# Navigating the defense & security training environment

CAE Defense and Security

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## Executive Summary

In the past decades, people around the world have enjoyed what is known as the 'peace dividend.' Many countries have forgone expensive investments in military equipment, training, or research and development to focus on domestic priorities. However, allied nations are facing a historic inflection point, where the rapidly shifting geopolitical landscape demands a revaluation of those priorities and the defense strategies which underpin them.

This geopolitical uncertainty takes place in the context of:

- A thoroughly connected society, where the public's perception of military activities, including training, can influence policy and funding.
- An environment of accelerating innovation and rapid technological advancement, specifically utilizing artificial intelligence (AI), augmented reality (AR) and virtual reality (VR).
- A new generation of military personnel who are digital natives that adapt more readily to training systems incorporating AI, AR, and VR, suggesting a demographic push towards modernized training methods.
- A cyber threat environment as real and as significant as the kinetic threat environment.

An additional consequence of this environment is a reduced window in which defense forces can prepare and respond to threats. Acquisition and training strategies must be agile enough to respond in a timely manner, whilst being robust enough to replicate or advance any level of intensity in conflict. Recent events in Europe have highlighted the delay in effective military strategies caused by an inability to provide proficient soldiers and aviators at the pace required to achieve mission effectiveness.

When nations do respond to conflict, it is not typically a unilateral approach. Every major conflict in the last century has been fought in conjunction and coordination with a coalition of other nations, and future conflicts are expected to continue this pattern. Military training and execution must have elements of standardization performance measures and outcome analysis to remain effective and interoperable with allied forces.

Past and current approaches to pilot training programs were developed to maximize production by using fixed curricula with set educational methods to

deliver a known "product" – a qualified aircrew. But these programs are no longer fit-for-purpose in the age of contemporary military operations and the learning needs and expectations of younger, connected, digitally native students.

The accelerating rate of change necessitates a robust change management strategy to incorporate modern student-centric methodologies and leverage innovative technologies in pilot training. Military forces must remain agile in their approach to integrating new capabilities effectively and promptly, whilst ensuring that the long-term benefits of such investments (e.g., more skilled pilots, improved instruction and safety, and enhanced decision-making capability) outweigh the burden of the transition.

While the current cost of achieving desired levels of operational preparedness is high, there is potential to dramatically lower it. Adopting readily available and innovative training approaches that leverage simulation can reduce cost of operations and provide additional time for nations to react. Adoption is supported through this robust change management approaches, assuming defense forces are open to collaboration and outsourcing, while developing their own sovereign capabilities. As societies become more connected, the public's perception of military activities, including training, can have a major influence on policy and funding. There is a need to ensure the shift to modernized training systems is communicated as a move towards greater efficiency, resilience, and safety.

Advanced air forces are increasingly developing partnerships with private industry to manage and deliver pilot training programs and facilities, transitioning from the historic model of government-run, government-operated pilot training programs. The private industry model has proven to significantly increase productivity, more readily available to integrate modern technologies and systems, and free up pilot resources to focus on critical operational tasking and warfighting capabilities.

Private industry can support an overhaul of pilot training programs. First, by integrating existing assets and new technologies to increase aircrew production and improve quality, and eventually by replacing them with a new training system based on new immersive simulators and optimizing the use of jet trainer aircraft. Transitioning these systems to government-owned, contractor-operated

models that comply with regulatory and budgetary requirements represents best practice and optimizes training outcomes in the long-term.

## Uncertainty

The eruption of large-scale war in Eastern Europe has resulted in NATO and the U.S., along with other western countries, committing billions of dollars in military and humanitarian assistance. That assistance includes weapons, ammunition, and training to assist the country in defending its territorial integrity and to ensure the war does not escalate or spread. The longer the U.S. and its allies continue to invest funding and weaponry into the wars in Europe and the Middle East, the less capable they are of deterring conflict in the South China Sea.

In its latest National Defense Strategy, Defense Secretary Lloyd Austin prioritized the People's Republic of China (PRC) threat in the Indo-Pacific region over Russia's threat in Europe, but it remains to be seen whether the U.S. investment in a resilient security architecture in the Indo-Pacific will deter any possible PRC attempts to resolve disputes by force. In 2024, Indo-Pacific nations are slowly increasing defense spending ranging from 3 percent for India and Singapore, to 6 percent for Australia and up to 16 percent for Japan in comparison to 2023. However, as the European conflict has shown, increased military effectiveness can be reduced through inefficient training systems.

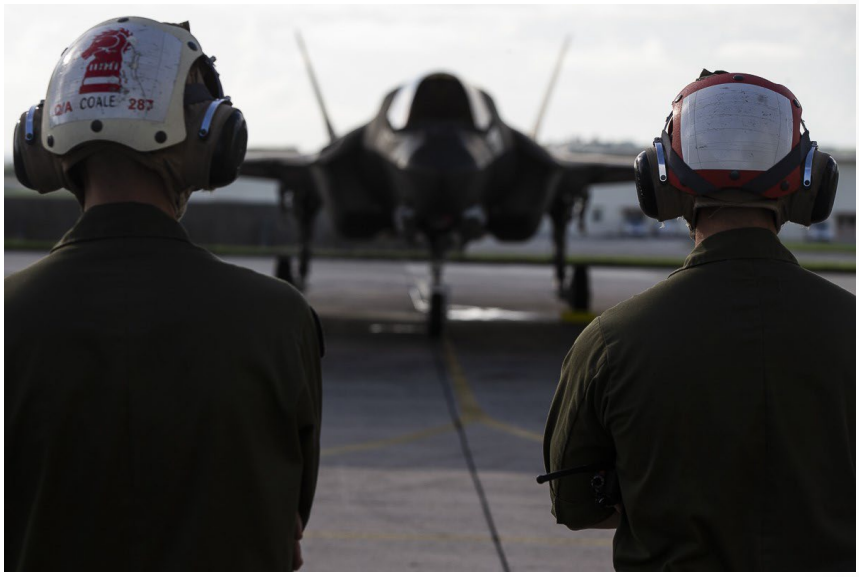
In an uncertain geopolitical landscape, collaboration between nations becomes increasingly important. However, the world is also experiencing an increase in fragmentation, with countries threatening to break into rival economic trade blocs. Barriers to trade have increased rapidly in the past years.

In 2019, in aggregate, countries imposed less than 1,000 barriers, but by 2022 that number had tripled to almost 3,000. Increasing fragmentation restricts the flow of high-tech goods, services and knowledge and can also lead to severe disruption in the commodity and energy markets. Over the long-term, it could impact global GDP by almost seven percent, or the equivalent of the combined GDPs of both Germany and France. The economic shocks from COVID-19 induced restrictions on movement and trade continue to reverberate. Average debt levels in emerging-market countries were 58 percent of GDP at the beginning of 2023 - almost 40 percent higher than they were a decade earlier.

Additionally, changes in global climate and other dangerous transboundary threats are already transforming the context in which many governments operate. Increasing temperatures, changing precipitation patterns, rising sea levels, and more frequent extreme weather conditions will affect basing and access whilst degrading readiness and capabilities.

Budgetary increases in defense spending to equip nations for uncertainty in the geopolitical landscape suggests that traditional approaches to capability acquisition and training are no longer fit for purpose. In Australia, the recent Defence Strategic Review has committed to "abandon its pursuit of the perfect solution or process and focus on delivering timely and relevant capability." In other words, political and military leaders must "move away from processes based around project management risk" towards embracing processes that consider "strategic risk management."

As the window for governments to react and respond to threats grows shorter each day, those responsible for acquisition and training must focus on the minimum viable capability in the shortest amount of time.



*(Defense Visual Information Distribution System)*

## Managing attrition

Militaries around the globe are experiencing shortfalls in personnel due to reductions in recruiting and retention which, among other things, will result in a diminishing ability to generate next generation air power.

*Why is this happening now?*

The issue is complex and multifaceted and, no doubt, so are the causes. The way the war in Afghanistan ended makes voluntary military service less compelling for people in countries that contributed militarily to the war effort. A general exhaustion with the Global War on Terror could also depress enlistment and retention rates. Additionally, the labor market has tightened as economies have emerged from the COVID-19 pandemic, and militaries need to adapt and offer compelling incentives to attract the best talent.

Demographics also play a role. As a country's population gets older, fewer young people are available to enlist. As a direct result of the pandemic, levels of depression, anxiety, and other mental health conditions had increased dramatically amongst those who faced extreme levels of social isolation. School closures and hastily introduced remote instruction caused test scores to decline rapidly. While youth obesity rates continued to increase during the pandemic, meaning more candidates were considered unfit for service.

Different countries can certainly point to other demographic and cultural factors affecting recruitment and retention, though the good news is these challenges can be resolved. For two decades, research has uncovered the culture shifts and behaviors associated with the next generation of personnel, otherwise known as 'Generation Z' and 'Digital Native' learners – those born from the late 1990s to mid-2010s.

Computerized technology has always surrounded Digital Natives; 'digital' proficiency is an intrinsic skill and caters to their minds that think and absorb information differently to previous generations. They are accustomed to rapid task switching—sometimes mislabeled as 'multitasking.' They have shorter attention spans and subsequently are at a higher risk of displaying a reduced depth of learning. Digital Natives are the generation who are now entering the workforce and graduating from university, who comprise of a growing

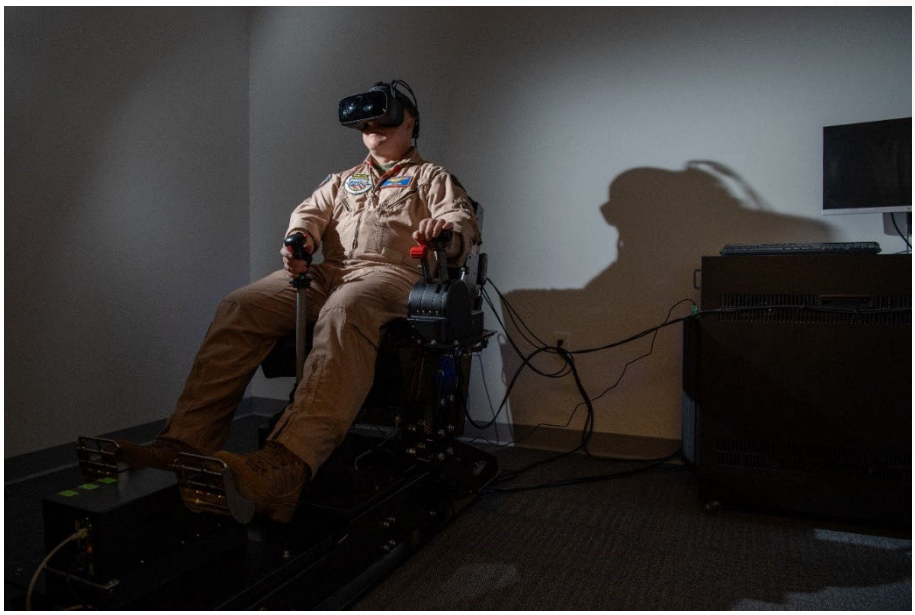
proportion of young recruits in western air forces.  Addressing the needs of this new generation – instead of trying to shoehorn them into a decades-old training paradigm – is currently the biggest challenge facing military trainers globally.

## Digitally Enabled Training and Efficiency

Geopolitical uncertainty and recruiting shortfalls increase the pressure on an air force's pilot training program to produce more pilots at the required proficiency level and at an accelerated pace.

To accomplish this in the current and traditional pilot training pipeline requires an increase in funding, equipment and, most importantly, labor resources that are already in short supply. Most training pipelines suffer in throughput due to a lack of resources and the use of outdated recruitment and training methods and technologies.

There is an obvious need for a time, manpower, and resource-efficient solutions to resolve the pilot training conundrum. Digital technologies such as immersive synthetic environments, data analytics, machine learning and artificial intelligence promise to improve the effectiveness and efficiency of military aviator training programs.



*(CAE) U.S. Air Force Initial Flight Training (IFT) Program.*

Today, in modern air forces, the application of digital technologies is mostly limited to high-cost training solutions and simulators of varying degrees of fidelity that use existing training methodologies. Given the uncertain geopolitical landscape, along with the new generation of students discussed above, future military pilot training must transform to become far more efficient in acquisition, resourcing, and operations.

In recent years, society's approach to education and learning has changed rapidly and is expected to continue. Advances in technology, underpinned and informed by research in learning and behavioural sciences, have been a major driver for this change.

This shift in attitude to education has also been influenced by non-technical aspects, such as people who are self-motivated in how they learn. Harnessing the power of 'community in learning' via virtual chat platforms and social nudging has compounded this motivation and has provided additional useful learning content outside of a formal Learning Management Systems (LMS). However, the freedom to access on-demand learning 'anytime and anywhere' has acted as the strongest enabler. Objectives for pilot training are becoming increasingly focused upon the retention of knowledge and skills for critical moments in live operational environments.

Combined with existing training material, new simulation technologies are a fundamental element of a future learning ecosystem. Advancements in simulation are reshaping the student training experience from one focused on centralized organizational control to a ground-up model that supports and satisfies an individual's motivation to learn. As educational best practices have moved towards more interactive and explorative learning, it is unsustainable for air forces to rely on legacy training methods and methodologies to deliver the same throughput and proficiency for a new generation of pilots. These Digital Natives not only expect these new learning and training methods, but they also require it.

Over recent years, the spectrum of training technologies and methods available to defense forces has expanded to include 'procedural trainers' and updated versions of Computer Based Training (CBT). This spectrum, now ranging from

digital textbooks to an instructor-led full flight simulator session, must expand to include diverse types of simulated learning and training.

Simulation for Experiential Training (SET) is one method that can be used to develop both procedural, tactical, and Crew Resource Management skills. Identifying scenarios that are rich in learning potential and staging them progressively to release more complex situations allow for a more immersive learning experience compared to what is feasible with limited access to high-fidelity, and often inaccessible, Full Flight Simulators (FFS). It is now possible and highly desirable to use SET for a range of basic learning and training tasks, which includes complex decision-making scenarios before student pilots first enter a Full Flight Simulator or a live aircraft.

The effectiveness and efficiency of SET technologies, like Virtual Reality, is becoming increasingly evident as students are learning and absorbing information at a faster rate when compared to traditional training techniques. Simplifying tasks using Virtual Reality is proven to enable better focus and memory, particularly when it comes to learning new information and refining their abilities to perform complex tasks. To put it simply, there is data that suggests learning outcomes may not always correlate with higher fidelity and can be achieved with SET.

In addition to SET, there are other methods that should form part of a future learning ecosystem. This includes embedded, sometimes referred to as blended training in the individual's environment. This entails having flexibility at work (or greater operational time) to meet long-term learning and training objectives. The United States Armed Forces are increasingly using this method for operational readiness training.

Instruction delivered by Artificial Intelligence (or a Synthetic Instructor) during SET also assists with the provision of coaching, and tailored feedback to students based on their performance, reducing the requirement for human instruction to constantly monitor a cohort of students. This unique capability stems from advancements in artificial intelligence, speech, and computing technologies allowing for tailored and repetitive training in a safe and low footprint simulated training environment.

Awareness of the specific student's profile, recent performance, and training objectives provide insight on effectiveness of training – assessing how pilots perform after following training recommendations and interventions.

Such patterns of performance and training allow greater awareness and understanding of trends of performance in human-capability to achieve air superiority. This may sound futuristic, but such techniques have been exploited for decades in training world-class athletes and sports teams. With this awareness, *why should we not* use these techniques in pilot training?

## Conclusion

The processes with which allied defense forces project air power must adapt to the current geopolitical security environment to the needs of future conflicts. High-end military equipment takes decades to develop and successfully deploy, which means air forces must tailor the force projection of existing equipment through the optimization of the humans in the loop. Certain militaries refer to this as Cognitive Weaponry.

The ways in which air forces currently conduct testing, evaluation, and training falls short of what modern learning sciences and available immersive technologies can provide. These have the potential to attract, engage, and deliver the required number of aviators to deliver optimized operational outcomes at the right time and pace.

Modern air forces must rapidly integrate and exploit these advancements to establish a modern student-centric learning ecosystem that focuses on the student's learning journey to successfully win tomorrow's fight. This approach promises to simultaneously improve training quality with relevant and engaging material, improving accessibility and flexibility, while lowering cost and shortening the overall training cycle; a capability that is now within reach of many western air forces.

# ABOUT CAE

CAE is the leading global training and simulation company developing solutions that prepare defence forces for mission success. As a technology company, we digitalize the physical world, deploying software-based simulation training and critical operations support solutions across the maritime, land, and air domains.

Around the globe, CAE employs 13,000 employees in more than 200 sites and training locations in over 40 countries. CAE represents more than 75 years of industry firsts—the highest-fidelity flight and mission simulators as well as training solutions powered by digital technologies. We embed sustainability in everything we do. Today and tomorrow, we'll make sure our customers are ready for the moments that matter.

CAE welcomes the opportunity to meet with Government, Defence, and Industry leaders to outline how our global expertise in training could assist Japan in quickly acquiring and uplifting sovereign operational capability to adequately scale up in critical times.

## Contact

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