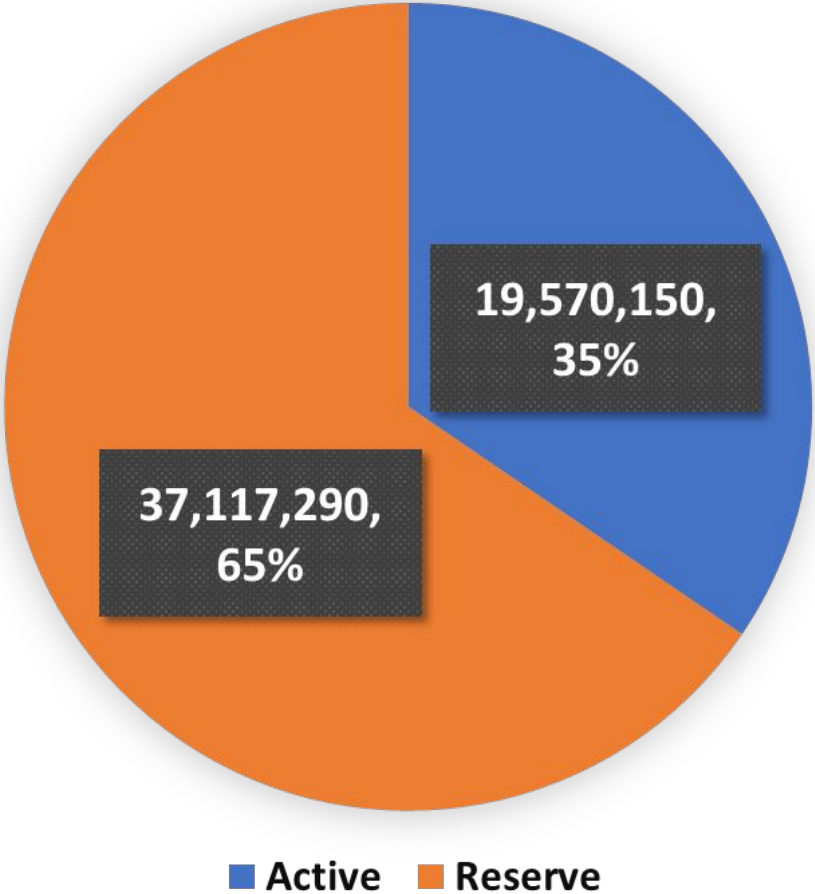
Military Training & Education Expenditure - %Total

~20%

- Manpower
- Platforms and Equipment
- Fuel and Maintenance
- Training Estate and Establishments
- Training Systems and Simulators

Global Military Numbers – 56.7m

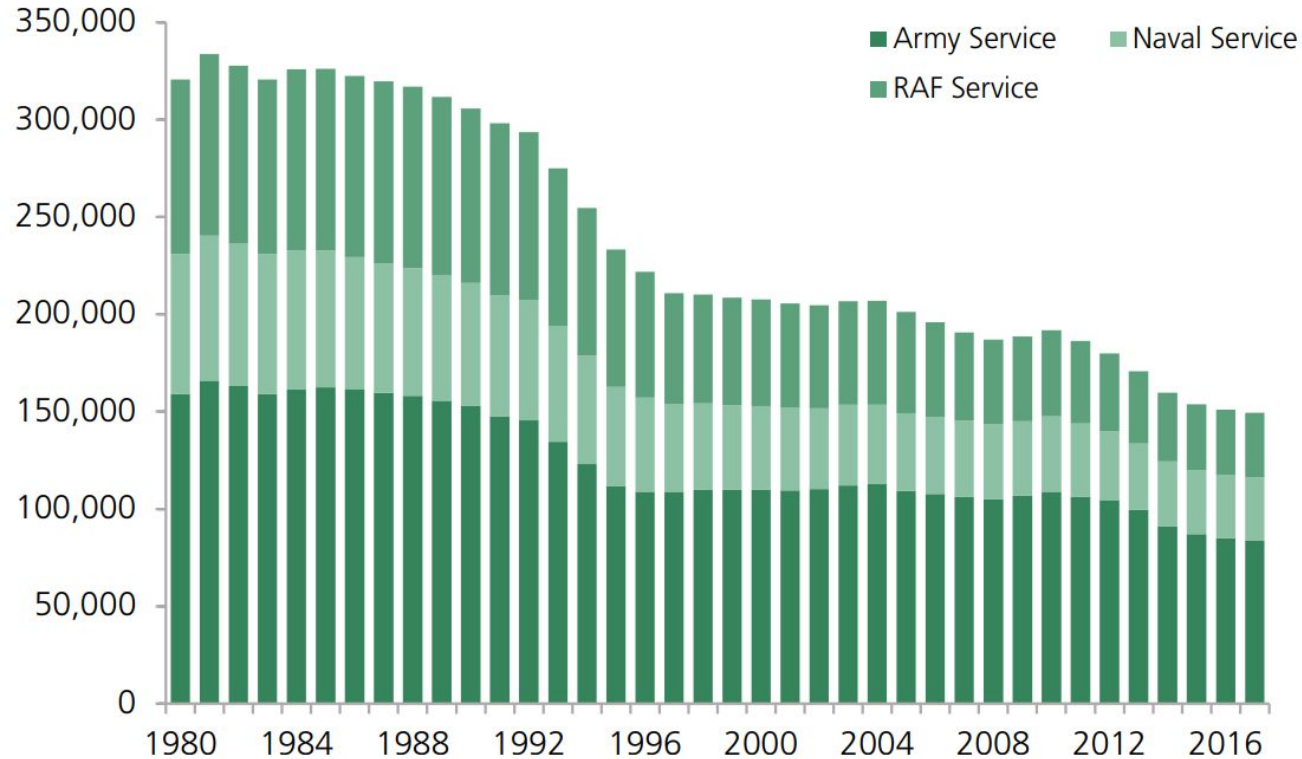
Global Military Numbers (Total 56.7m)



		Active
1	China	2,183,000
2	India	1,395,100
3	United States	1,347,300

		Active + Reserve
1	South Korea	8,130,000
2	North Korea	7,490,000
3	Vietnam	5,482,000

UK Military Trends

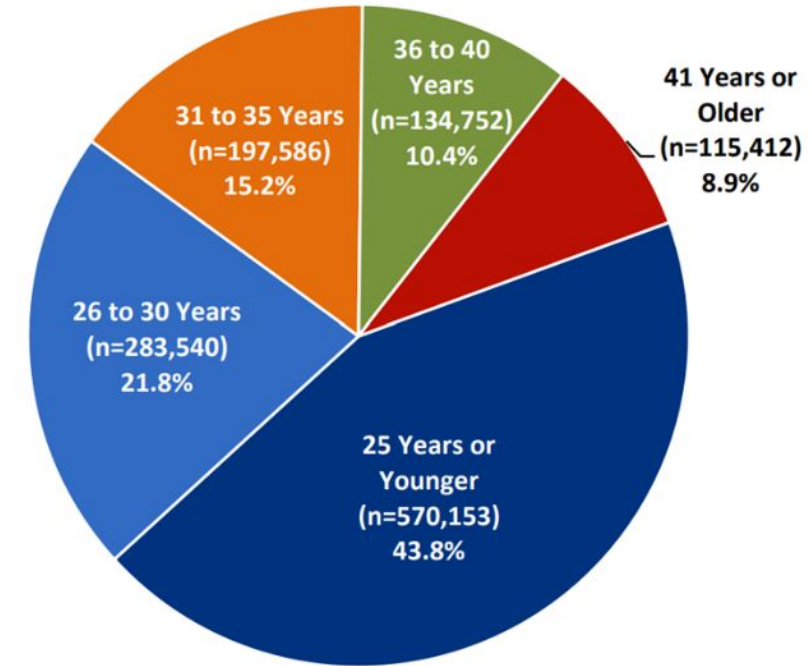


2016/17 Intake
(total strength - 138,351)

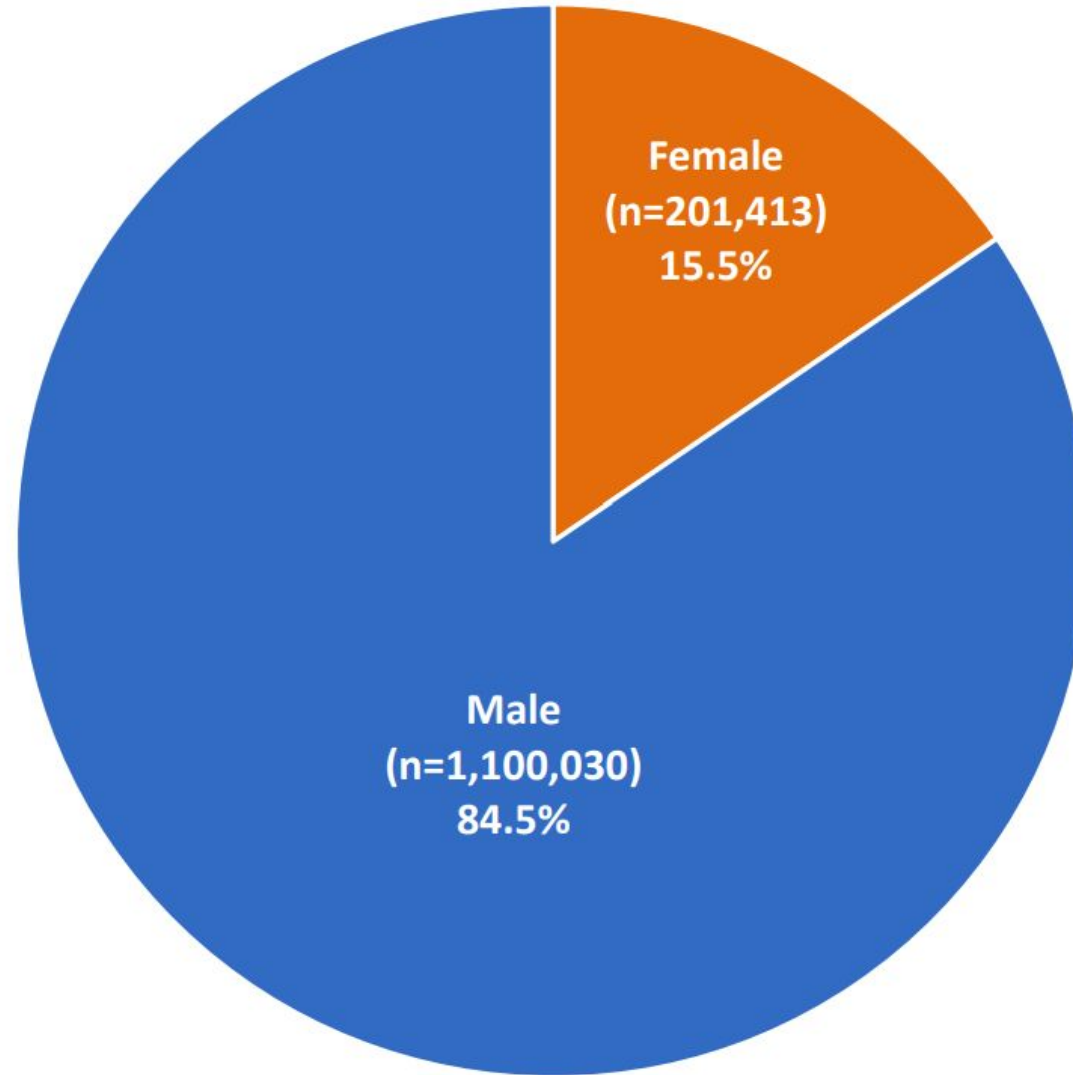
- **Army - 8,294**
- **RAF - 2,044**
- **RN - 3,045**

Military Demographics (US Active Duty, 2015)

- **44% - Age 25 or younger**
- **91% - Age 40 or younger**
- **28.5 years - Average Age**



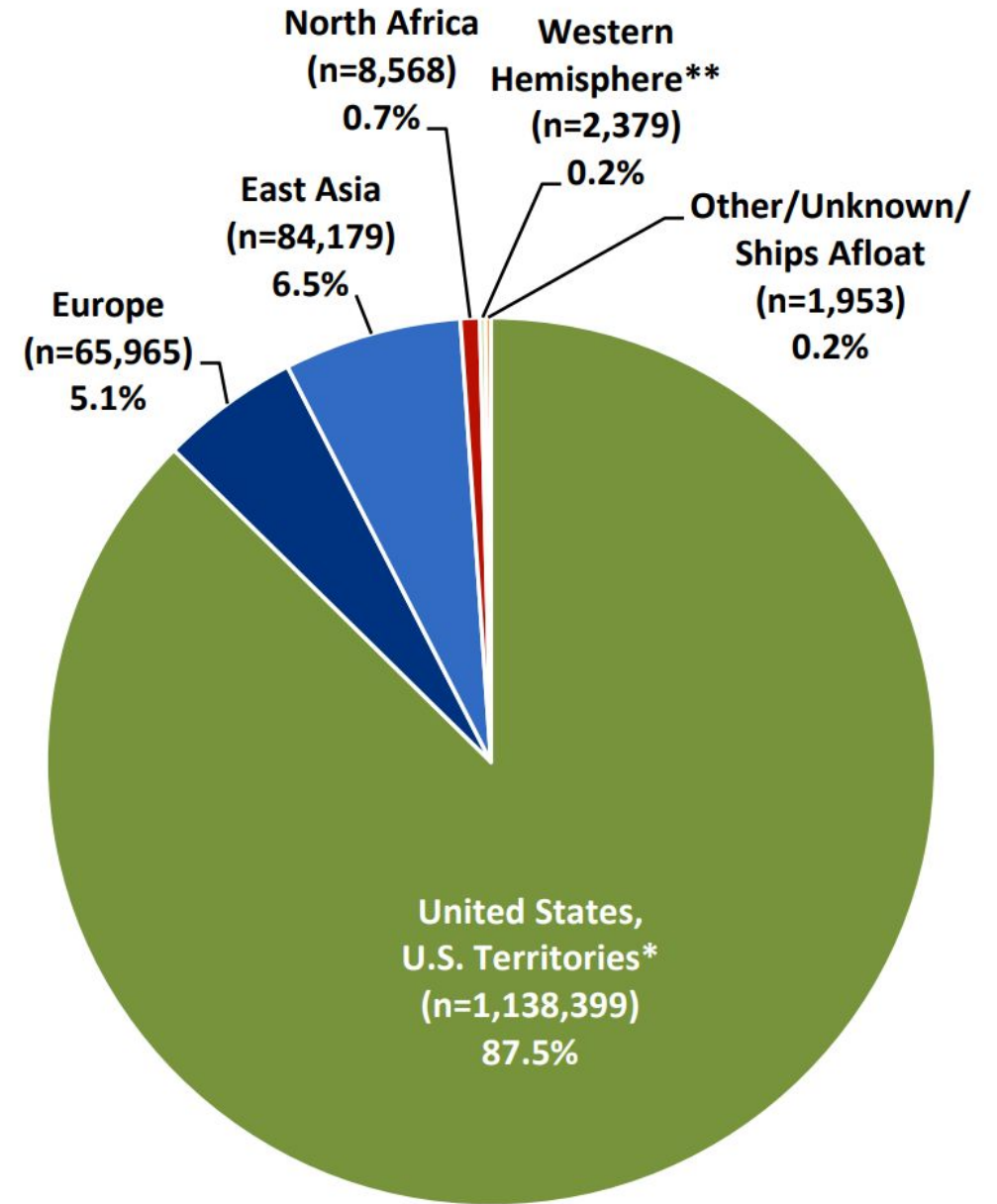
Military Demographics (US Active Duty, 2015)



Military Demographics (US Active Duty, 2015)

- **21% - Bachelor Degree or Higher**
 - **84% - Officers**
 - **7% - Enlisted**
 - **(28% - US Adults 18-44yrs)**

Military Geographic Location (US Active Duty, 2015)





Military Training Basics

The Global Security Context

- The world in a process of rapid & fundamental change
- Long-term shifts in the balance of global economic & military power
- Emergence of powerful non-state actors
- Predictable and unpredictable threats
- Rapid civil technology developments & escalating cyber threat
- Increasingly congested and complex world



- **War is chaotic**
- **No battle plan withstands contact with the enemy**
- **“All but war is simulation”**
- **“Train as you Fight”**

UK Royal Navy Training



- “are we ready to fight tonight?”
- “are we prepared to fight tomorrow?”

Nations Train Differently



- National and Military Culture
- Appetite for Risk
- Operational Tempo
- Equipment
- Training Methodology and Technology
- Resources
- Allies and Enemies

Basic Training



Specialist Training



Team Training



Collective Training and Exercises



Coalition Training and Exercises



Military Knowledge and Skills

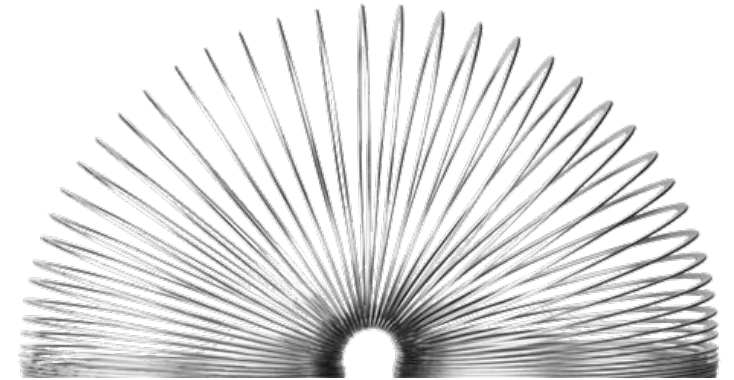
Depth



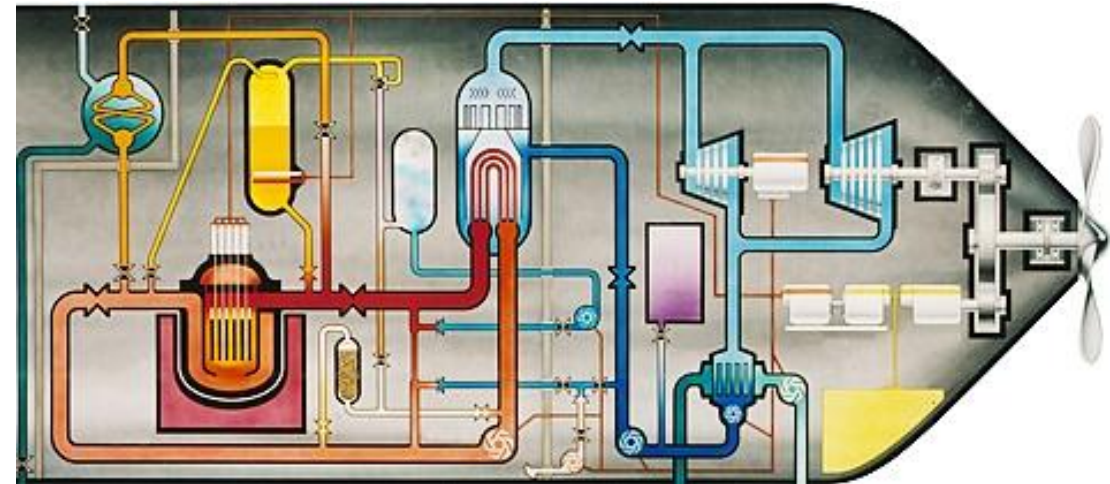
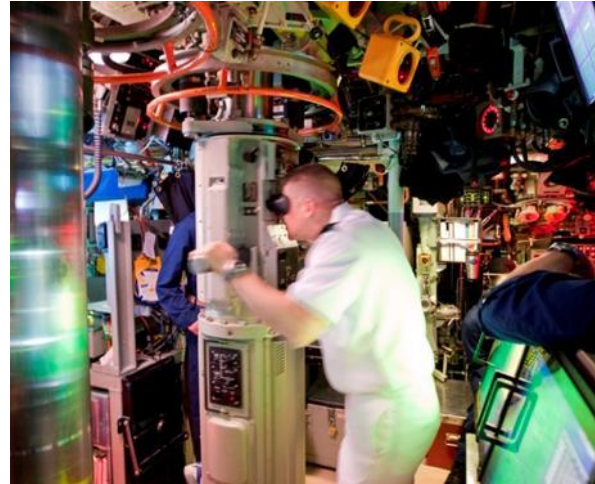
Breadth



Flexibility



Example – Nuclear Submarine



How do the Military Achieve this Level of Training and Education?

- The Military understands that training and education is fundamental to their endeavour
- People are assessed by how well they do in training
- Career progression depends on training and education
- Peer pressure
- Much of military life is spent training and exercising
- Lessons learnt are fed back



A Very Short History of Military Training Technology

Oldest Surviving European Training Media

Franconian Fechtbuch
(Combat Manual)
~1300



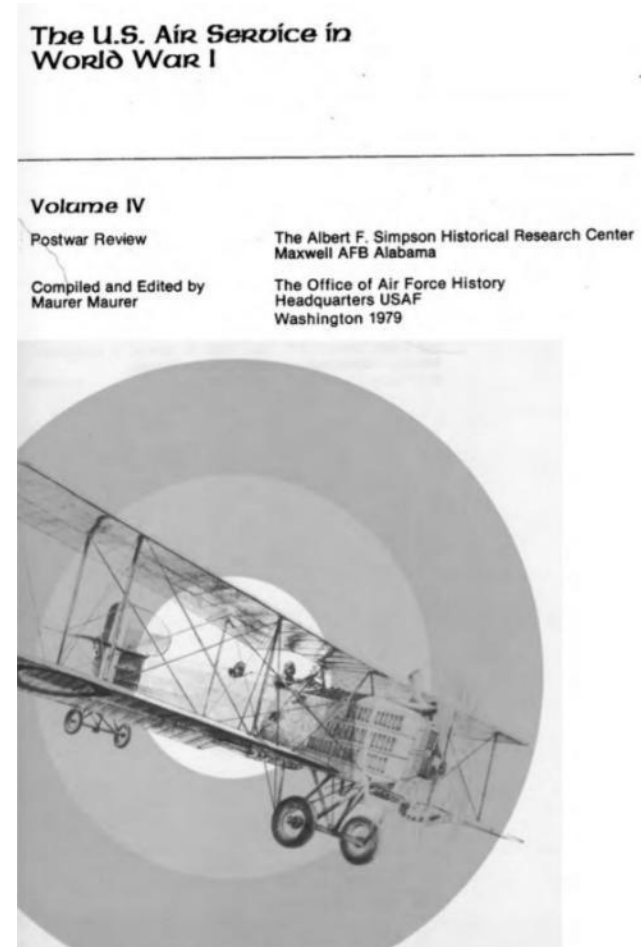
WWI Flight Simulation



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WWI US Air Gunnery Training

- “Academic instruction is not sufficient; the learner should have **ample practice**.
- **Brief lectures** giving the fundamental theory.... much better than long, intensive discussions which tire the minds of the listeners and cause a loss of interest.
- ...instruction centers on the use of a single gun, whereas in actual practice the twin gun is universally used. This **discrepancy between instruction and practice** should not occur.”



WW2 Link Trainer



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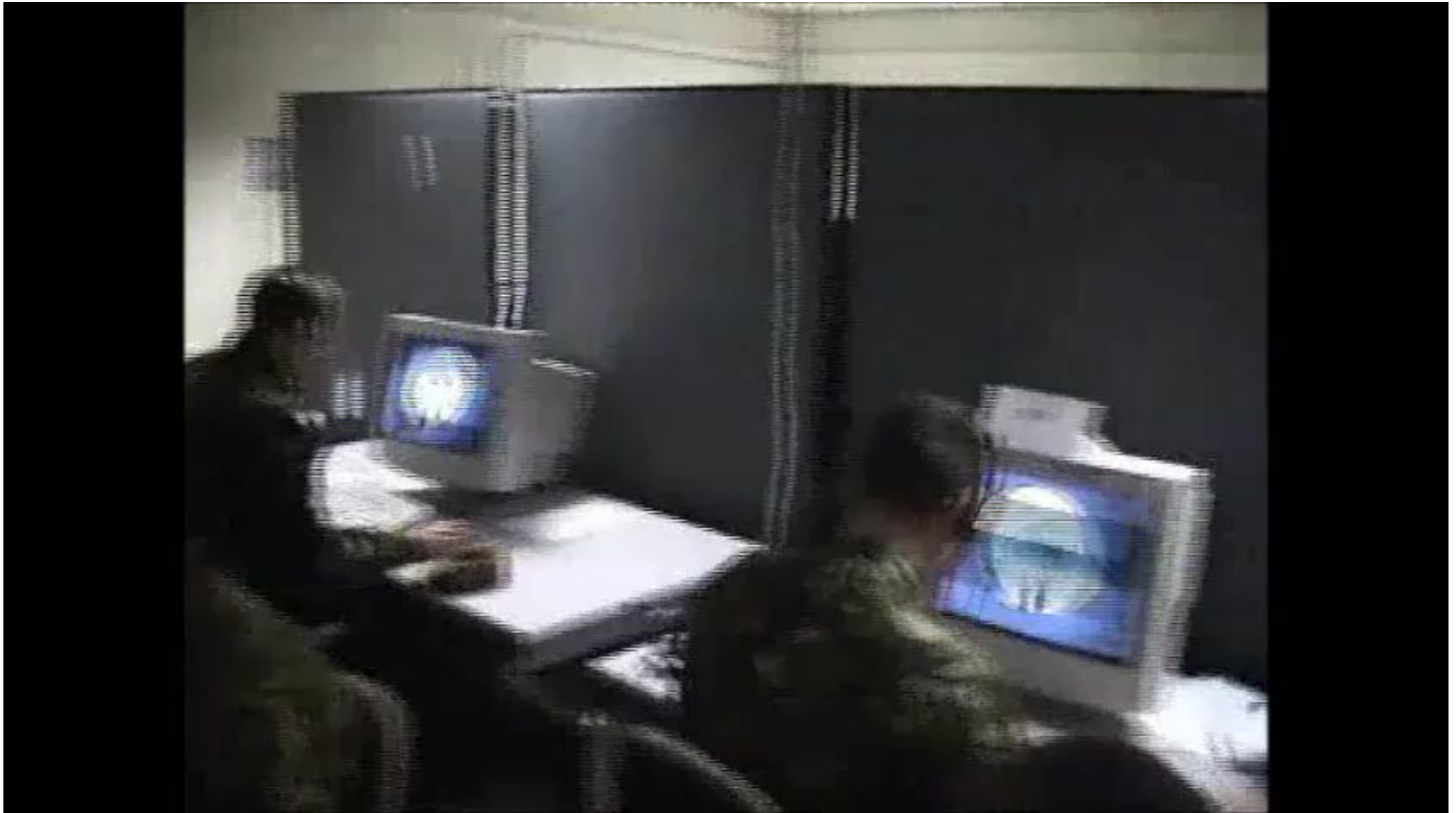
1970s Flight Simulation



It worked, but...

- **Inflexible - Scenarios and Training**
- **Expensive and High Maintenance**

UK Dismounted Infantry Virtual Environment (2002)



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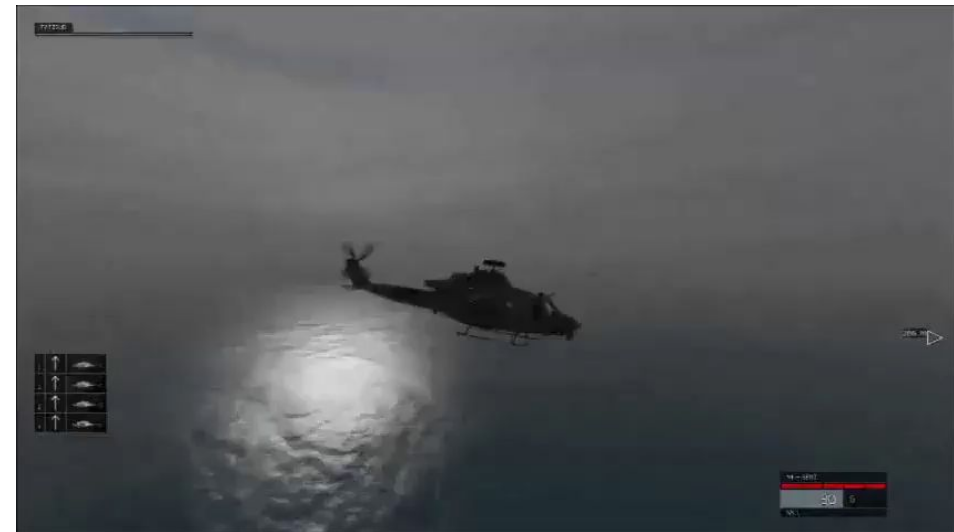
Computer Games in Training - 2008



When to use Games in Training?

- Games effective for cognitive or “how to think” training
- Games are not typically used to train motor skills, e.g. shooting a rifle or stomping around in the mud

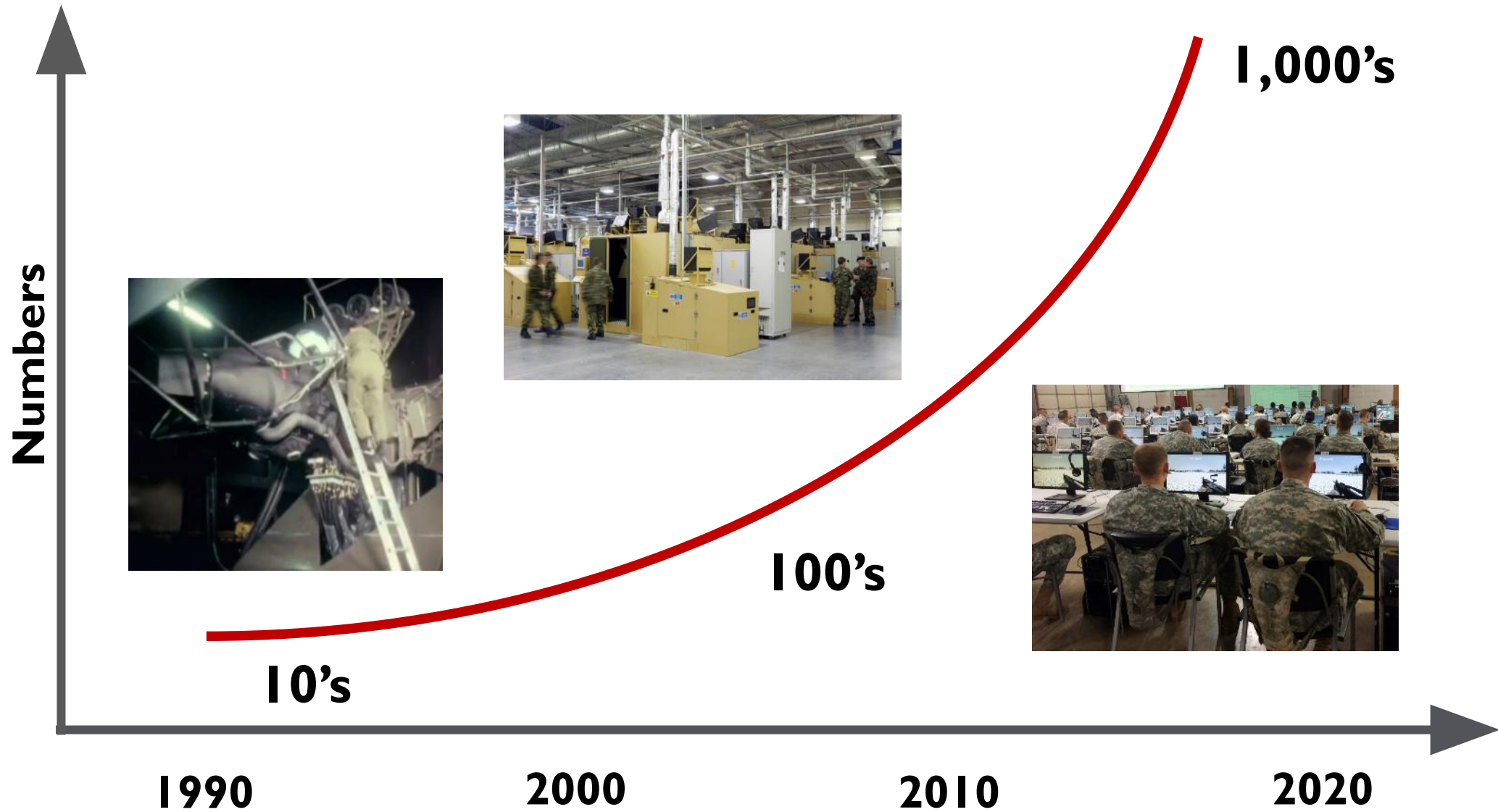
Games-Based Simulation Now - Land, Sea, Air, Anywhere



Bohemia
Interactive



Military Access to Simulation

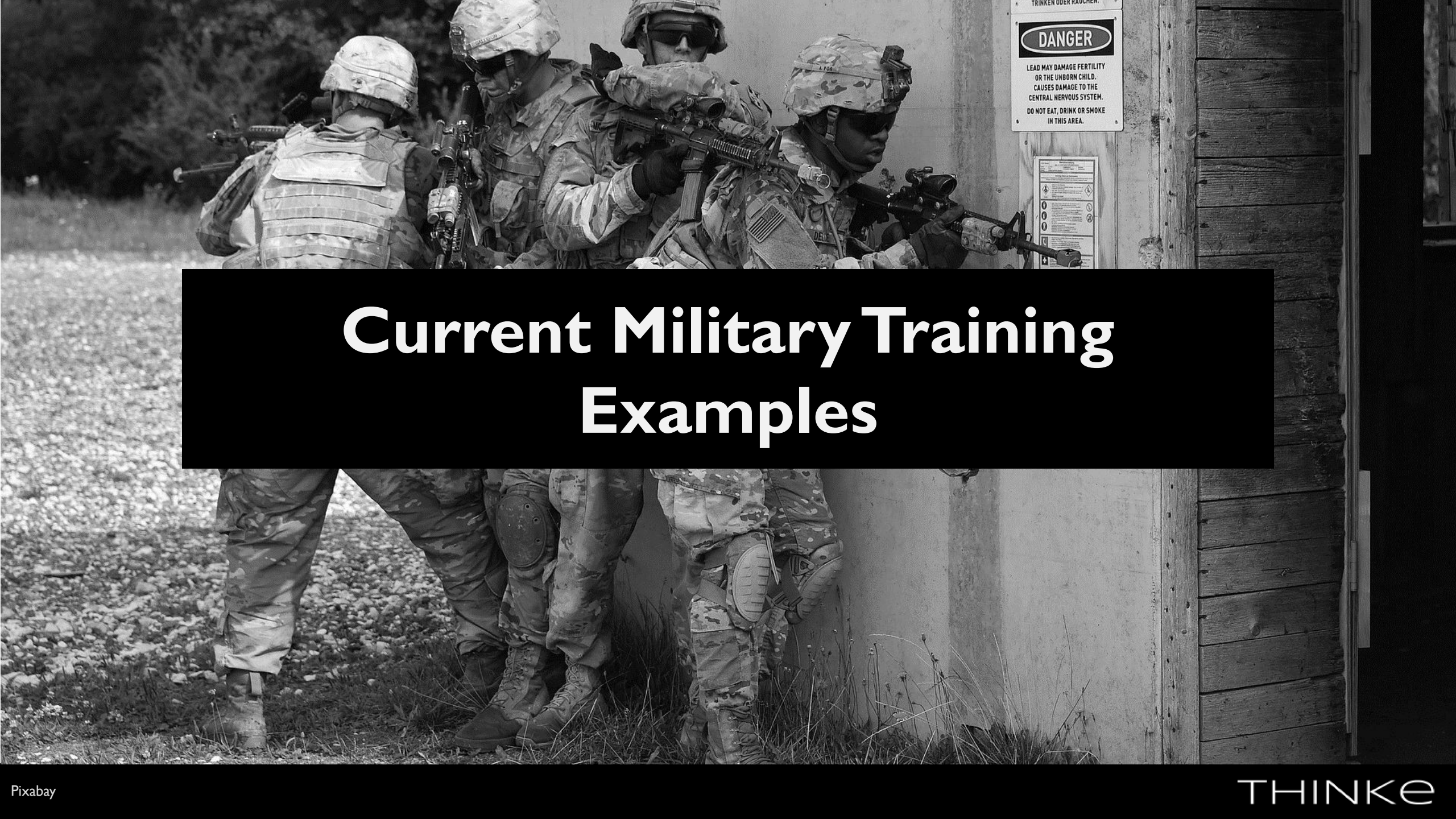


Digital Media Consumption



E-Learning





Current Military Training Examples

Fast Jet Training at RAF Valley (UK)



Swedish Air Force – Shift to Competence Based Learning

- Learning outcome focus rather than on course timetable
- Caters for greater diversity of skills and experience
- More risk (lack of repetition)
- Relies on very high-quality instructors



Changing Technology and Training Needs



Panavia Tornado (1970s on)

- Analogue
- Knobs, Dials



Lockheed Martin F-35 (2010s on)

- Digital
- “Glass Cockpit” - Touch Screen

UK Unit Based Virtual Training - Training as a Mobile Service

- Mobile contracted service supporting every Regular unit in the British Army
- Capacity of 10,950 trainees per annum
 - 73 units ~150 soldiers and officers
- Responds to unit demand but also collects and spreads best practice as it goes around the units
- Exploits gaming technology



Maritime Operations Room Training



Maritime Composite Training System



Maritime Firefighting and Damage Control Training

On-Shore Royal Navy Firefighting Training

- > 12,500 students trained every year
- 20 year contract worth £150m

Damage Repair and Instructional Unit (DRIU)

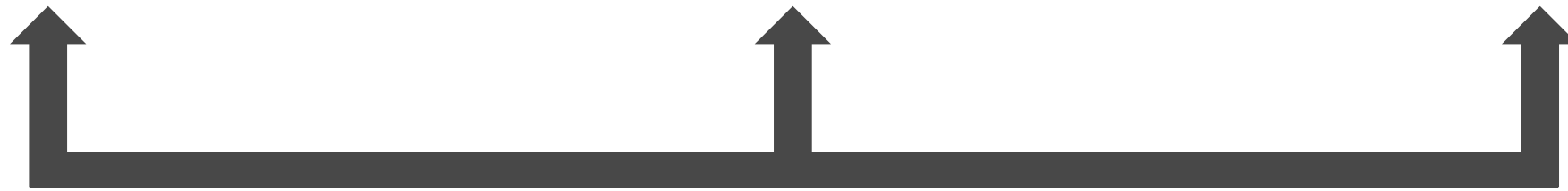


UK Parachute Training - VR in Use (RAF Brize Norton - 2011)



Military Networked Simulator Training

(Geographically Distributed or Co-Located)



High Level Architecture
HLA or DIS

USAF Distributed Mission Operations Network (DMON)

- DMON allows different aircraft simulator platforms located across the globe to interoperate and train together in a realistic virtual environment via a secure network
- Provides on-demand, inter-team training for the Combat Air Forces on a daily basis



Live Simulation

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People in
Instrumented
Real World



Virtual Simulation

-

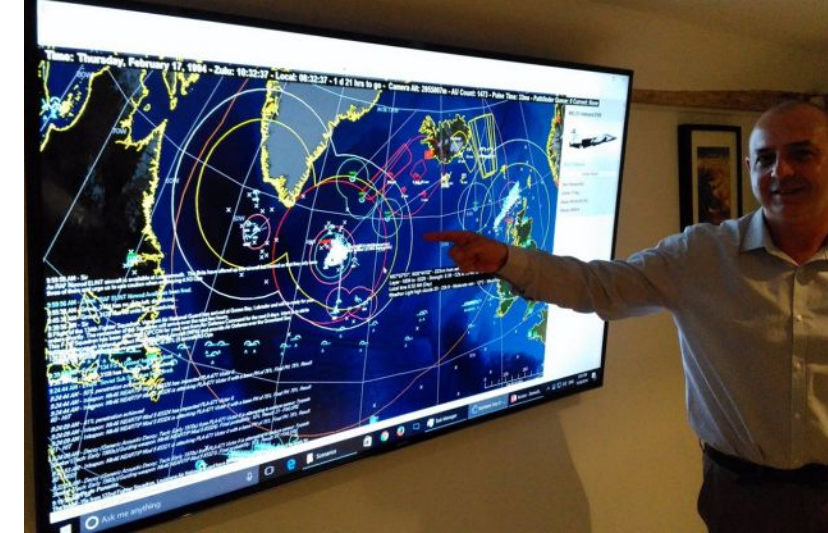
People in a
Virtual World

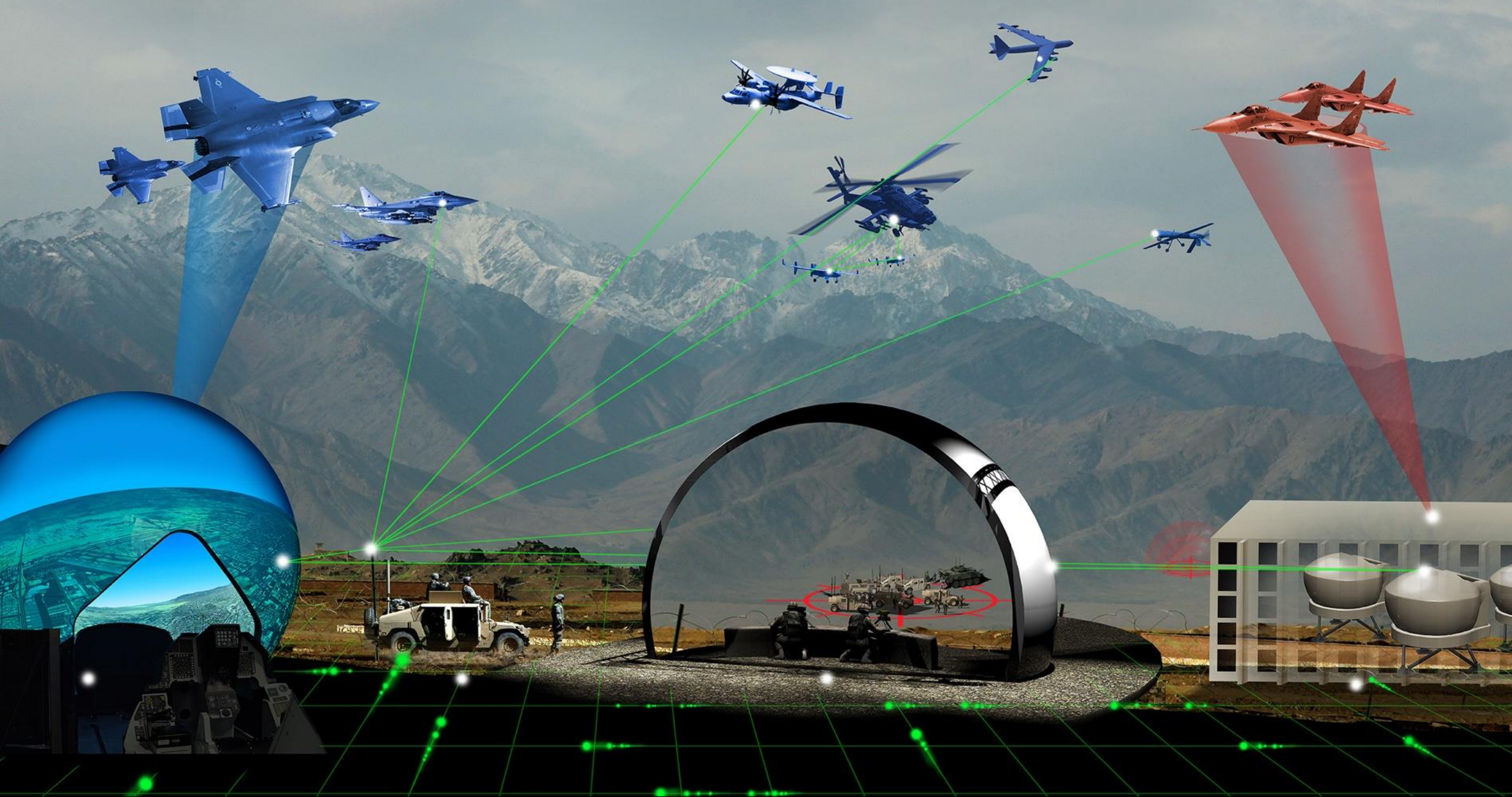


Constructive Simulation

-

Simulated
People & World





Live-Virtual-Constructive Infrastructure

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Deployable Training Devices – US Army Aviation Combined Arms Tactical Trainer (AVCATT)



Live/Simulation Balance



Live Training

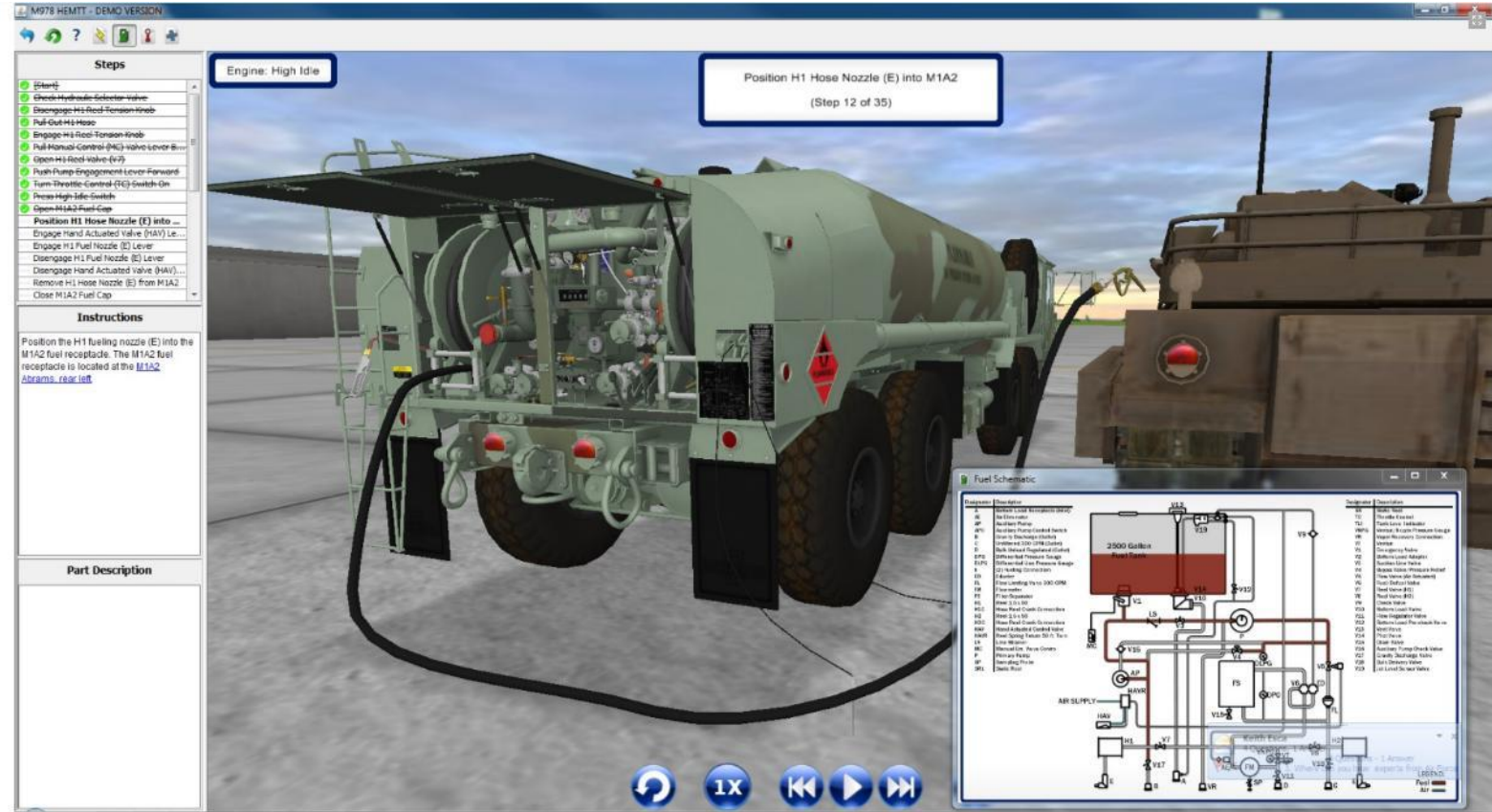
- Fear
- Friction
- Fog of War
- Real Comms
- Build Muscle Memory
- Real Weather & Terrain Effects



Simulation-Based Training

- Flexible and Deployable
- Repeatable
- Safe
- Fully Instrumented
- Less Cost and Equipment
- Less Environmental Impact

Maintenance and Support Training



UK Defence Learning Management Capability

- 200,000 Defence Learning Environment Users
- 15,000 different course types
- Training at Home, Home Station, Deployed, and at Sea on most end-user devices
- A digitised, coherent, learning and training environment that accurately records achievement, ongoing needs, and development opportunities



Military Training Challenges and Opportunities

Television Shortcuts

A dying habit: why the average BBC1 viewer is 61



709

Simon Usborne

Wednesday 29 March
2017 17.38 BST



 Old medium ... has TV lost its appeal to young people? Photograph: simonkr/Getty Images/iStockphoto

Changing Demographics

What's Next?



Digital Native

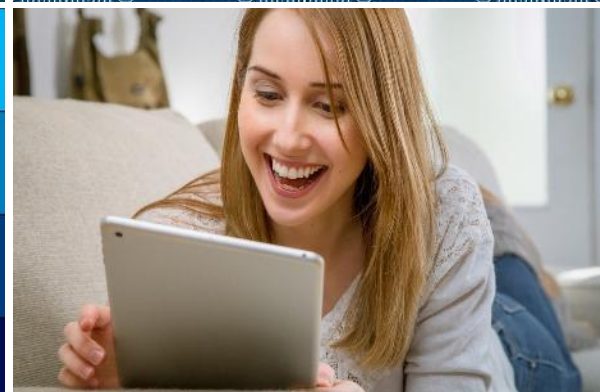
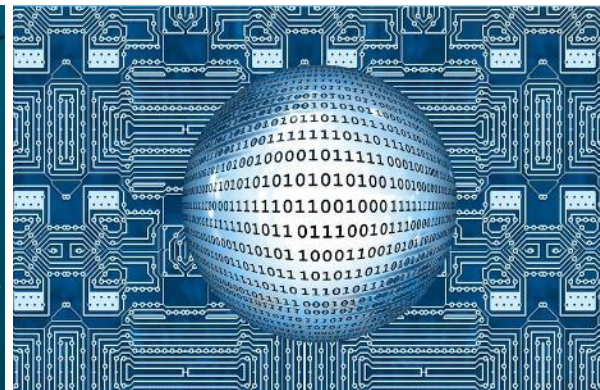


AI Native?

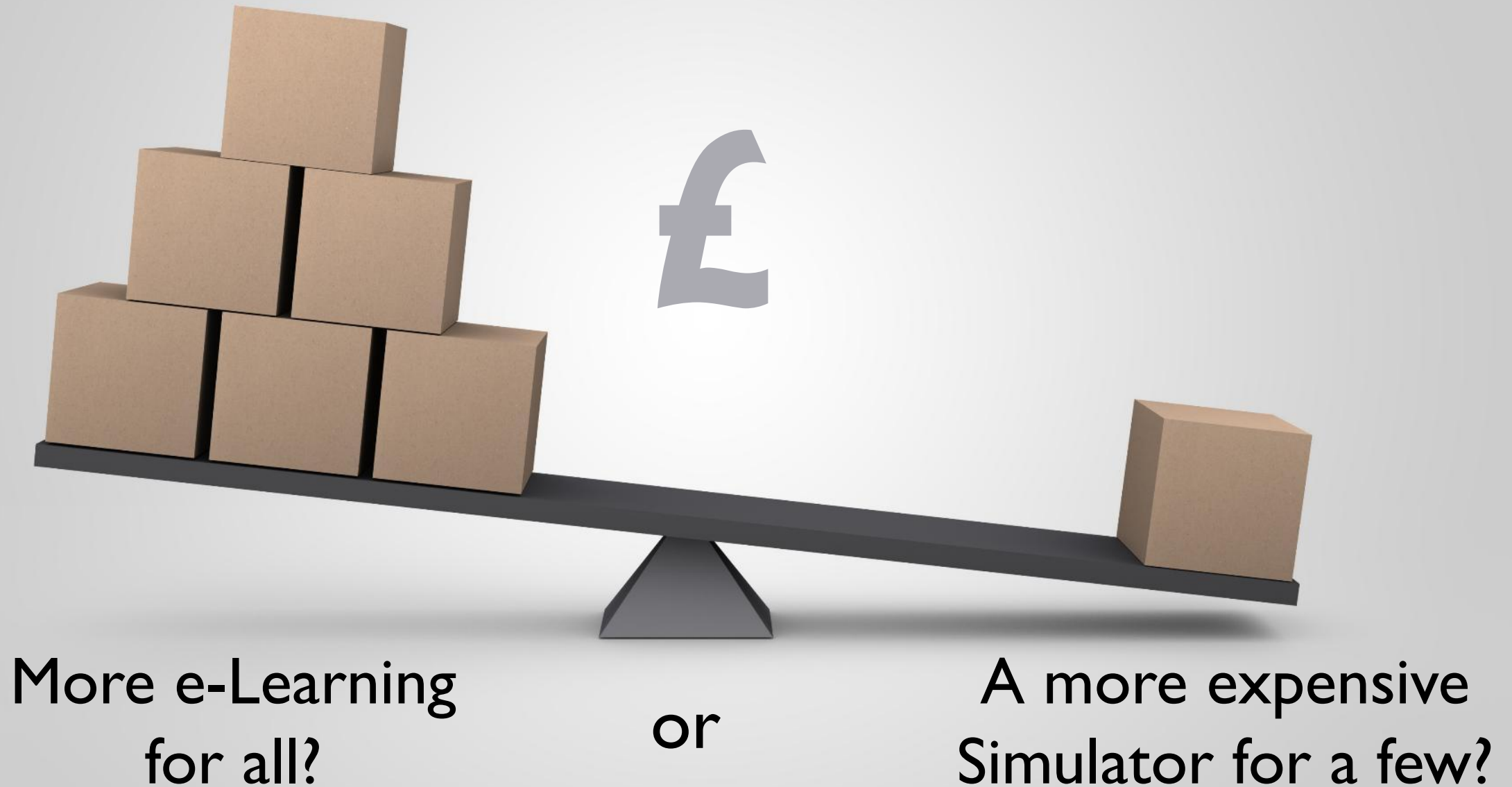
Train and Retain the Trainer?



Technology Now – Choices, Choices...

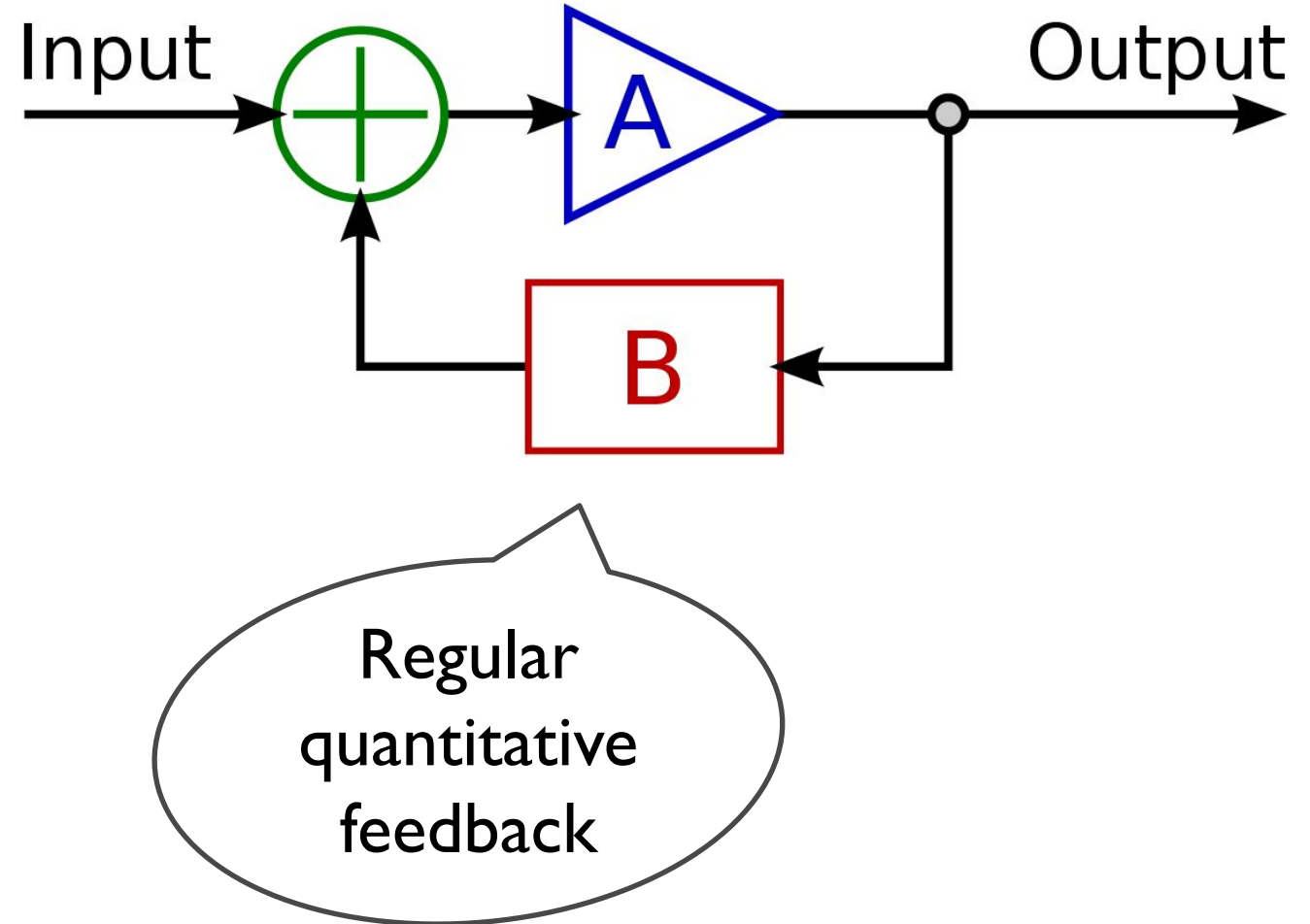


Where to Invest?



Training Requirements

- There are processes to determine training requirements, eg. Training Needs Analysis, however:
 - Conducted early in project lifetime
 - Irregularly reviewed and typically qualitative evidence



Training Providers - Innovation v Stability?

- Adaptability
- Responsiveness
- Technology Exploitation



- Investment
- Stability of Supply
- Stability for Trainers

Striving for Training System Interoperability

Challenges

- Project Priorities v Enterprise Priorities
- Different Vendors
- Different Timescales
- Different Technology

Response

- Standards Bodies
 - Simulation Interoperability Standards Organization
 - NATO Modeling & Simulation Group

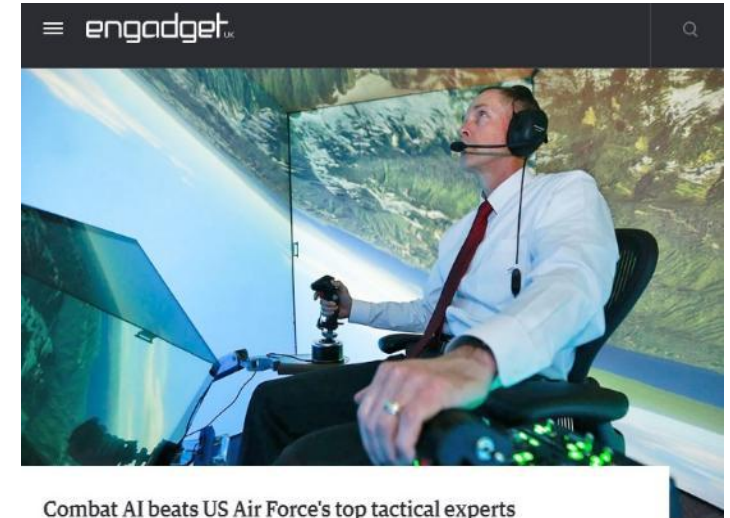


The Rise of Military Autonomous Systems



US Navy
X-47B

US AFRL
“ALPHA”



Combat AI beats US Air Force's top tactical experts

And it only requires the processing power of a Raspberry Pi.



Andrew Dalton , @dolftown
06.28.16 in Robots

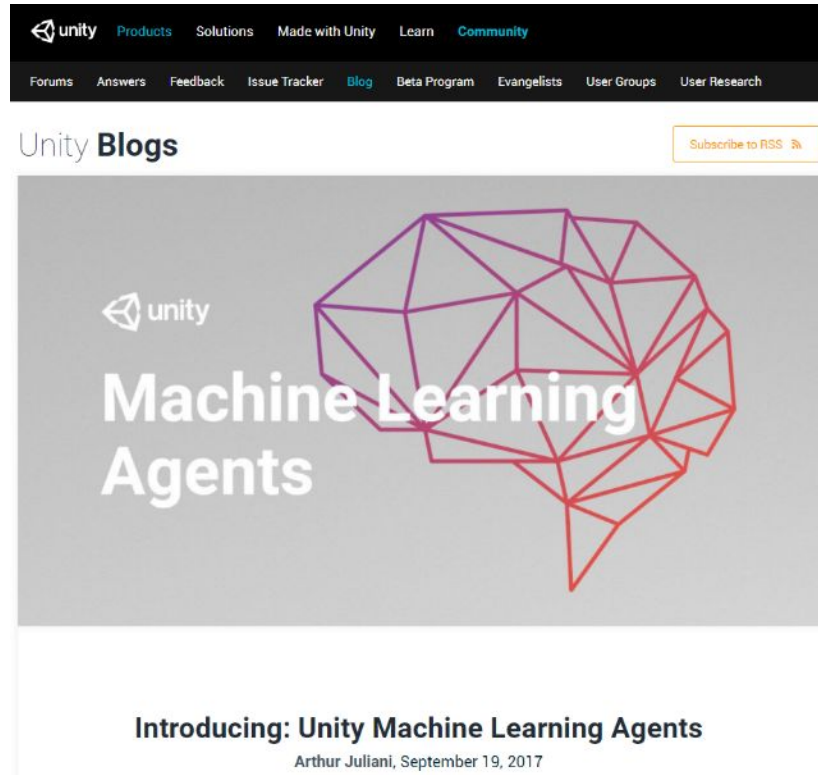


US Army
Manned-Un
manned
Teaming
(MUM-T)

US Navy
Autonomous
Craft



Unity Games Engine Machine Learning Agents (Sep 2017)

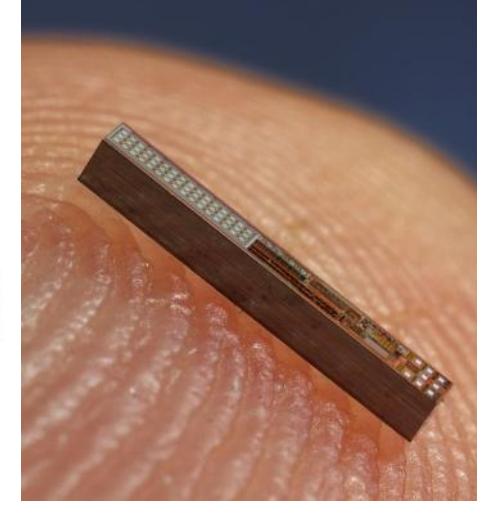
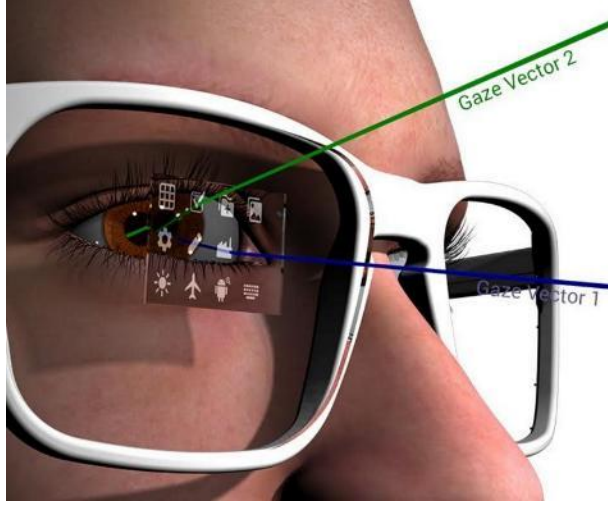


Simulation/Games being
used to “train”
AI Programs

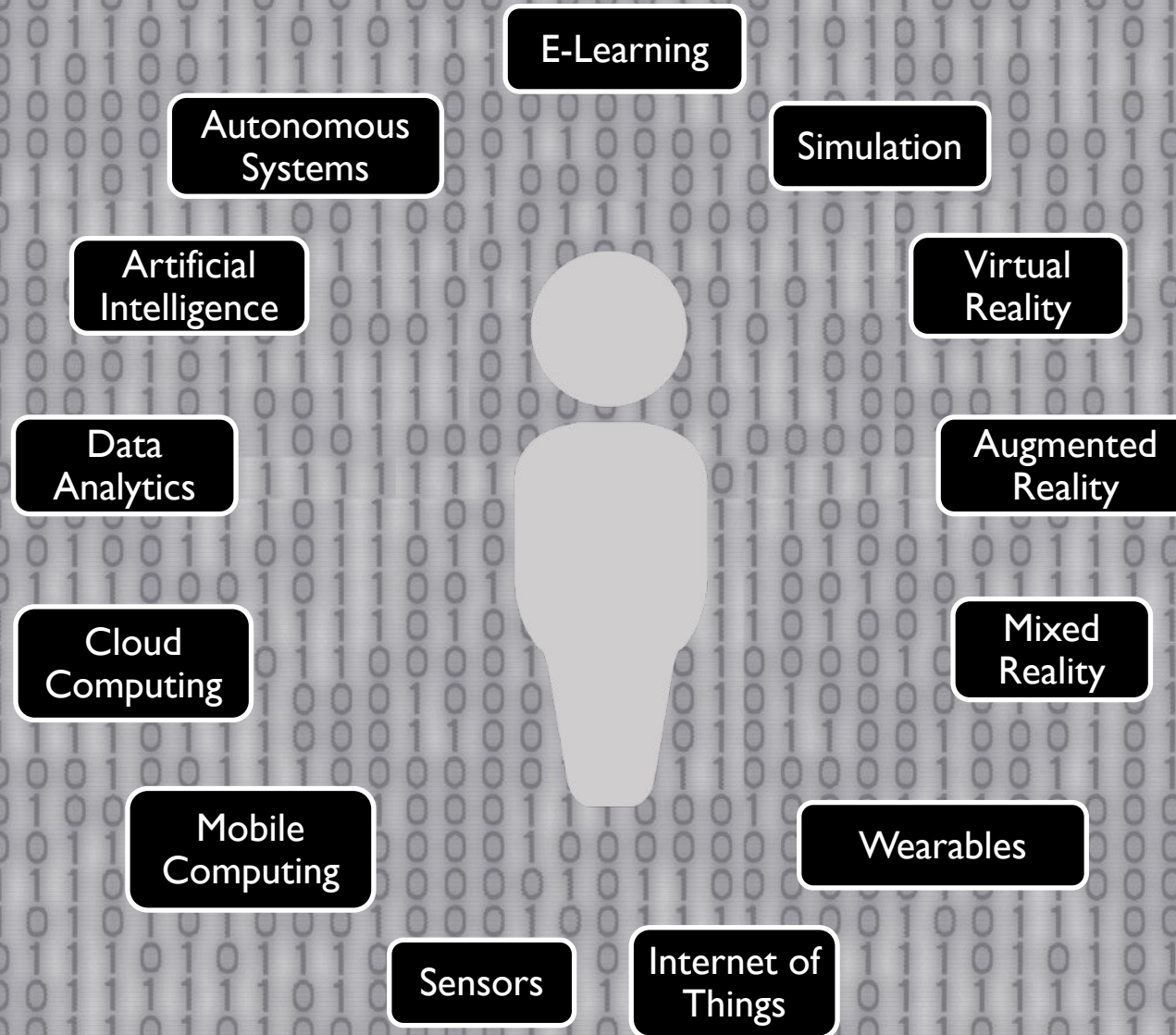


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Quantified Human



Digitisation of Training



A Fourth Revolution - Training 4.0 (?)



1st

2nd

3rd

4th

Paper,
Chalk

Paper,
Electro-Mecha
nical

Digital
Media

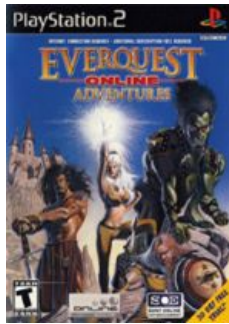
Digitisation of
Training



Islands of Training Data

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What Can We Learn From Massively Multiplayer Online Games? (MMOGs) In a Defence Training & Simulation Context?



- MMOGs offer a new way of thinking for Defence about persistency of training and simulation data and user community support
- A defence MMOG approach would bring benefits to trainees, trainers, analysts and the enterprise, driving cost effectiveness and improving flexibility

Some Benefits of a MMOG-Based Approach

Trainee

- Performance measured and recorded, accessible through career
- Training content and other trainees easy to discover and share knowledge with

Trainer

- Access to a training and education environment 24/7, maintained and updated centrally
- Training scenarios easy to access, develop and share

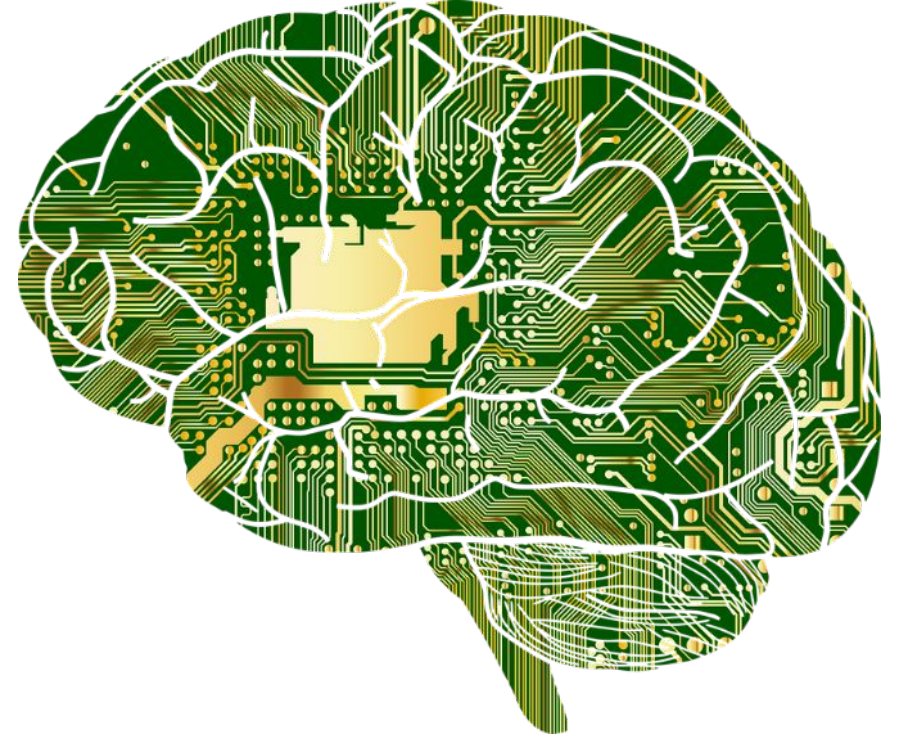
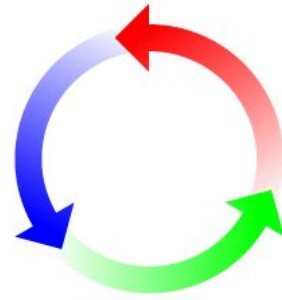
Training Analyst

- Training and human factor analysts collect training data and can conduct analysis on:
 - human performance and training systems effectiveness, and
 - methodologies/pedagogies

Enterprise

- Software and data maintained and upgraded centrally reducing costs and responding better to changing operational needs

Humans, Artificial Intelligence and Data



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**making an
impact?**



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Questions?

