



THINKE



**8th SMi Annual
Military Flight Training Conference
London - 9/10 October 2019**

Military Flight Training and Simulation in the 2020s?

Andy Fawkes

Simon Newcomb

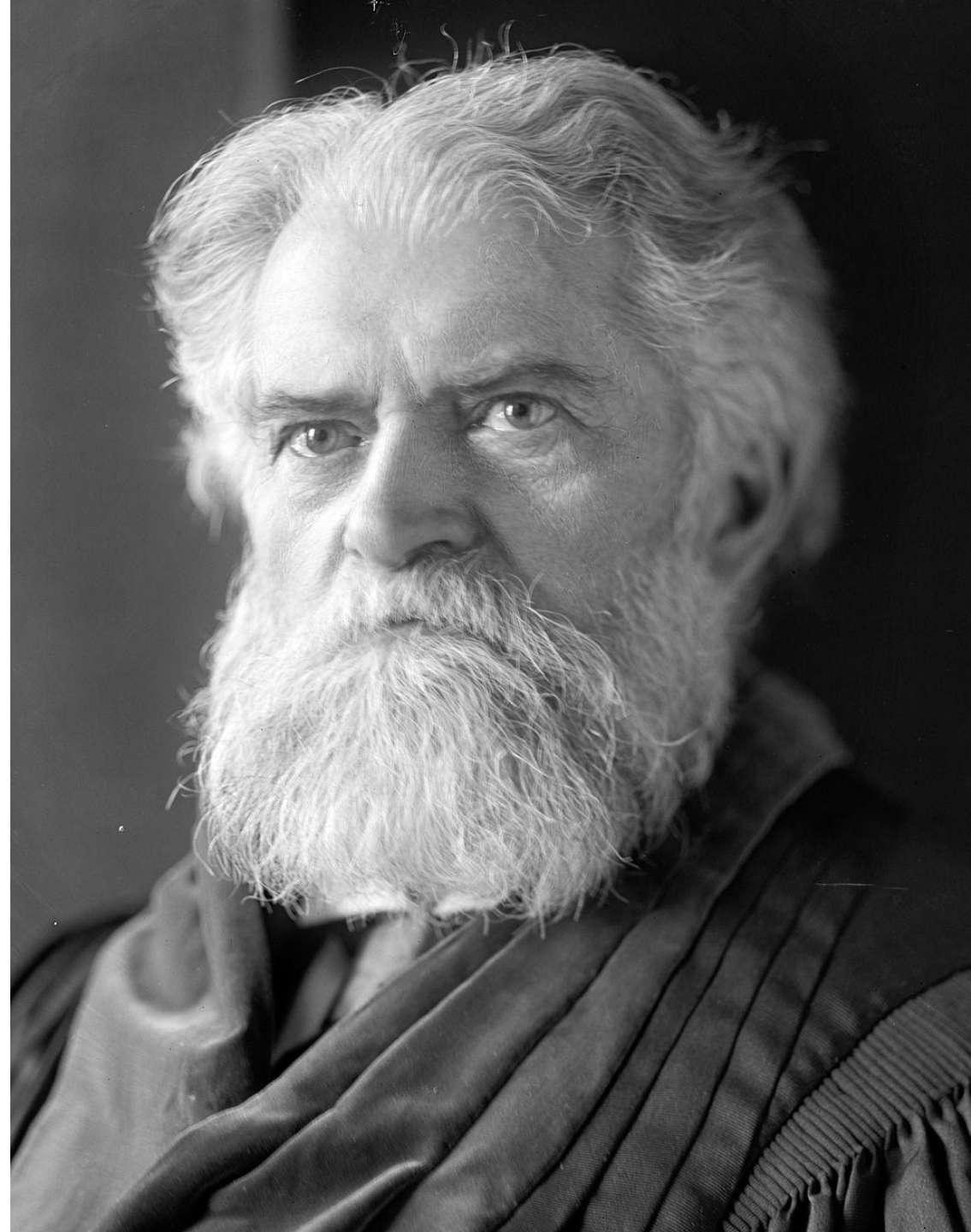
1835-1909

US Navy Professor of Mathematics

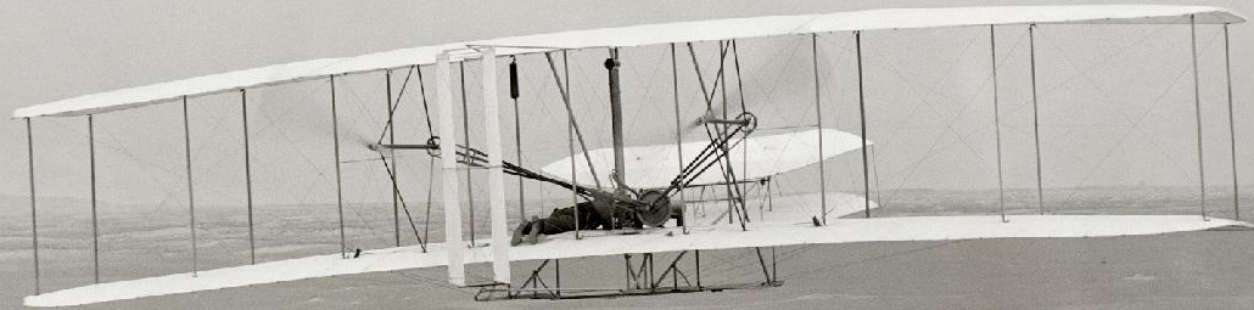
The Outlook for the Flying Machine

October 1903

“The mathematician of to-day admits that he can neither square the circle, duplicate the cube or trisect the angle. May not our mechanics, in like manner, be ultimately forced to admit that aerial flight is one of that great class of problems with which man can never cope, and give up all attempts to grapple with it?”



December 1903



Flight Training and Simulation in the 2020s

- Context
- Recruits
- Some Technologies of Interest
- Quick(ish) Wins

Context



THINKE



10:47Z Ship is at Flyi
16:00 121 ALA → 3
16:00 56 BPE → 2

THINKE





Potential Peer+ Threat Environment

S-400



S-500?



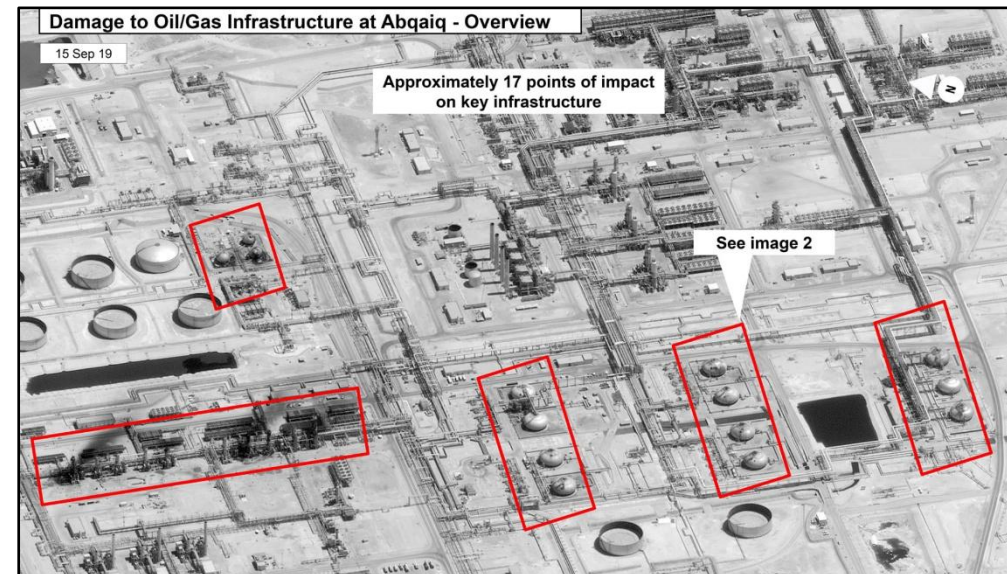
10 Jan 2019

2019



“Low Tech” Air Threat

14 Sep



CNBC MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV SEARCH QUOTES

POLITICS

How Saudi Arabia failed to protect itself from drone and missile attacks despite billions spent on defense systems

PUBLISHED THU, SEP 19 2019 • 4:54 AM EDT | UPDATED MON, SEP 23 2019 • 6:35 AM EDT

Natasha Turak @NATASHATURAK

SHARE f t in e ...

KEY POINTS

- Saudi Arabia in 2018 spent an estimated \$67.6 billion on arms — second only to the U.S. and China.

The Future - Not a Greenfield Site



UK Air Training Capabilities

A400M

Apache

ASDOT

AUV

C-130

C17

DCS&S

DOTC(A)

DSALT2

E-3

F-35

iASTC

JFST

LTPA

MFTS

MSHTF

P-8

STARS

TFST

TyTan

WIST

PFI – Private Finance Initiative

- Military Flying Training System (MFTS) Contract
- 25 Years from 2006
- Medium Support Helicopter Aircrew Training Facility (MSHATF) Contract
- 40 Years from 1997



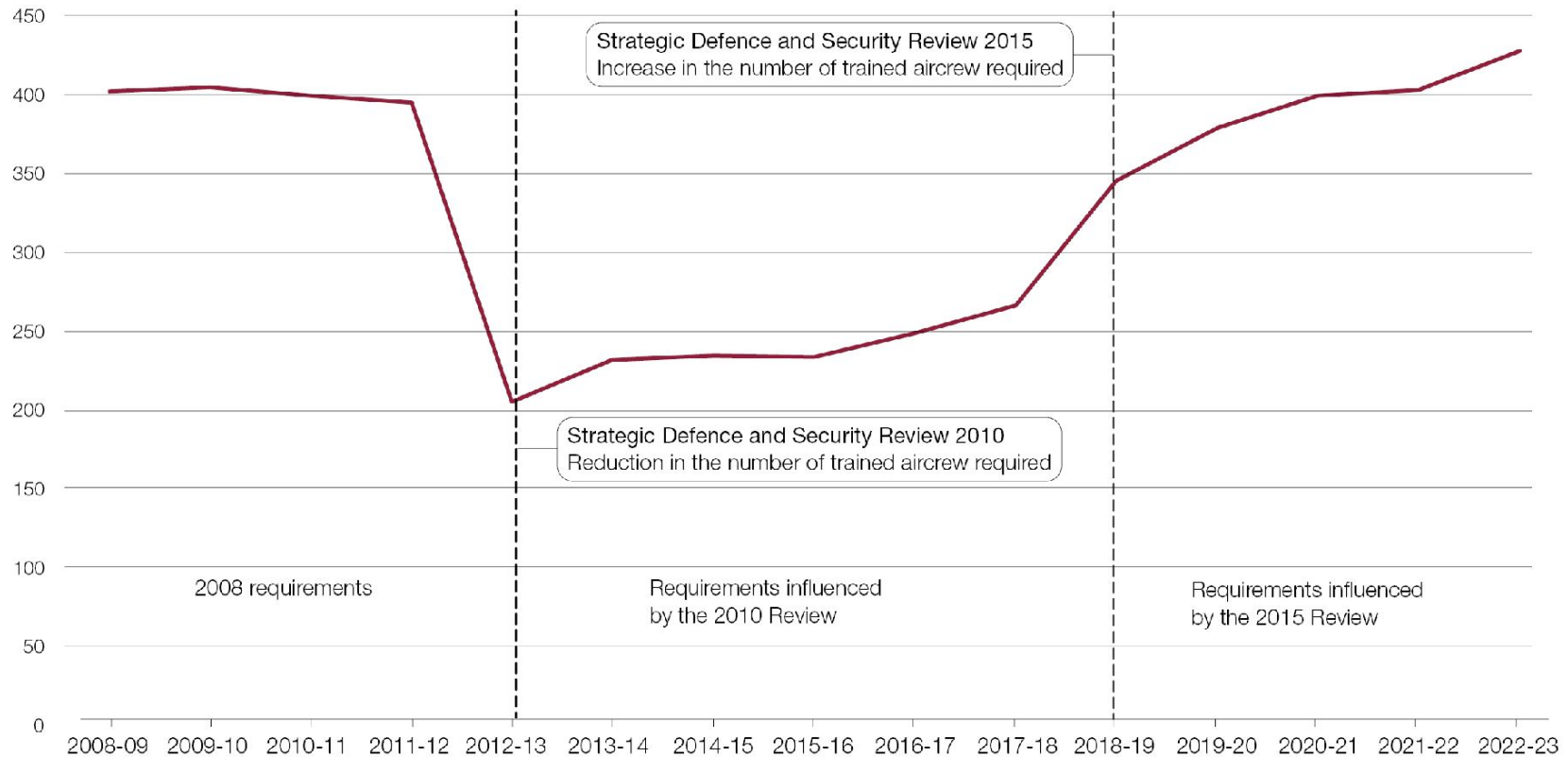
UK National Audit Office (NAO) - 4 Sep 2019

Investigation into Military Flying Training

Ministry of Defence requirement for students completing Phase 2 training, 2008-09 to 2022-23

The Ministry of Defence's aircrew requirements have changed over time

Number of aircrew required to complete Phase 2 each year



Fast-jet pilots	46	46	46	44	34	32	34	27	29	35	25	40	40	40	40
Helicopter pilots	144	144	144	144	73	83	76	81	87	89	86	104	106	109	109
Multi-engine pilots	46	46	46	46	15	28	26	25	24	28	121	108	109	106	106
Rear crew	162	165	160	157	80	85	95	97	105	111	110	123	141	144	169
Total	398	401	396	391	202	228	231	230	245	263	342	375	396	399	424

Room to Manoeuvre?



**What are We
Seeking in
Training?**

Faster



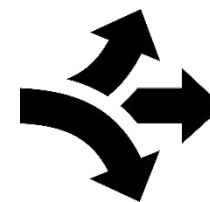
Cheaper



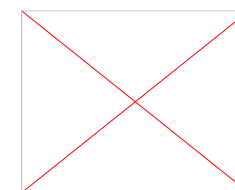
Better



Flexibility



Joint



Recruits

Recruits





RAF Age Distribution - 2019

38% of the RAF is ≤ 29
and 74% ≤ 39

Royal Air Force		32 860
Under 18		200
Female	20	8.9
Male	180	91.1
18 - 19		910
Female	100	11.2
Male	810	88.8
20 - 24		4 790
Female	660	13.9
Male	4 130	86.1
25 - 29		6 470
Female	980	15.2
Male	5 490	84.8
30 - 34		6 100
Female	1 040	17.0
Male	5 070	83.0
35 - 39		5 800
Female	940	16.2
Male	4 860	83.8
40 - 44		3 670
Female	570	15.5
Male	3 100	84.5
45 - 49		2 710
Female	320	11.7
Male	2 390	88.3
50 - 54		1 790
Female	110	6.0
Male	1 680	94.0
55 - 59		410
Female	20	4.4
Male	390	95.6
60 and Over		10
Female	~	~
Male	10	88.9
AVERAGE AGE		33

UK Armed Forces Biannual Diversity Statistics: 1 April 2019

“Digital Native”

generally considered a person born in the 1980s and after growing up in the digital age with day to day access to computers, games, Internet, etc.



Broadly, 55% of the RAF now are Digital Natives and 85% by 2030

**UK Children aged 12
to 15 spend 12.2
hours a week
gaming in 2017**

**and 11 to 64 year-olds
8.9 hours**



FIND WHERE YOU BELONG

SEARCH **ARMY JOBS**



**Air Chief Marshal
Sir Stephen Hillier
Jan 18**

**“teenagers playing on
their Xbox at home
should take their
gaming to the next
level and join the RAF
to operate real drones”**

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Login

Join the RAF for the real thing, Xbox teenagers are told: Head of the air force says young gamers should take it to the next level by operating drones

- Air Chief Marshal Sir Stephen Hillier wants more young people to join the RAF
- The service will be celebrating their 100th anniversary with events this year
- Among the major events planned is a flypast along the Mall before the Queen
- RAF chiefs hope a display of military might could provide a boost to recruitment



By LARISA BROWN FOR THE DAILY MAIL

PUBLISHED: 00:32, 12 January 2018 | UPDATED: 00:53, 12 January 2018



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387
shares

194
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Teenagers playing on their Xbox at home should take their gaming to the next level and join the RAF to operate real drones, the head of the air force said yesterday.

Air Chief Marshal Sir Stephen Hillier said the RAF's next 100 years will see a huge shift towards unmanned flying machines as he outlined plans for centenary celebrations.

What's Next?



Digital Native

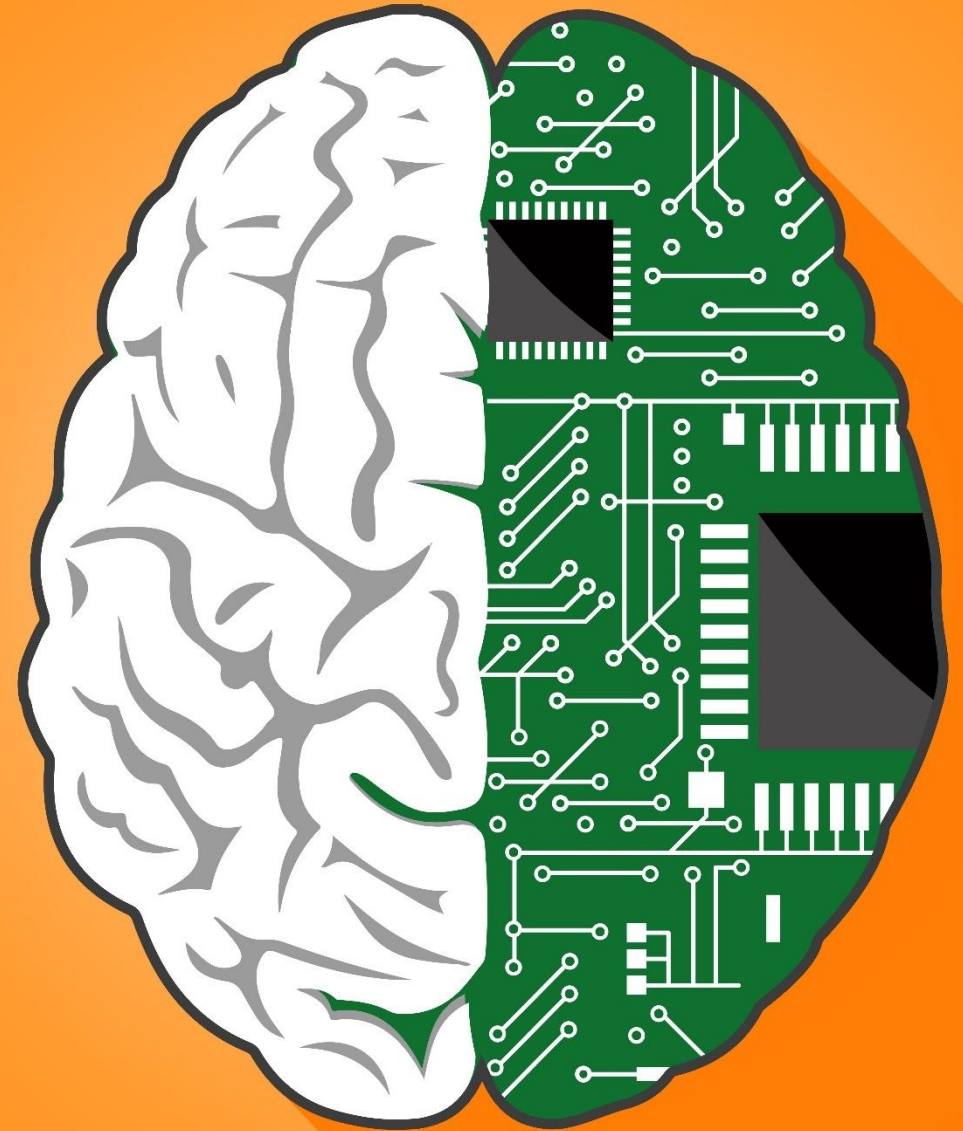


AI Native?

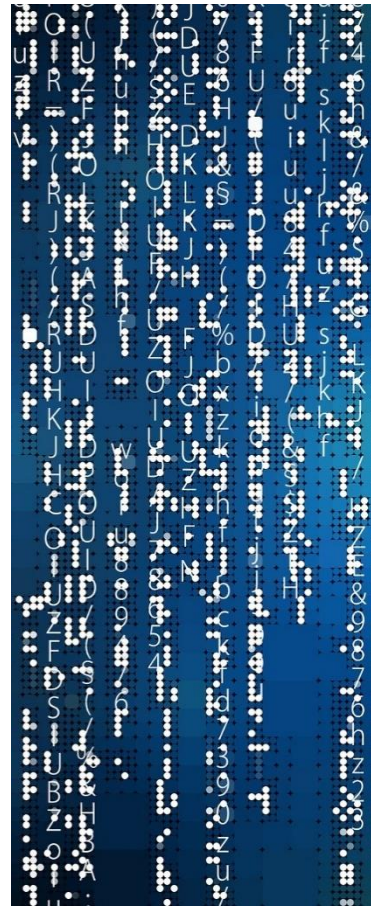
Some Technologies of Interest

AI

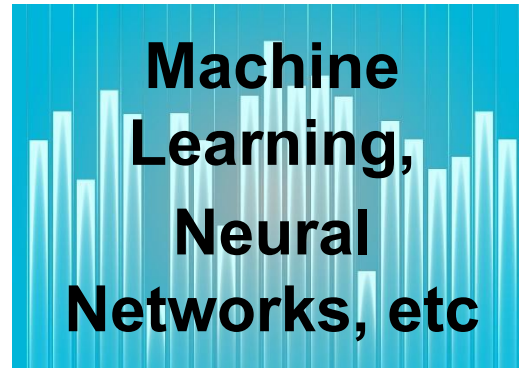
- Personalizing the learning experience
- Virtual mentoring/tutor
- Advanced analytics
- Creating digital training content
- Training that automatically changes to fit the skill level of the player
- More cost effective, faster simulation design & production
- Improved simulation AI-driven characters & effects
- Reduce the need for training



Exploiting Big Data



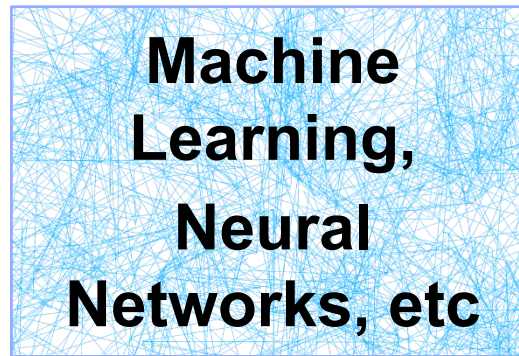
Big Data



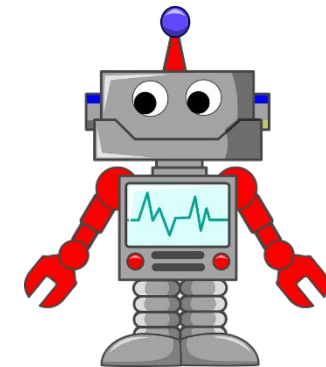
Analysis



Human Decisions

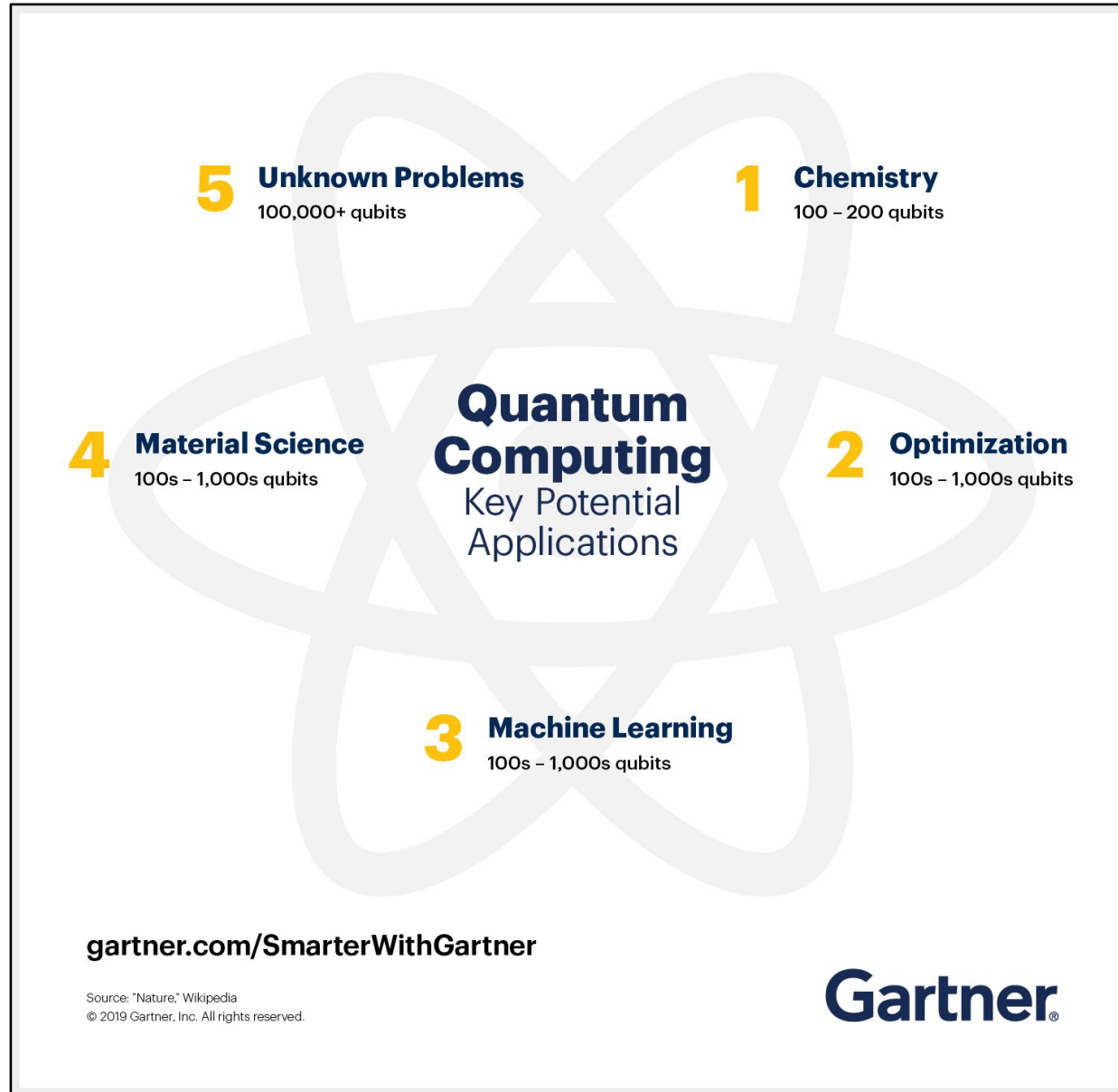


“Training”



Automation

Quantum Computing



- Artificial Intelligence
- Molecular Modelling
- Cryptography
- Financial Modelling
- Weather Forecasting

The article header features a dark blue navigation bar with a logo and links for 'TECH JOBS', 'TECH TOPICS', 'TECH HUBS', and 'FOR EMPLOYERS'. Below the navigation bar is a hero image with a person, a bar chart, and a cube. The article title is in large, bold, dark blue letters. The subtitle is in smaller, dark blue letters. The date and author information are at the bottom of the header.

QUANTUM COMPUTERS WILL TRANSFORM HOW WE MAKE AND PLAY VIDEO GAMES

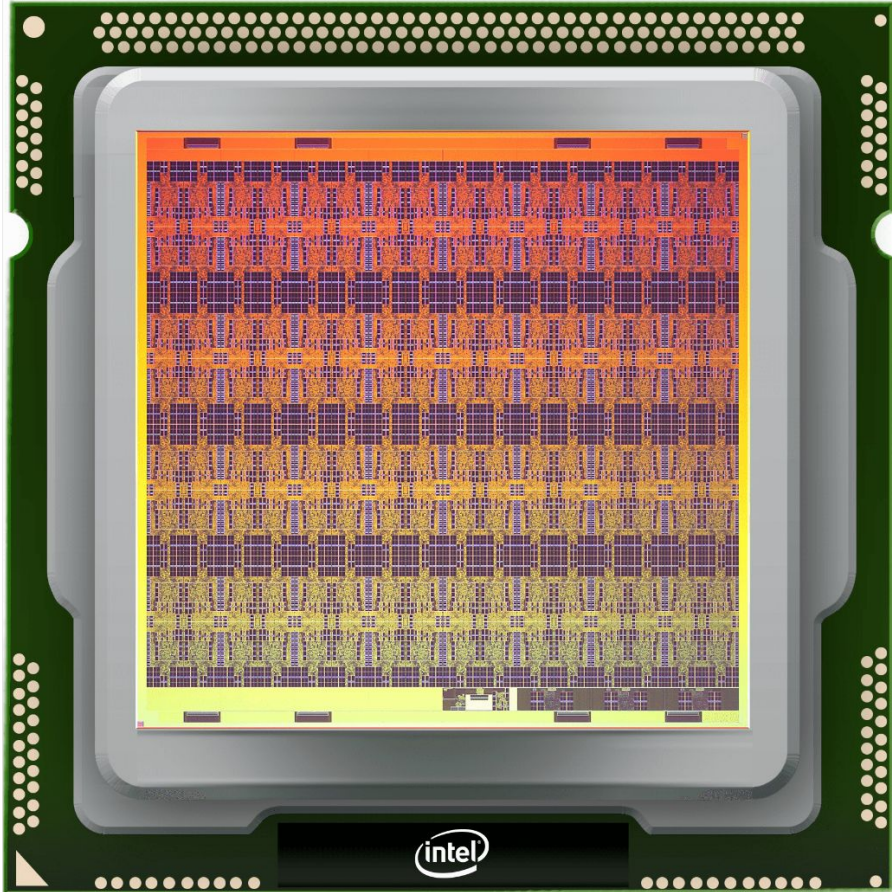
Better-than-ever graphics, non-player characters that move hyper-realistically and truly random level generation — that's what quantum means for gaming.

September 17, 2019

Written by [Stephen Gossett](#)

[in](#) [f](#) [t](#) [cc](#) [en](#)

Neuromorphic Computing



- Chips and programs that emulate the neural structure of the human brain
- Requires far less power
- Could one day blur the line between human and machine cognition

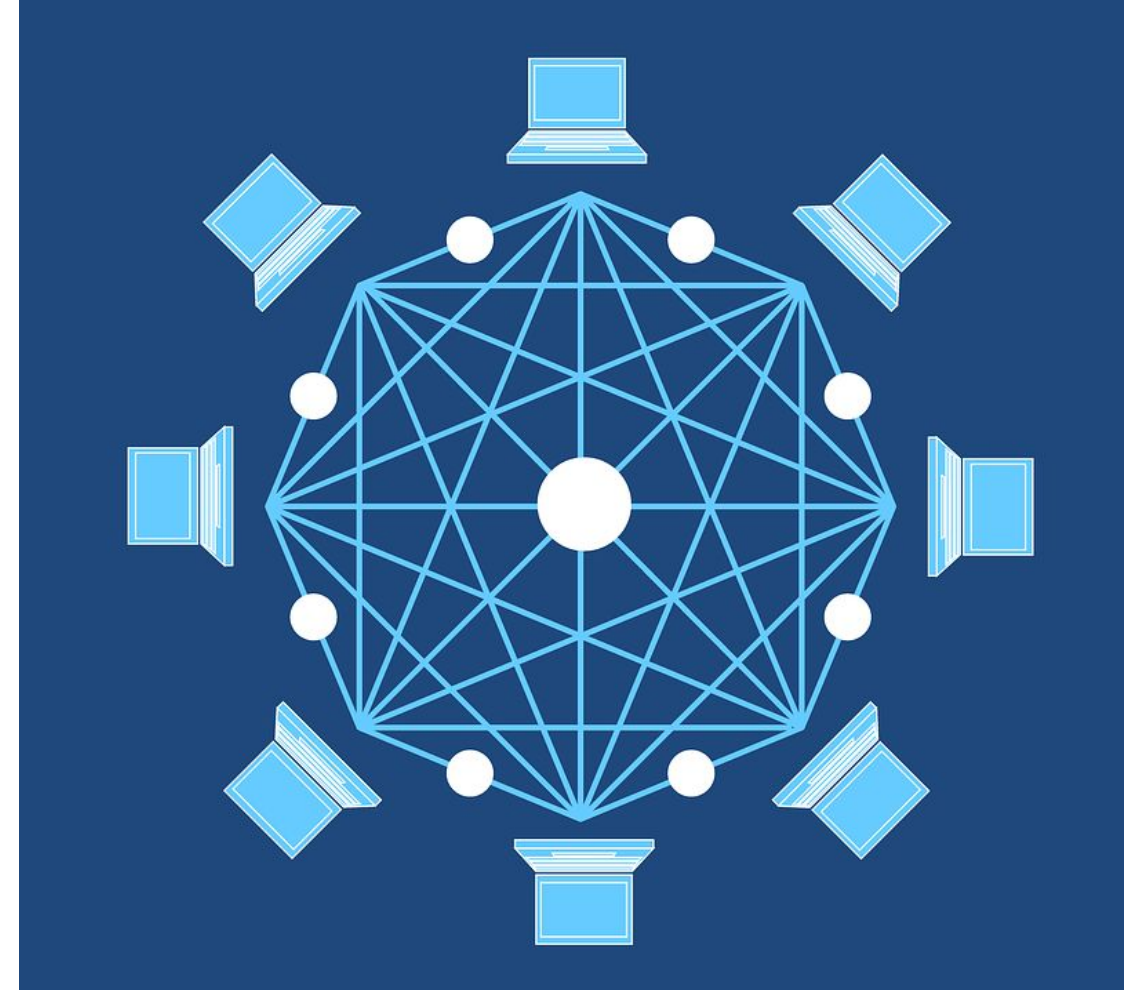
Edge Computing



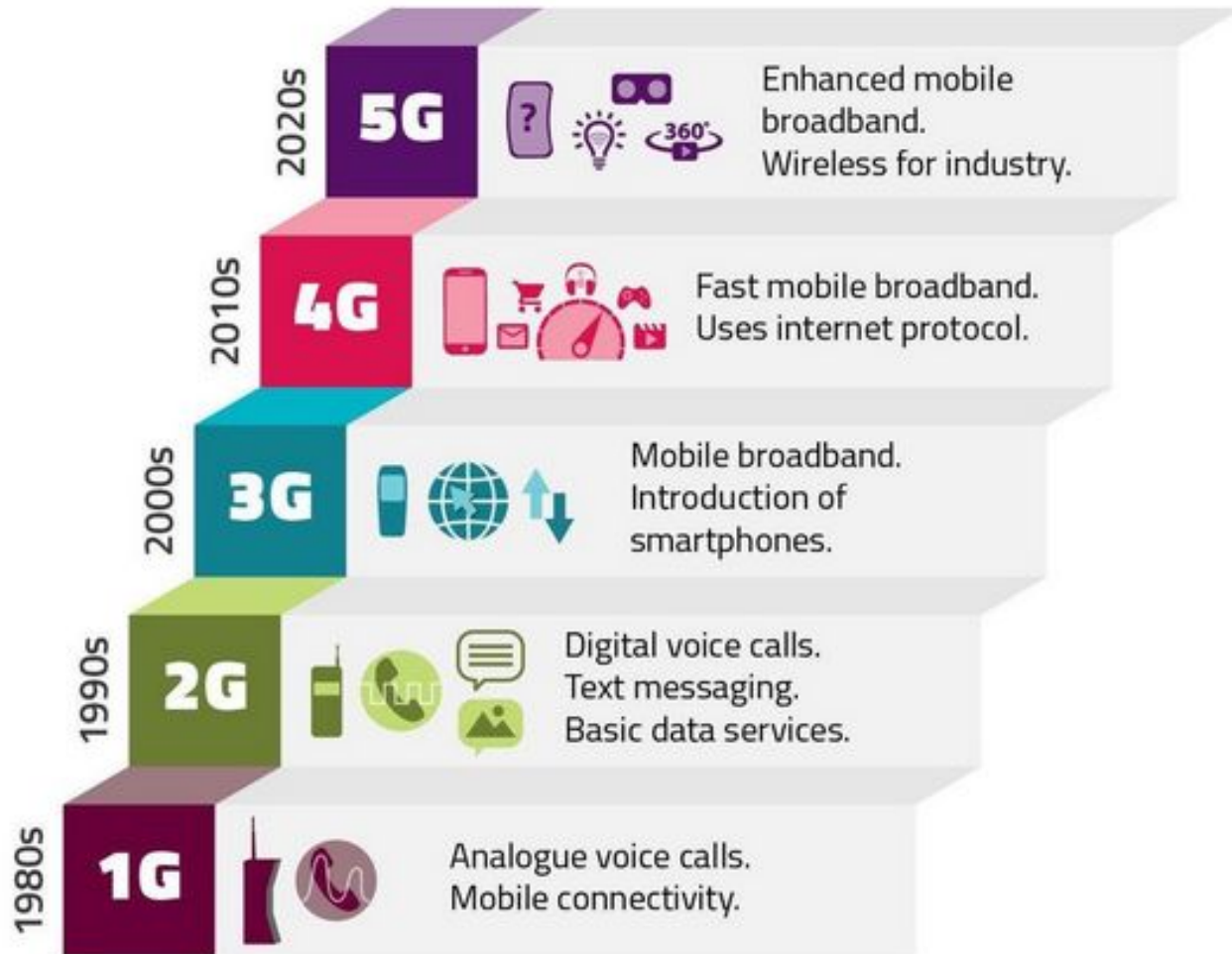
- Data is processed locally rather than being transmitted to a data centre (the Cloud)
- Reducing latency/ improving response times and saving bandwidth
- Enables smart applications and devices to respond to data almost instantaneously
- Potential to improve distributed training latency and security

Blockchain

- A growing list of records, called blocks, that are linked using cryptography
- Many potential applications beyond Bitcoin
- Could host an individual's "Knowledge Score" through their life, capturing both in-house and external training and education



5G



- **Faster, reduced latency**
- **Greater Exploitation of the Cloud**
- **Enhanced Capability for VR/AR, Reducing Local Headset/Processor Burden**

Additional Realities – Extended Realities XR

Reality

**Augmented
Reality**

**Mixed
Reality**

**Virtual
Reality**

**The real
world**

**Information
layered over
vision**

**Blend of real &
digital information
to enhance reality**

**Fully virtual
world**



Pilot Training Next graduates 14 in learning experiment's second iteration

By Dan Hawkins, Air Education and Training Command Public Affairs / Published August 30, 2019



[PHOTO DETAILS](#) / [DOWNLOAD HI-RES](#) 1 of 2

Brig. Gen. Jeannie Leavitt, Air Force Recruiting Service commander, poses for a group photo with Pilot Training Next students after graduation from the learning experiment's second iteration Aug. 29, 2019, at Joint Base San Antonio-Randolph, Texas. PTN is a program to explore and potentially prototype a training environment that integrates various technologies to produce pilots in an accelerated, cost efficient, learning-focused manner. (U.S. Air Force photo by Sean M. Worrell)

ENGAGE

[Facebook](#)[Twitter](#)

[Air Force Social Media Guide \(PDF\)](#)
[USAF Social Media Sites](#)

US "Pilot Training Next"

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



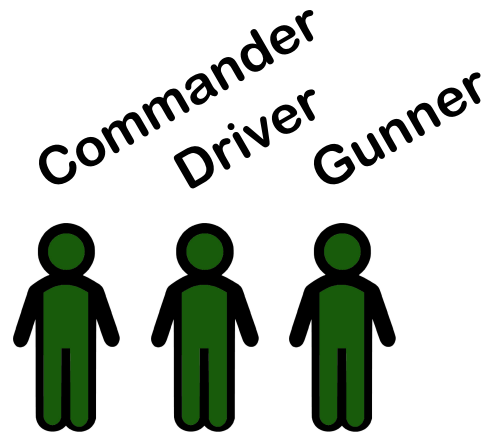
Virtual Reality in Land Training Pilot Q1 2019

- The aim was to identify how Virtual Reality technology might support future Army Team/Collective Training
- 30+ Trainees in VR

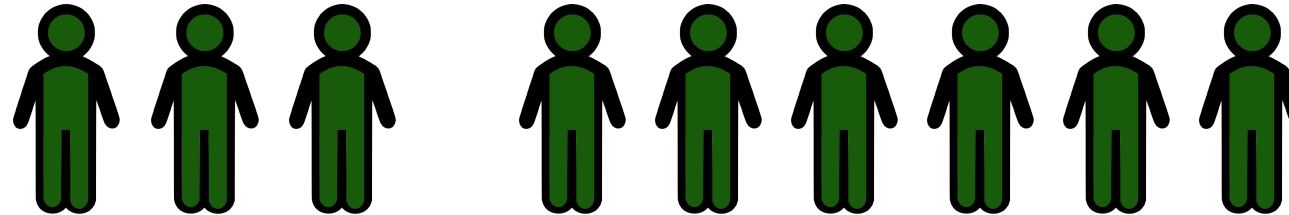


The "Training Audience"

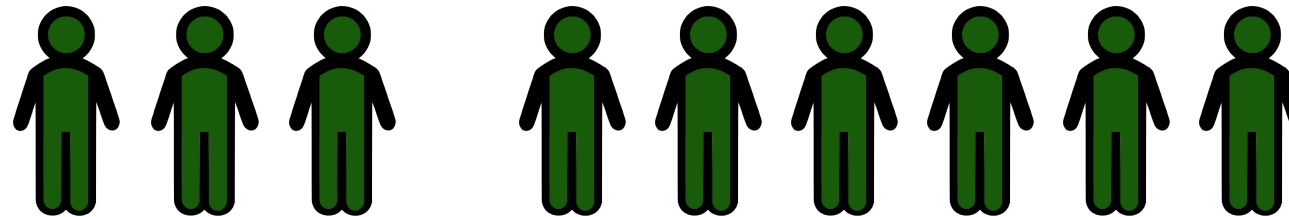
Warrior
1



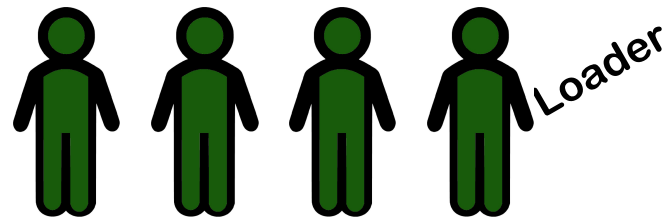
Warrior
2



Warrior
3



Challenger 2
Tank



Infantry

31

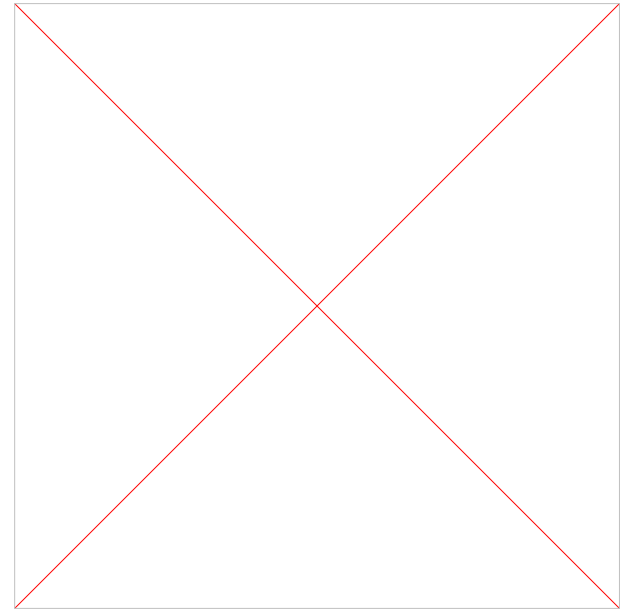


Teamwork Effectiveness Training

- Leadership – character, knowledge and action that inspires
- Situation Awareness – shared mental model of team situation
- Decision Making – team collectively makes a choice
- Communication – right information, right people, right time
- Co-operation – team goals over individual's

Why VR for Team/Collective Training?

- **Flexible, scalable, deployable and cost effective**
- **Immersive environment creates a high-risk but 'safe to fail' environment**
- **Can rapidly rehearse and repeatedly practice in a variety of scenarios**



THINK

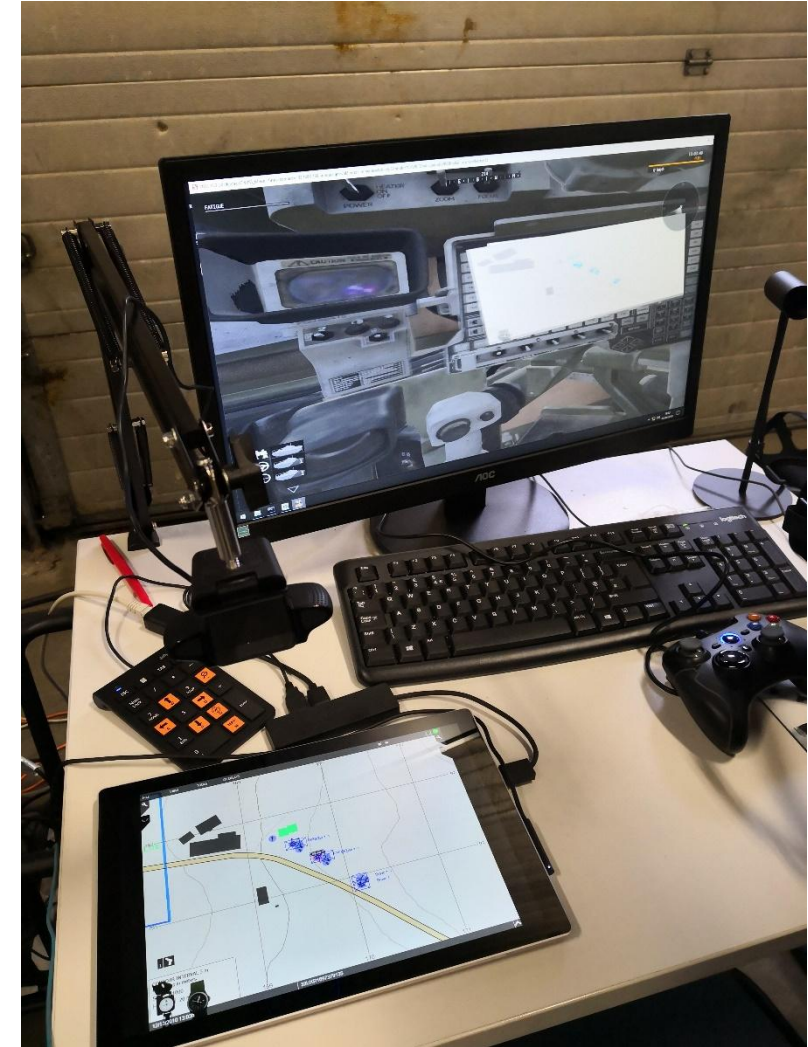


in Virtual
Simulation
you look at
the Virtual
World,

in VR, you
are in it

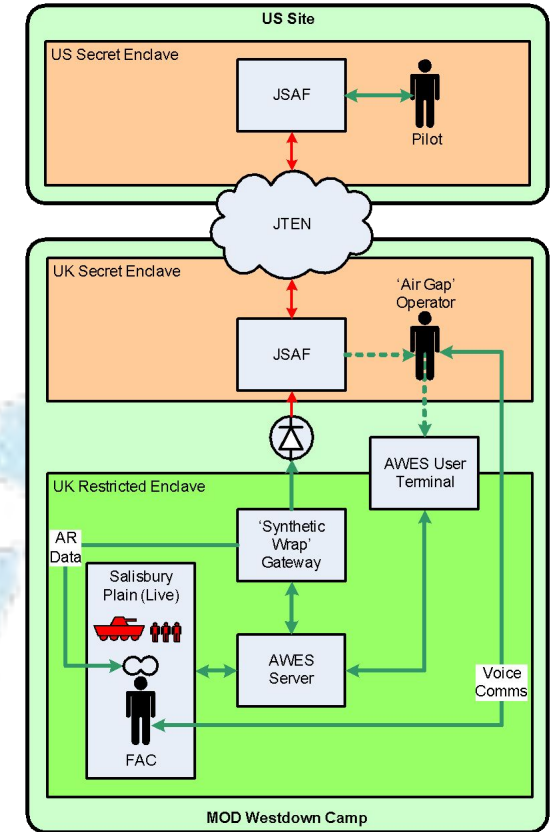


Mixed Reality Visual Systems



Augmented Reality – 2008

- US Pilot in US-Based Flight Simulator
- Transatlantic Connection
- UK Soldier on Salisbury Plain with Augmented Reality Sight
- Virtual Bombs landing on Real Terrain



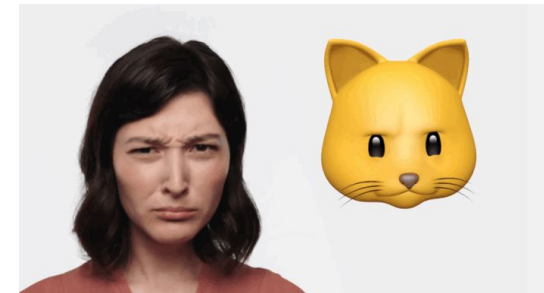
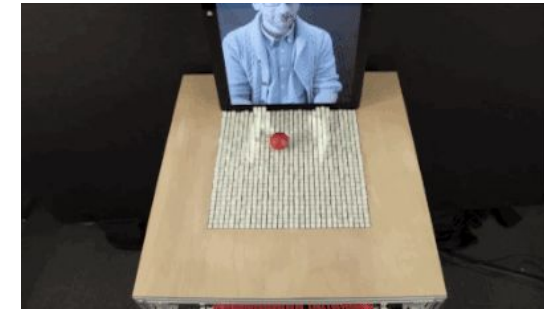
Close Air Solutions (UK)

Real + Virtual - Hyper Real Immersion – 2018



Next-Generation User Interfaces

- Gesture Interfaces
- Tangible User Interface
- Emotion Sensing
- Brain-Computer Interface



Wearables



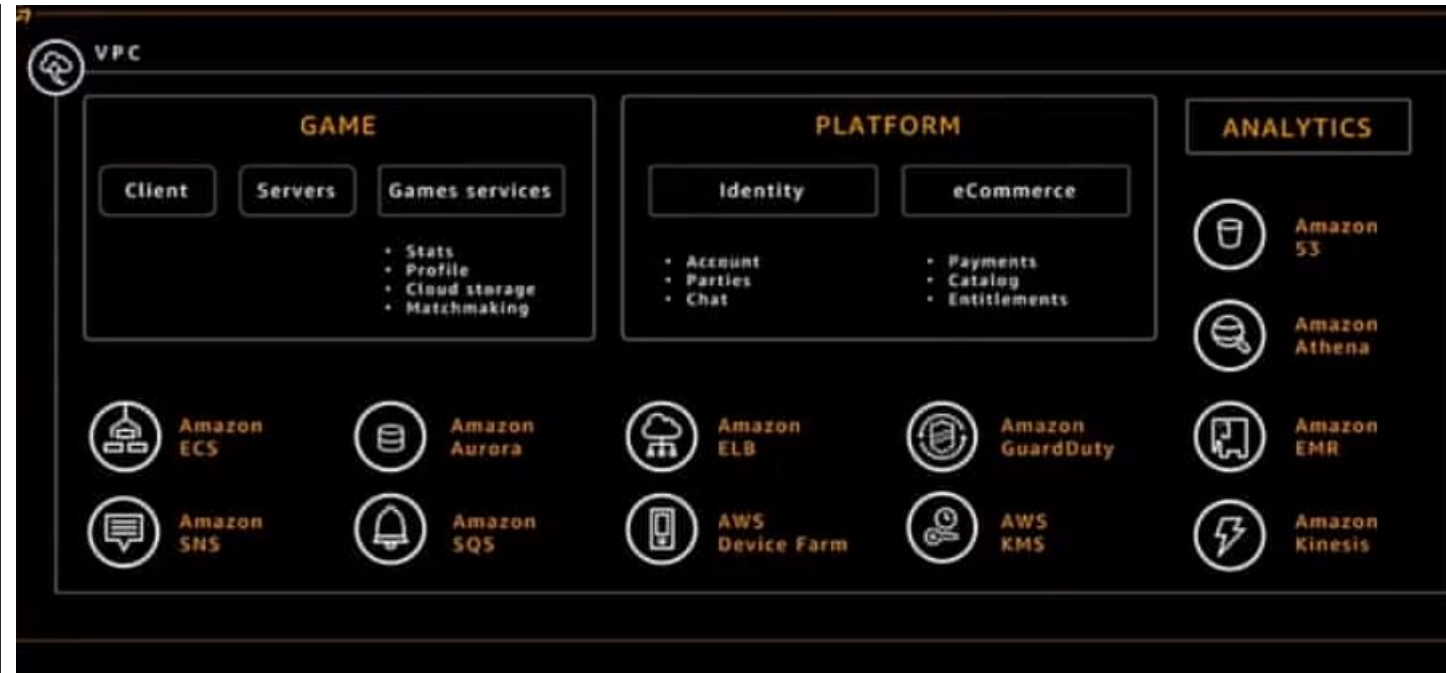
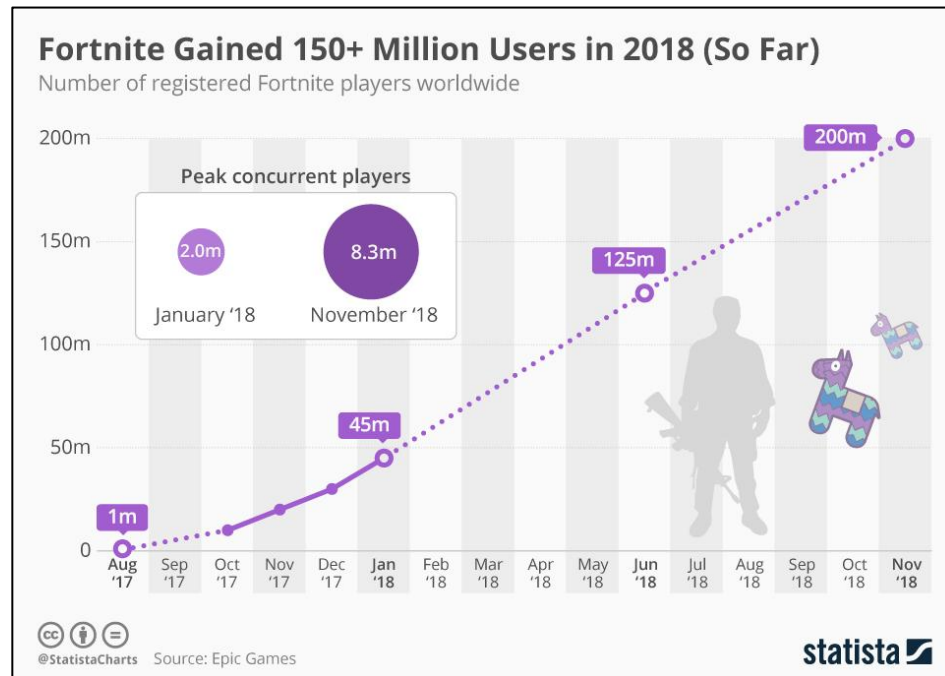
Some Insights from the Latest Online Games



Fortnite Hosting



- Epic Games exploits Amazon Web Services (AWS)
- Fortnite servers around the world to reduce latency
- Each month Epic collects two petabytes of data
- From 0 to 250 Million Players in 24 Months



Games as Social Networks



CO.DESIGNTECHWORK LIFECREATIVITYIMPACTAUDIOVIDEONEWSRECOMMENDERSUBSCRIBE

03.11.19

More than a game, Fortnite is emerging as the best new social network

The wild popularity of the shooter game is a reminder that socializing is way more fun when you're actually doing something with your friends.

**FORTNITE**GET FORTNITEBATTLE PASSCREATIVECOMPETITIVEWATCHNEWSFAQHELPMERCH



FORUM

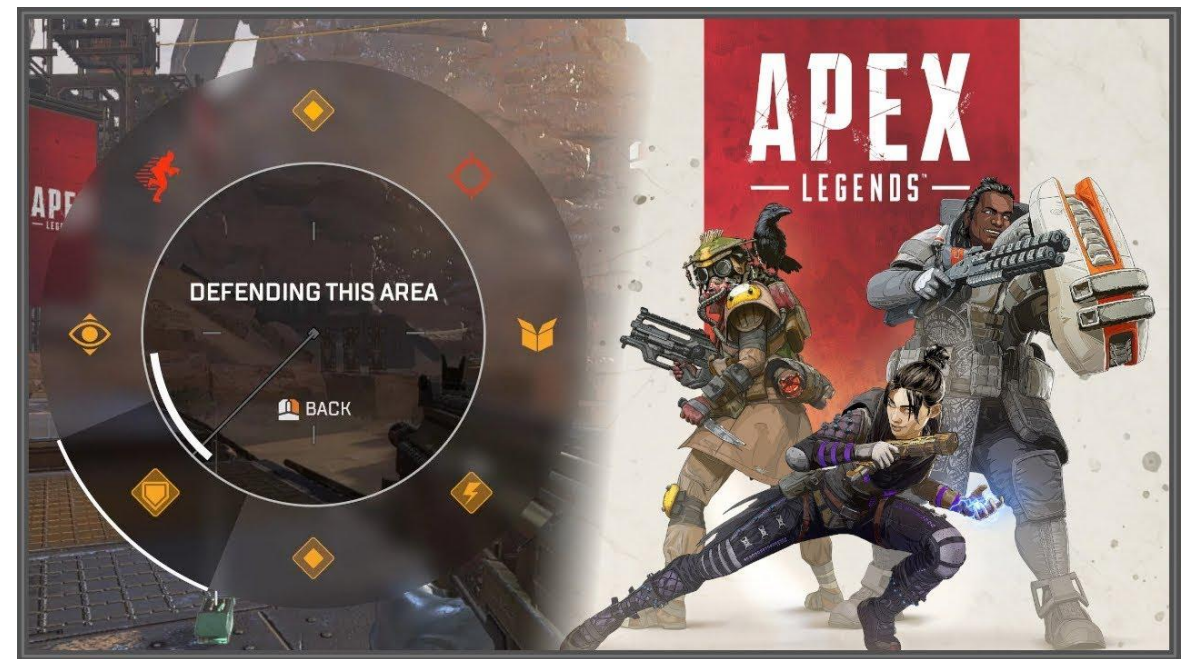
HOMEMESSAGES

NEW TOPICSDEV TRACKERCONSOLE USERS CLICK HEREFORUM RULES

FORUMS	TOPICS	POSTS	LAST POST
OFFICIAL NEWS			
Announcements All official news, announcements and official information.	593	28,779	Challenge Issues Investigation by FreeRyft Today, 08:36 AM
Patch Notes and Hotfixes Patch notes and hotfix information.	49	1,721	v8.40.1 Client Update by 013T.Rusav Yesterday, 03:12 PM
BATTLE ROYALE			
Battle Royale General Drop in and join the conversation about all things Battle Royale.	27,338	159,978	Epic can easily implement FOV sliders but why not ? by Scrooge34x Today, 12:07 PM
Mobile Drop in and join the conversation about all things Battle Royale on Mobile.			
Sub-Forums: iOS (2,095/8,453)Android (3,685/15,387)			
Guides, Tips and Tricks Share your tips and tricks to stay three steps ahead of your opponent.	2,216	10,902	Giving out this account for free by Not-MianW-7 Today, 11:44 AM
Fan Made Share your passion projects, post your fan made content and find others to collaborate with.	2,766	5,765	Moveable Emotes by i05PARTAN117 Today, 11:32 AM

Apex Legends (Team-Based Battle Royale)

- Released 4 February 2019, Free-to-Play
- 50 Million Players Joined in One Month
- Earning \$92 million in revenue across all platforms
- A novel ping system allows teammates to mark supplies, locations, and enemies



Google Stadia

- Platform-Agnostic Cloud Gaming Service Launching Late 2019
- Streaming Games at up to 4K resolution/HDR at 60FPS
- “State Share” Integration with YouTube allows Viewers to Launch a Game using the Same Save State as the Streamer



Stadia GDC 2019 Gaming Announcement

Cross-Platform Play

- An online video game that allows players using different game hardware such as Consoles, PCs, Mobiles etc to play with each other simultaneously



As a Template for Training & Simulation Delivery?

- **Simulation as the Core of a Training Ecosystem**
 - Sharing & Discovery
 - Matchmaking & Social
 - At the Point of Need Across Hardware & Geographically
 - Consistent User Interfaces Across Training Systems
- **Drive Towards Cloud/Hybrid Cloud**
- **Exploit Data, Analytics & AI across the Enterprise**
- **New Methods of Communication to Enhance Human Interoperability (& perhaps with Autonomous Systems)**
- **Track Cultural and Recruitment Implications**
- **Learn how Technology & Convergence in Gaming are Forcing Innovation & Industry Competitiveness**

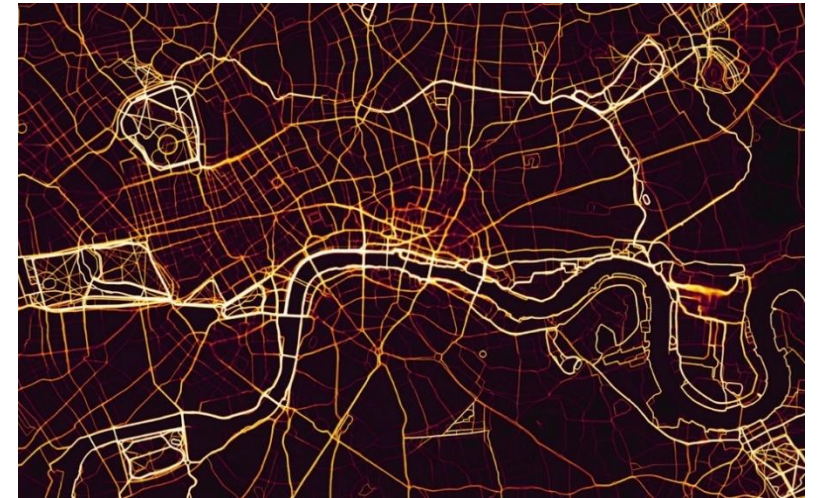
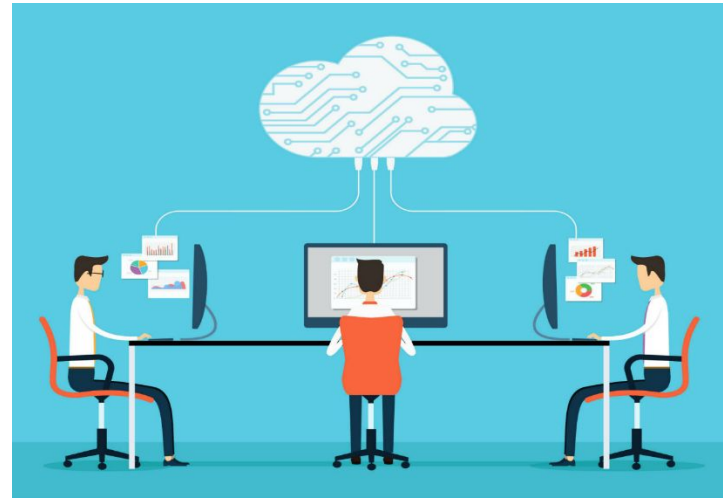
Quick(ish) Wins

UK National Audit Office (NAO) - 4 Sep 2019

Investigation into Military Flying Training

- **Data on Students in Training:**
 - The Department does not hold data centrally on student training across the entire three-phase training process, with Navy and Army student data held within their respective commands.
 - The Department had difficulty in providing the number of students completing training, the number of students waiting between courses, and how long training has taken.
- **Cost of Training:**
 - Given training costs sit across a number of different areas, the Department does not know how much flying training costs.
 - It does not have data on the total cost from Phase 1 to Phase 3; how much it costs for it to meet its MFTS (Military Flying Training System) responsibilities, such as military instructors; or the full cost of training aircrew outside the MFTS.

Training Data Generators



Bringing Data Together

Manager



Aviator



Analyst



Ops

Training

HR



Ops

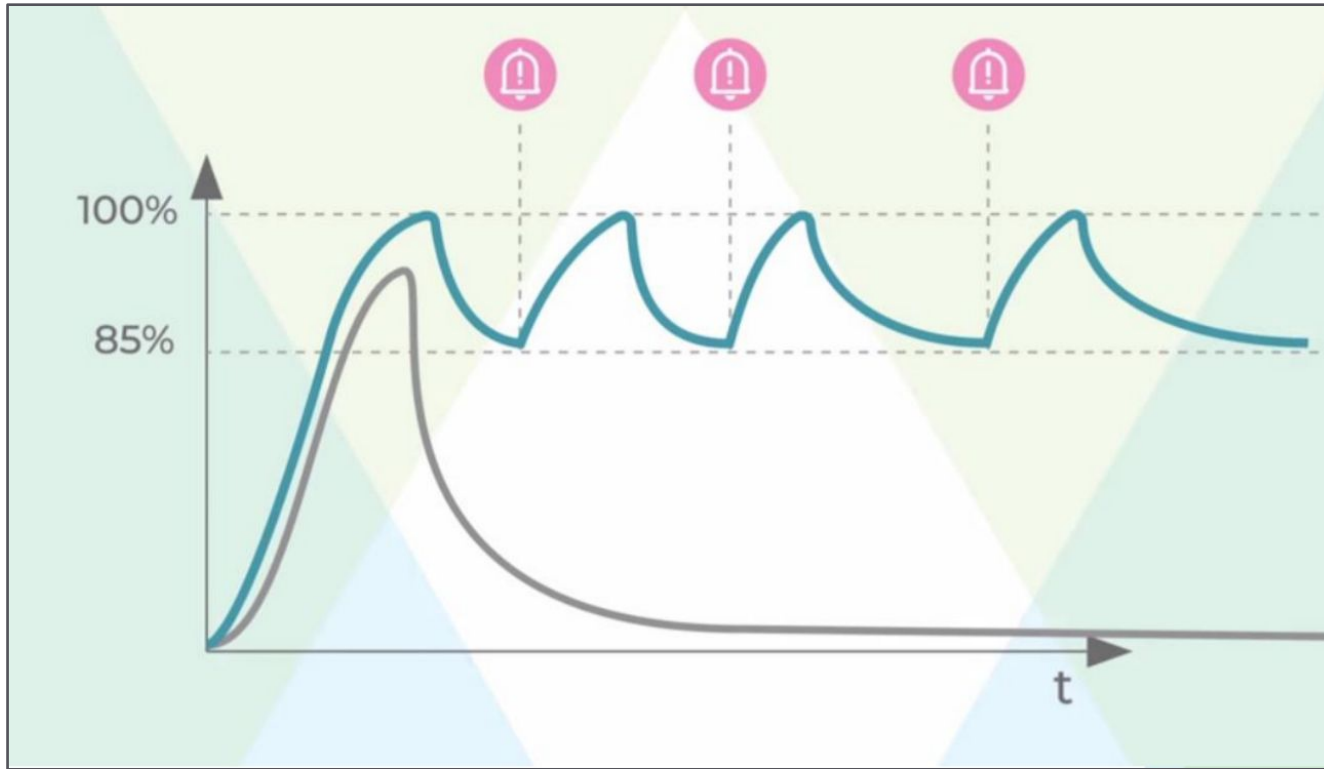
Sim/xAPI

DLMC

TAFMIS

JP
A

Maintaining Proficiency/Reducing Skillfade



Questions?

