8 November 2017 - A Military Training Perspective - Technology and Trends

The OPITO Safety & Competence Conference, Kuala Lumpur, Malaysia - by Andy Fawkes-Version-Final-Trancript

Let us all welcome Andy Fawkes, an independent consultant in training and simulation. His topic today is **A Military Training Perspective: Technology and Trends**.

Thank you very much.

Speaking straight after lunch is always a challenge, so hopefully I'll be able to keep you interested. I listened to the earlier talks, which were excellent, and I've included some videos because I was told they're important.

I'm also grateful to be here because, from what we heard this morning, artificial intelligence may eventually take over presenters' jobs. I'm equally grateful that none of you checked Glassdoor and decided you had something better to do this afternoon, so thank you for staying. I've got about 45 minutes.

My talk is **A Military Training Perspective: Technology and Trends**, and I'd like to thank the organisers for inviting me. I'm not suggesting the military does training any better or worse than anyone else; this is simply a different perspective, particularly on how technology is used.

The image on the title slide is intended to communicate that the military operates across land, sea, air and cyber domains. There may even be a submarine beneath the surface and a military communications satellite overhead. In other words, this isn't just about offshore or maritime operations—I'll also be talking about land and air.

Before we begin, I'd like to explain the perspective I'm speaking from. This isn't a sales pitch.

I spent many years in the UK Ministry of Defence, primarily on the customer side of training systems. I also worked with NATO, which gave me the opportunity to see how many different nations approached military training.

More recently, I've become what I jokingly call "uberised", working independently for a number of companies. The main one is Bohemia Interactive Simulations, where we've adapted gaming technology into military training software. I'll show you some examples later.

I also spent a week with the Society of Petroleum Engineers. A little knowledge can be dangerous, but it was a fascinating experience and allowed me to meet many people from your industry. In addition, I spend a lot of time giving talks and, more importantly, listening to what other people have to say.

So that's the lens through which I'm viewing today's subject. I know there are former military personnel in the audience, and I'm certainly not claiming to know everything. I'm simply sharing my own perspective.

Here's what I'm going to cover.

First, I'll get the statistics out of the way. Then we'll look at the fundamentals of military training before moving on to some videos. I'll also discuss how military training has evolved over time, provide some examples of current practice—mostly from the UK and US, simply because those are easiest to find information on—and finally discuss some of the current challenges and opportunities. Many of these themes have already emerged during today's earlier presentations.

Let's begin with some context.

Although the military isn't really an industry, the figures help set the scene.

Global military expenditure is approximately **$1.7 trillion**. That's an enormous amount of money. The chart on the right shows the largest spenders, based on recent Swedish research. Reassuringly—or perhaps not, depending on whether you're in the defence industry or a taxpayer—overall expenditure appears to have levelled off in recent years.

Training represents a significant proportion of that spending.

When I was in the UK Ministry of Defence, we estimated that around **20%** of military expenditure was devoted to training and education. Much of that cost comes from personnel. You need people to train other people. You may also need additional aircraft, tanks and other equipment purely to support training activities.

It's a substantial investment.

Looking at personnel numbers, there are approximately **57 million** active and reserve military personnel worldwide. The chart shows the size of different armed forces around the world.

One important point is that militaries don't just train full-time personnel. They also have reservists who may only complete a few weeks of training each year, creating a very different training challenge.

In the UK, personnel numbers have declined over time. That's not necessarily a bad thing. Greater automation means modern warships, for example, require far fewer crew than the steam-powered ships of the past.

Even so, the number of new recruits entering service every year remains substantial. Every one of those people has to be trained. It's a continuous process.

Demographics are also changing.

In the United States, around **91%** of military personnel are expected to be aged 40 or younger. One point raised this morning was that we often focus on new recruits, but before long, those same Millennials will become instructors themselves. They may also expect to teach and learn in different ways.

Gender balance is another important consideration. This example is from the US, but the trend is broadly similar in the UK. Recruitment isn't only about attracting younger people; it's also about encouraging greater diversity, particularly in engineering and technical disciplines.

One final point on demographics.

Military officers, particularly in the United States, are generally very well educated before they even begin their careers. Understanding who joins the military should influence how training and education are designed.

Finally, despite media coverage suggesting that the US military is constantly deployed around the world, the reality is that most personnel spend the majority of their careers at their home base or within their own country. I suspect that's true of most armed forces.

If you're still awake after all those statistics, thank you.

Let's move on to some of the fundamentals of military training.

Again, I can't claim to speak for every nation, but these are the broad trends I've observed throughout my career.

The military environment is characterised by constant change. Technology is evolving rapidly, driven by both civilian and military innovation. Threats can be predictable or completely unexpected.

The world itself has changed. It's far more connected and densely populated than it once was. We're much less likely to see vast conventional armies sweeping across open plains than in previous centuries.

Another important characteristic is that warfare is fundamentally chaotic.

You never know exactly what your opponent is going to do because they're making decisions independently. That's why the old saying remains true:

"No battle plan survives contact with the enemy."

As a result, military training must develop people who are adaptable. They need to think flexibly because they cannot predict exactly what will happen.

This leads to another familiar phrase:

"Train as you fight."

No simulation can perfectly recreate the realities of combat, but the aim is to get as close as possible so that operating equipment and working with colleagues become second nature.

More recently, I heard the Royal Navy express this idea in another way:

"Are we ready to fight tonight? And are we prepared to fight tomorrow?"

The goal is to develop people who can adapt to changing circumstances, whether they're officers or enlisted personnel, while also encouraging innovation and independent thinking.

There is always a balance to strike. The military requires discipline and standard procedures, but it also needs individuals who can think for themselves when circumstances demand it.

As I mentioned earlier, different nations train in different ways.

I've attended several conferences on training fast jet pilots—people who fly some of the most sophisticated aircraft in the world. These pilots cost between six and ten million pounds each to train, yet every nation approaches that task differently, even when operating exactly the same aircraft. I find that fascinating.

Training methods are influenced by national military culture. Some countries place a greater emphasis on live training than others. There are obvious questions about how much risk you're prepared to accept with live ammunition and realistic exercises.

Operational tempo also makes a difference. If a country isn't actively involved in conflicts, its training priorities will naturally differ from those of a nation engaged in ongoing operations.

Equipment, budgets, alliances and potential adversaries all influence how militaries train, which makes it difficult to say there is a single correct approach.

Despite those differences, the overall structure is remarkably consistent.

Basic training focuses on preparing people for the physical demands of military life. Recruits learn to work as teams, march, develop basic military skills such as handling and firing a rifle, and, perhaps most importantly, build camaraderie.

That sense of camaraderie is fundamental because people ultimately have to trust one another with their lives.

After basic training, soldiers, sailors and air personnel move into specialist training.

The range of specialisms is enormous, from fast jet pilots to ship's cooks, with training taking place in a variety of environments, including Arctic, desert and maritime conditions.

At this stage, individuals build expertise in their own profession.

The next stage is team training.

People begin learning how to operate together. That might involve a helicopter pilot and co-pilot, a mortar crew, a ship's bridge team or even a military band. Success depends not only on individual competence but also on communication.

We were discussing communication over lunch. One of the key questions is whether people understand each other's roles and feel confident enough to speak up if something appears to be wrong. There are recent examples where failures in communication have had serious consequences.

Beyond that comes collective training, where multiple teams work together.

This type of training is more difficult to organise because it requires many different units to be available at the same time. A typical example would be soldiers coordinating with aircraft so that munitions are delivered accurately and safely.

Finally, there are coalition exercises.

Even the largest nations rarely operate alone. Most military operations involve allies, so coalition training develops interoperability. Personnel learn to communicate effectively, understand each other's procedures, identify where equipment is compatible and where it isn't, and build trust between nations.

Because of the complexity involved, these exercises happen less frequently, but they are extremely important.

What I hope this illustrates is the enormous breadth and depth of military knowledge and skills.

Take a nuclear submarine as an example.

You need people capable of operating a nuclear reactor, sonar systems and weapon systems. You also need engineers, navigators, the captain and, just as importantly, the ship's cook. The range of skills required is extraordinary.

That raises an interesting question:

How do militaries consistently achieve such high levels of training?

From my experience, it's largely cultural.

Nobody questions the importance of training. People may debate which systems or methods should be used, but they never question whether training itself matters.

Progression depends upon it.

Individuals are continually assessed, and unless they achieve the required standard, they don't move forward in their careers.

Peer pressure is another significant driver. Nobody wants to let their colleagues down.

A large proportion of military life is spent on exercises and training. Ideally, if you're not deployed on operations, you're training for them.

Lessons learned during operations are fed back quickly, particularly those affecting doctrine. Procurement changes, however, often take considerably longer. Although operational lessons may be identified rapidly, updating equipment and systems can still be a slow process.

I'd now like to move on to how military training has evolved.

Some of these ideas may seem old, but many are surprisingly modern. It also gives me an excuse to show a few videos.

If you look back through history, one of the oldest surviving military training manuals dates back several centuries.

Around 140 years later, the invention of the printing press transformed military education. Training material could now be reproduced and distributed widely rather than existing as a single manuscript locked away in a castle. Technology was already changing the way military knowledge spread.

Moving into the First World War, aviation provides one of the earliest examples of simulation technology.

Pilots were among the first groups willing to embrace simulators because the alternative was so dangerous.

Research suggests that around 90% of First World War pilots who lost their lives did not die in combat. Many were killed during training or because of mechanical failures.

Training safely on the ground suddenly became extremely valuable.

The short film you've just seen is one of those early simulators.

Although they didn't have modern video technology or YouTube, it demonstrates that simulation has been part of military training for over a century.

I also came across a First World War report on air gunnery training that remains remarkably relevant today.

It concludes that academic instruction alone is not enough. Learners require extensive practical experience. Brief lectures are valuable, but instructors must also remain current with operational practice.

The report even notes that some instructors were teaching outdated methods and had become disconnected from reality.

That's still an important lesson today. Instructors themselves must continually update their knowledge if training is to remain effective.

The next example comes from the Second World War.

The famous Link Trainer represented military training on an industrial scale.

Interestingly, the technology behind it originated from automatic player pianos. Once again, entertainment technology crossed over into training applications.

Approximately half a million pilots trained on Link Trainers during the Second World War.

Perhaps just as importantly, the instructor remained central to the learning process.

The simulator allowed students to practise difficult instrument flying safely on the ground while the instructor guided them throughout the exercise.

Despite the poor quality of the surviving film, these simulators made a profound contribution to wartime pilot training.

In fact, Link Trainers had already been exported around the world, including to Germany and Japan, demonstrating how widely simulation technology had spread before the war.

Moving into the 1970s, we can see another major step forward in flight simulation.

Pilots have often been among the earliest adopters of new training technologies because of the risks involved in flying and the high cost of mistakes.

This next example demonstrates the arrival of computerisation in simulation.

The simulator was designed for pilots of vertical take-off combat aircraft. It allowed them to learn to fly without leaving the ground. Like so many aspects of modern life, the entire exercise was controlled by computer.

The model landscape was reproduced in great detail, and a television camera scanned the physical model to project a full-colour image onto a monitor inside the cockpit.

At the time, it was described as being "as real as the real thing."

I find that phrase particularly interesting.

By today's standards the technology looks primitive, but at the time it represented the closest experience available to real flight.

The limitation, however, was flexibility.

Those simulators were incredibly expensive and required extensive maintenance. The landscape was physically built into the simulator, so you couldn't simply fly somewhere else. Whatever terrain existed inside the model was all you had.

The next major development occurred during this century, when commercial computer games began to influence military simulation.

I was involved at the time these changes were taking place.

Traditional military simulators were expensive, and organisations had become emotionally and financially invested in them. When commercial gaming technology emerged, many people in defence procurement and research dismissed it as nothing more than entertainment.

The next video used the original *Half-Life* game engine.

What struck me wasn't the graphics—it was the people.

The participants weren't treating it like a computer game. They were communicating constantly, working together, solving problems and becoming emotionally engaged in the mission.

You could clearly see teamwork developing.

Even with relatively simple graphics, the level of immersion was remarkable.

As I mentioned earlier, I now work with Bohemia Interactive Simulations.

The next clip was recorded around 2008 and features our current CEO explaining why commercial computer games can become valuable military training tools.

The company began with a commercial game called *Operation Flashpoint*, which won several awards after its release in 2001.

From that starting point, additional layers of functionality were added specifically for military users.

One important capability was **After Action Review**.

After completing a scenario, participants could replay the exercise, analyse what had happened and discuss what had gone well or what needed improvement.

Another addition was compliance with military simulation standards, allowing the software to communicate with other defence simulation systems.

Real-time editing was also introduced.

An instructor could modify the scenario while it was running—for example by introducing an improvised explosive device or changing battlefield conditions—without stopping and restarting the exercise.

The system also supported multiplayer training.

Infantry, armoured vehicle crews and pilots could all participate simultaneously within the same virtual environment.

Fifty or even one hundred soldiers could train together, each using their own computer while working towards a common objective.

Of course, soldiers still have to go into the field and fire real weapons.

Simulation doesn't replace live training.

Instead, it supplements it by allowing people to practise procedures repeatedly so that, when they encounter stressful situations in real operations, their responses become much more instinctive.

Back in 2008, we openly acknowledged that simulated training wasn't yet as realistic as real life.

However, we were working steadily towards that goal.

Since then, research—although understandably limited because it's difficult to conduct controlled studies with military personnel—has consistently shown that games and simulation are extremely effective for repetitive practice.

People rehearse procedures over and over again until they become second nature.

As a result, when they're required to perform those tasks in the real world, they no longer have to consciously think through every step.

Simulation has also proved particularly valuable for team training.

That has been one of its greatest strengths.

Modern simulation has advanced enormously.

Today's systems are no longer limited to a single aircraft or vehicle.

Whether you're operating on land, at sea or in the air, modern software can simulate virtually every aspect of the operational environment.

We're now moving towards genuinely global simulation systems that can represent entire operational theatres rather than isolated training scenarios.

The world of simulation has changed completely.

This final video is much more recent and features our CEO again—this time with a little more grey hair.

We've already discussed virtual reality earlier today, but VR is only one component of a much broader technological shift.

The aim is no longer simply to create realistic software. It's to combine software with modern hardware to produce much more immersive training environments.

In this example, an Oculus Rift headset is combined with a Leap Motion sensor and connected to a desktop computer running the VBS simulation environment.

It's also linked to FlexAir, a constructive simulation that acts as the simulation host.

The objective is straightforward.

A pilot can sit at relatively inexpensive hardware and interact naturally with the virtual cockpit, reaching out to operate switches and controls using hand gestures rather than traditional input devices.

Instead of relying on a keyboard or mouse, the pilot interacts directly with the simulated aircraft, creating a much more intuitive and immersive training experience.