



AN EYE FOR A STORM

◀◀ Imagining the Future of ADF Professional Military Education ▶▶

AN EYE FOR A STORM:

**Imagining the Future of Professional Military
Education and Its Effect on the ADF of Tomorrow**

**By August Cole and P.W. Singer
Useful Fiction LLC**

Introduction:

“The military leader, the commander, is a central figure in our common narratives about war.”

So writes [Therese Heltberg](#) in her essay [“Art, Craft, or Science: How We Think About Military Leadership.”](#)¹ But what goes into the making of that military leader, and how can narrative assist in explaining it?

This is the central question at the heart of “An Eye for a Storm.” Deploying a deliberate blend of narrative and research (known as [“Useful Fiction”](#)), it envisions not just a future military mission, but also the future of professional military education.² These are key issues to explore as the Australian Defence Force implements its [Defense Enterprise Learning Strategy](#)³ toward planning for 2035 and beyond, to ensure it has the [“intellectual edge”](#) in future wars and strategic competition.⁴ Through fictionalized vignettes following a young officer from the classroom to the midst of battle, the reader sees the emerging real-world trends and technologies that an ADF leader might face in the future, as well as the age-old challenges of decisions and consequences that will continue to play out in a realm of deep uncertainty. The key lesson, however, is what being “future

¹ Therese Heltberg, “Art, Craft, or Science: How We Think About Military Leadership,” *Modern War Institute*, Dec. 29, 2016 <https://mwi.usma.edu/art-craft-science-think-military-leadership/>

² August Cole and P.W. Singer, “Thinking the Unthinkable with Useful Fiction,” *Journal of Future Conflict*, 2019.

https://www.queensu.ca/psychology/sites/webpublish.queensu.ca.psycwww/files/files/Journal%20of%20Future%20Conflict/Issue%202%20Fall%202020/Issue_2-Singer.pdf

³ Australian Defence Force, “Defence Enterprise Learning Strategy 2035.” <https://www.defence.gov.au/ADC/Docs/Defence-Enterprise-Learning-Strategy-2035.pdf>

⁴ Mick Ryan, “The Intellectual Edge: A Competitive Advantage for Future War and Strategic Competition,” *Joint Force Quarterly*, Feb 7, 2020. <https://ndupress.ndu.edu/Media/News/News-Article-View/Article/2076007/the-intellectual-edge-a-competitive-advantage-for-future-war-and-strategic-comp/>

ready”⁵ truly requires. An officer’s success or failure in the future will come in part from the education and experiences they were provided long before the point of decision.

It may be an imagined story of the future, but history tells us that the stakes of getting the education aspects of “future ready” right couldn’t be higher. If the Duke of Wellington was reputed to have said of Eton, “It is here that the battle of Waterloo was won!” it is also important to remember what George Orwell quipped in 1941: ["Probably the battle of Waterloo was won on the playing-fields of Eton, but the opening battles of all subsequent wars have been lost there."](#)⁶

⁵ “Creating a future-ready ADF,” *ADF Defense News*, October 19 2020. <https://news.defence.gov.au/technology/creating-future-ready-adf>

⁶ Oxford Academic, “Misquotation: ‘The battle of Waterloo was won on the playing fields of Eton,’” August 8, 2013. <https://oupacademic.tumblr.com/post/57740288322/misquotation-the-battle-of-waterloo-was-won-on>

OVER THE LACCADIVE SEA

3 MAY 2038 / 0532 HOURS

“Embassy roof looks clear. I don’t see any major storm debris, so we should be able to put down. That’s good, ’cause in these winds, fast-rope would’ve been impossible,” the tiltrotor’s pilot said.

“Copy,” replied Lieutenant Siobhan Freestone.

The verbal confirmation was protocol, just in case the Integrated Generative Combat System glitched, or, even worse, had somehow been compromised. There was always that tension in the fusion of artificial intelligence and human battle.⁷ Everything may now run *through* “Iggy,” but that was not the same as trusting the AI decision-support system⁸ *with* everything.

It was also the first thing the officer in the 39th Joint Combat Group had said during the last twenty minutes. So the sound of Freestone’s own voice being broadcast back into her earbud shook her out of her thoughts, making her realize that she needed to do another visual on her troops. She closed the two projected windows on her tac-glasses⁹ with an exaggerated double blink. That stopped the pop-ups feeding imagery from the tiltrotor’s sensor suite as well as the view from the Wedge drone¹⁰ scouting ahead of them. The lens then cleared, except for a few numeric augmented-reality icons layered over what her eyes saw in her natural field of vision.

⁷ Peter Layton, “Fighting Artificial Intelligence Battles: Operational Concepts for Future AI-Enabled Wars” Joint Studies Paper Series, No. 4, Feb. 2021. https://www.defence.gov.au/ADC/Publications/documents/joint_studies/JSPS_4.pdf

⁸ “Using AI to Assist Commanders with Complex Decision-Making.” Conference paper for Interservice / Industry Training, Simulation, and Education Conference (I/ITSEC), 2018 https://webcache.googleusercontent.com/search?q=cache:s-xJppeo_HoJ:https://community.apan.org/cfs-file/_key/docpreview-s/00-00-10-50-31/ITSEC_5F00_Paper_5F00_18702_2D00_Using-AI-for-Decision_2D00_making_2D00_07142018.pdf+&cd=5&hl=en&ct=clnk&gl=us&client=firefox-b-1-d Accessed January 13, 2021

⁹ Kyle Mizokami, “Mixed Reality Goggles Will Give US Army Soldiers Super Vision,” *Popular Mechanics*, February 13, 2020.

¹⁰ Coyote drone, Raytheon Missiles & Defense.

<https://www.raytheonmissilesanddefense.com/capabilities/products/coyote>

She took in her team. Lit by the sunrise peeking through the tiltrotor's rain-washed port windows, the eight soldiers in the squad that she pulled for this mission were each lost in their respective feeds.¹¹ Just like she had been doing moments earlier, they were trying to suck in as much information as they could before they hit the red zone. She thought about how each of them was facing that core problem from the essential [change in the information operating environment](#) that the instructors had first talked about way back during her very first weeks at the Australian Defense Force Academy.¹² Information for her forebears had been a scarce commodity. Now, they had drilled home, it was almost endless. And that made it both a capability and a danger.

So how you handled it became not a hunt, but a triage. Embassy viz cable on a nearby skirmish between two armed factions, with geotagged video: push to the squad. Seven-day meteo forecast: skip. Embassy staff bios: skip. IP library of embassy compound networked and personal devices: push. Local and international crowdfunding trendlines: skip. Tide chart: push. Updated layout for the embassy and surrounding buildings, including subterranean models: push.

Yet, coping with info overload was an issue of focus. Miles, the fires specialist, would have probably set his filter for pulling down data on likely targets in the op-zone. By contrast, Dodgy, the squad's

¹¹ Todd South, "How algorithms and primate research can help decide the best size for your squad," *Army Times*, September 14, 2020.

<https://www.armytimes.com/news/your-army/2020/09/14/how-chimpanzee-research-can-help-decide-the-best-size-for-your-squad/>

¹² Elizabeth M. Marlin, *Using Artificial Intelligence to Minimize Information Overload and Cognitive Biases in Military Intelligence*, School of Advanced Military Studies-US Army Command and General Staff College, 2018, <https://apps.dtic.mil/sti/pdfs/AD1071764.pdf>; Alex Young, "Too Much Information Ineffective Intelligence Collection," *Harvard International Review*, August 20, 2013, <https://hir.harvard.edu/too-much-information/>

networks specialist, would be focusing on spectrum availability.¹³ You had to trust them in their filtering; no officer could micromanage how each of them sipped from their own personal firehose.

To give them some semblance of a common operating picture, though, Iggy helped identify which information everyone in the unit needed, such as the alert marker about a battered red CONEX container floating a half block down from the embassy. It had likely broken loose in the typhoon, but it also could contain something very nasty inside, hence the marker. Whoever had programmed Iggy had given the system a “better safe than sorry” algorithmic ethic.¹⁴

Whatever data danced across their respective minds, the bodies of her soldiers looked set: Freestone saw no visible signs of undue stress that she’d been trained to look for at the Academy’s emotional intel leadership course.¹⁵

She smiled. Unlike what her Pop had to deal with back in Uruzgan, she knew that it was likely that in a few minutes they could be trading fire with an adversary with better gear or even better drug cocktails coursing through their bloodstreams. But she knew how well her team could adapt. Her confidence came from that relentless curiosity they all shared about how to become more capable soldiers. To be flexible was to ensure relevance. To remain static was the same as choosing to move aside.¹⁶ This was their identity – and their edge.

¹³ Peter Layton, “Mobilizing Defense In the Fourth Industrial Age,” Lowy Institute, March 27, 2019. <https://www.lowyinstitute.org/the-interpretor/mobilising-defence-fourth-industrial-revolution>

¹⁴ “Creating a Future Ready ADF,” Australian Defence Force, October 19, 2020. <https://news.defence.gov.au/technology/creating-future-ready-adf>

¹⁵ Harvey Deutschendorf, “New Research Shows This Is the Best Way to Teach Emotional Intelligence,” *Fast Company*, November 26, 2019. <https://www.fastcompany.com/90435922/new-research-suggests-this-is-the-best-way-to-teach-emotional-intelligence>

¹⁶ Department of Defence, Australian Government. “Defence Enterprise Learning Strategy 2035.” <https://www.defence.gov.au/ADC/Docs/Defence-Enterprise-Learning-Strategy-2035.pdf>

She knew some of that confidence also derived from a shared feeling of something like *déjà vu*. From the sights and sounds, your senses were surrounded by so many of the exact same elements as the hyper-realistic sim training environments. At that thought, she licked her lips and took a sip from her hydration tube. The one sense they couldn't ever simulate was the slightly different tang in your mouth that came from pumping adrenaline during a real-world operation.

Four days ago, the unit had been out yet another “sim, run, and sun” op. The third one of the year, this one had focused on integrating real-time planning with urban reconnaissance, while building better ties with the Indian military. Only, the “sun” and “sim” part of the plan had to be thrown by the wayside on the second day of the exercise. A drought-fighting weather modification program¹⁷ 2,000 kilometers away had apparently gotten its calculations wrong and ended up sparking a typhoon that had slashed across half of the region.

Figuring out whom to blame was for the politicians and lawyers. For Freestone and the 39th, the days became a blur. HMAS *Adelaide* had become the hub of everything from aid deliveries to air strikes on local insurgents and gangs exploiting the chaos.

A few hours earlier, Freestone had come back from pulling security for an NGO's logistics depot, hoping to get a shower and a nap before her next tasking. Iggy had other plans. When this latest order had come in from Canberra, it had instantly matched the need to which squad had the most recent training on the closest related sim to the real-world mission parameters. With a pol-mil marker put on it, the mission also judged to require a more senior officer. So, Iggy had advised the task force CO that Freestone was the best choice. Everyone liked to think Iggy somehow had it out for them, but there

¹⁷ Arwa Mahdawi, “China is Scaling Up Its Weather Modification Programme - Here's Why We Should Be Worried,” *The Guardian*, December 15, 2020. <https://www.theguardian.com/commentisfree/2020/dec/15/china-scaling-up-weather-modification-programme-we-should-be-worried>

was nothing personal about it. The system just ran a series of rankings of everything from background and availability to calculating what swapping out someone on another mission would mean for its own expected success and that mission's ranked importance. It was all a black box; no human could ever really know why an AI decided what it did.¹⁸ But she guessed the embassy evacuation sim she'd done during that exercise with the U.S. Marines last year had probably driven Iggy's recommendation.

Freestone's screen on her forearm buzzed and she tapped the flexible screen to wake it up.

Her eyes widened when she read the revised mission orders. *Bloody hell*, she thought. This was definitely not what they'd planned for in that sim...

¹⁸ Ariel Bleicher, "Demystifying the Black Box That Is AI," *Scientific American*, August 9, 2017
<https://www.scientificamerican.com/article/demystifying-the-black-box-that-is-ai/>

SCHOOL OF INFANTRY

17 MARCH 2035 / 1440 HOURS

The hard rubber pearl-like nodes pressing into her temple and forehead were not unpleasant. If you positioned the scanner at just the right angle, it even came close to feeling a bit like a head massage. But it did nothing for the emotional and intellectual pain that Freestone and every student felt right now. “Neuroscience of Tactical Leadership” was a course whose sole purpose seemed to be to use simulations to show cocky junior officers just how ill-equipped they were.

Napoleon had insisted his Marshalls know at least forty texts on past battles.¹⁹ The course leads took that 19th-century insight but crossed it with 21st-century war-gaming tech.²⁰ Each module fused lecture and live sim of a historic military operation in which the student assumed the tactical-level responsibility. Week One had started out with them holding the line at ANZAC Cove, dodging Maxim gunfire while trying to manage information flow from foot messengers. And that had been the easy introduction week, each one becoming progressively more difficult as more variables were thrown in. Yet, as the students both learned and experienced concepts, they were also themselves the object of study. While their minds scanned virtualized worlds for Ottoman artillery positions or Japanese Zeros flying over Sarimbun Beach, monitors scanned a student’s brain center activity for how well the concepts were translating.

¹⁹Ray Janowicz, “Is Wargaming a Useful Tool to Train Officers?” The Cove, November 17, 2020

<https://cove.army.gov.au/article/wargaming-useful-tool-train-officers>

²⁰ “This Battlefield Simulation Opens a Window to the Past,” *Israeli Homeland Security*, February 20, 2021.

<https://i->

[hls.com/archives/107095?utm_source=Israel+Homeland+Security+%28iHLS%29&](https://i-hls.com/archives/107095?utm_source=Israel+Homeland+Security+%28iHLS%29&utm_campaign=176fbb8b9a-)

[utm_campaign=176fbb8b9a-](https://i-hls.com/archives/107095?utm_source=Israel+Homeland+Security+%28iHLS%29&utm_campaign=176fbb8b9a-)

[ENGLISH_DYNAMIC&utm_medium=email&utm_term=0_8ee2e16ed1-](https://i-hls.com/archives/107095?utm_source=Israel+Homeland+Security+%28iHLS%29&utm_campaign=176fbb8b9a-)

[176fbb8b9a-89869565&mc_cid=176fbb8b9a&mc_eid=5863d47f08](https://i-hls.com/archives/107095?utm_source=Israel+Homeland+Security+%28iHLS%29&utm_campaign=176fbb8b9a-)

For the capstone session, though, Freestone could feel that something was different. It wasn't just the heat, though that was bad enough with the building's cooling system struggling to keep up with the 49-degree outside temperature. A TA stalked the aisles to ensure not just that each rig had strong signals, but that everybody had a water bottle nearby.

The professor's introduction to the sim quickly confirmed it.

"Rather than dip back into our past, we've modded the scenarios to take you somewhere else – the future," said the disembodied voice of Professor Howard, remote teaching from the much cooler climes of Hobart.

"I have to warn you about this future, however. Few of you will succeed in it, which I know is going to be difficult for such hard-chargers to accept. Remember, though, what Einstein said, 'Failure is success in progress.'"

Freestone knew that at that moment, every other student was thinking the same thought: *Screw Einstein*. They would be the exception.

Then the sim kicked off. Through the lens projection into her iris, Freestone saw herself standing in the sand, water just touching the edge of her boots. She looked down at her hands. Where there had once been motion sensor gauntlets, now she saw her skin, but modulated with the red and brown of a sunburn and caked dirt. In her right hand, she held a simulated encrypted tablet. She swiped it on, the gauntlet in the real world registering the move in the simulation, and the display of the tablet marked her position as just outside the village of Buna.²¹

²¹ "Battle of Buna," Australian War Memorial.
<https://www.awm.gov.au/collection/E84314>

The name was familiar, but before she could process the scene any more, the water around her boots started rippling. Then churning and frothing. She looked up to see an LCM-1E landing craft run up on shore beside her, its ramp already half-way down. *An amphibious landing scenario then*, she thought, her mind both acting in the sim and thinking it through. She began to call up the micro-memes that she made after the ADF amphibious doctrine module earlier in the semester.

The tablet began pulsing messages and data, as did the tac-screen on her forearm, its straps held together with mil-tape. The metal ramp of the craft slammed down with a splash, a petty officer screaming at her to “Get them moving!” Freestone looked over to where he was pointing and saw what seemed like an almost endless row of wounded soldiers, their uniforms not just bloody, but tattered and rag-like.

That’s when the situation clicked. Rather than some glorious amphibious landing that the doctrine envisioned, this was an evacuation. And it wasn’t going well by the looks of it.

She moved from the beach into the nearby treeline as she processed the information on the tac-screen. The task was to figure out how to make a last stand as the rest of her massively outnumbered unit retreated in defeat. Looking to her left and right, she assessed the perimeter that she was to hold, while checking sitreps and the ammunition status of her unit. She made quick adjustments, ordering a simulated soldier here and there to give a better field of fire for the unit’s remaining light machine gun and pushing out a Bogong sensor bot to extend their info bubble.

Her tablet then pinged with warning. And there was the wrinkle they always threw at you in the sims. A swarm of [Crayfish amphibious bots](#) was incoming. She’d focused on the most likely route of attack, but the enemy didn’t have to play by her plan.

Freestone quickly alerted her simulated soldiers to reposition the perimeter, moving their icons to alternate rally points. She then called in for air support. A scratchy voice from the simulated CAOC gave a reply that was not what she needed to hear.

F-35s inbound, but not – I repeat – not, carrying air-to-surface munitions. CAS is a no go...

The second twist. They often threw those in to complicate things, Freestone knew, as well as to get students used to experiencing digitized versions of Clausewitz's maxims on the simple and the difficult in war.²²

The first Crayfish reached the sand, clawing for traction as it began to move inland. More bots appeared behind it, a mix of types, some of them spindly-armed gunners wielding multiple Type 05 submachine guns for close-in killing. Suicidal breacher bots scuttled past them, headed for the tracked landing craft full of wounded soldiers, now trying to pull itself off the beach.

Freestone gave the fire order and her soldiers opened up, chewing through the first wave. But there were [just so many](#).²³ Even worse, every bot taken out in the swarm was actually just more data for the swarm to use to choose its next target. So, this is what it felt like to be on the pointy end of the "Blade of Victory" doctrine.²⁴

²² Carl Von Clausewitz (1832): 'Everything in war is very simple, but the simplest thing is difficult'

²³ John Arquilla and David Ronfeldt, *Swarming and the Future of Conflict*, RAND, 2005.

https://www.rand.org/content/dam/rand/pubs/documented_briefings/2005/RAND_D B311.pdf;

John A. Sauter and Kellen Bixler "Design of unmanned swarm tactics for an urban mission", Proc. SPIE 11021, Unmanned Systems Technology XXI, 110210K (13 May 2019); <https://doi.org/10.1117/12.2518116>;

Paul Scharre, *Robotics on the Battlefield*, part II: The Coming Swarm, CNAS, 2014. https://www.jstor.org/stable/resrep06405?seq=1#metadata_info_tab_contents

²⁴ US Army TRADOC, "The PLA: Close Combat in the Information Age and the "Blade of Victory" *US Army Mad Scientist Laboratory*, April 6, 2020.

<https://madsciblog.tradoc.army.mil/225-the-pla-close-combat-in-the-information-age-and-the-blade-of-victory/>

Freestone ran to take cover behind a rock as big as the Landy her mom used to drive her to rugby practice in. She looked back at the screen to try to see an opening, but there was none. As the swarm of red dots around her unit grew, Iggy flashed a spectrum sweep update, showing how the bots were coordinating their attack.

Wait. That was it. She tabbed back to the spectrum data, as the scratching sound of the Crayfish making their way through the underbrush got louder and louder. That was the most disconcerting part of these sims – the audio was sometimes too good.

She held her focus though, then messaged the CAOC: *What r F35 EW n cyber weps status?*

OVER THE CAPITAL EMBASSY DISTRICT

3 MAY 2038 / 0536 HOURS

A haptic buzz tingled along Freestone's spine, the electrical pulse just strong enough to alert her body with a physical warning.

Microseconds later, the tiltrotor flared and banked hard. Sun-bleached concrete rushed up at Freestone through the window until it felt like she could reach out and touch the top of the apartment building they barely skirted. She cursed out loud as she switched her view back to the tiltrotor's turret-mounted cams.

The feeds showed coiling grey plumes of smoke reaching down into the urban canyon from the roof deck of a sky-rise. The tiltrotor transport dipped lower yet. This time, Freestone's body was prepared for it, leaning into the turn as a sound like stones on tin popped. That was the diverters – prop-powered bots that simulated the EM and heat signature of the tiltrotor – firing off. The tiltrotor then banked again before it leveled off and picked up speed while flying no more than a few meters above the flooded streets.

The grey plumes then corkscrewed away from the tiltrotor, before crashing into the water a few hundred meters away. She didn't need Iggy to tell her. It was the telltale sign that the Wedge's electromagnetic payload had fried the missiles before they'd even been tricked by the diverters.

Her screen then pushed a new alert. The threat bubble had been altered, and a CAS asset – callsign "Bolt 29" – was already inbound with pre-cleared strike authorization.

She looked over to see the tiltrotor's crew chief rapping his gloved knuckles in frustration on the bulkhead next to his minigun, which would now go unfired. Someone had tried to put a scratch on his baby. But, instead, their partnered Cobber drone would be the one to get the satisfaction of a payback it couldn't even enjoy.²⁵

²⁵ Kelsey Reichmann, "Boeing's Loyal Wingman Drone Completes Low-speed Taxi in Australia," *Aviation Today*, October 23, 2020. <https://www.aviationtoday.com/2020/10/23/boeings-loyal-wingman-drone-completes-low-speed-taxi-australia/>

AUSTRALIAN DEFENCE FORCE ACADEMY 1 NOVEMBER 2033 / 0245 HOURS

For a nation that prided itself on its coffee, the sour taste of the dregs of the flat white was almost unpatriotic.

Freestone forced herself to gulp it down, though. They'd been at it for almost three hours straight, and she needed the wake-up. The final assignment for the Human-Machine Dynamic Mission Systems course sounded simple: Get all four of your autonomous armored vehicles from their start point to their endpoint.

The problem was the supposed one-kilometer straight line ran through a battered and war-torn city. Topped apartment blocks. Thermobaric IEDs placed in sewer lines. Cluster and EM mines springing out of windows. Civilians scouting for water. Even more devilish was that Dr. Igovic's red-team AI only got better with each class.

"If it tastes so bad, why don't you just pop a stim instead?" asked Yashin, seeing her wince at the tepid drink.

"It is one of those org culture things they don't put in the training wiki," Freestone explained. "Stims are fine out bush, but frowned on when in barracks. It's stupid, I know. It'll change, give it time."

A direct commission brought in to boost the force's technical chops just two months earlier, Yashin had been a permalancing junior software architect, spending his days and nights in a mix of gaming and gig jobs for Sydney data management firms. The Defence Force Recruiting algos had ID'd his skill sets as a match. An ADF human recruiter had tracked him down and talked him up during an e-sports stream.²⁶ Yashin had taken the offer through a combination

²⁶ Ben Kesling, "Army Deploys Videogames to Reach Recruits Amid Pandemic," Wall Street Journal, May 17, 2020. <https://www.wsj.com/articles/army-deploys-videogames-to-reach-recruits-amid-pandemic-11589734800>

of patriotism and the promise of actual full-time employment. Plus, he'd told Freestone, he just liked being able to work somewhere other than the same cocoon-like coding pod he had spent most of his waking hours for the last three years.²⁷ That was why he didn't understand much of the military culture yet, and why he'd resist moving to a similar, just less comfortable government-issued coding chair.

Yashin shrugged at the new knowledge, then changed the subject. "You surf?"

"No," Freestone said, curious what had sparked the question. The direct commissions were sometimes like that, their minds always racing off in new directions, the conversations with them taking unexpected turns.

"You should give it a go," he said, as his fingers simultaneously coded the software. "You get in the water, and it's always changing, never the same. Except. A great wave is a great wave, no matter how much it's blowing, the time of day, swell period, tide, whatever. That's what you're always looking for."

She watched as his hands danced, moving blocks of code back and forth across the projected screen.

"You don't wait for perfect conditions," he continued, "or only surf the same spot day in and day out, or wait for somebody to tell you to go – because by then it's too late. The rules about stims, how we're

<https://www.wsj.com/articles/army-deploys-videogames-to-reach-recruits-amid-pandemic-11589734800>

²⁷ Mark Armstrong, "The Singapore Armed Forces Volunteer Corps and Opportunities for the Australian Total Force," *The Cove*, October 8, 2019. <https://cove.army.gov.au/article/the-singapore-armed-forces-volunteer-corps-and-opportunities-the-australian-total-force>

supposed to use these bots, all this stuff.²⁸ Go find that wave. That's all a good idea is."

"Sure. But is there a point to this?" she asked, dubious that Yashin had ever actually been surfing in the real world vs a sim.

"Now, take a look at what I've done here," Yashin said. "What do you think?"

It was brilliant. Blocks of code taken from an open-source self-guiding control algorithm for a civilian subterranean utilities bot, but inserted into their simulated hunter-killer patrol. The hardware and mission of the two had seemingly nothing to do with one another. One was a soft-skinned bot the shape of a cucumber, the other in the simulated form of a tank-like armored ground vehicle. But the new code more heavily weighted data about their physical surroundings, rather than prioritizing immediate proximity to one another as they had been programmed. Their systems could still create mutually supporting fires, but by very different margins than the vehicles' original Army-specific software requirements envisioned. It'd present the red-team AI with something unexpected, which was half the solution for these projects. It went back to the rule they had learned in the studies of the 2020s ops in places like Socotra and the SCS. *Don't try to outsmart an AI, surprise it.*

Freestone knew that was also half the point of their own assignment. While the students were supposed to be learning, they were also teaching Igovic's AI itself. Training went both ways now.

²⁸ Inspired by a quote from Sir Michael Howard as cited in Tweet by Gen. Mick Ryan (@warinthefuture).
<https://twitter.com/WarintheFuture/status/1351426390864760835/photo/1>

AUSTRALIAN EMBASSY

3 MAY 2038 / 0615 HOURS

As the soldiers jumped out of the hovering tiltrotor, it was hard to tell the prop wash from the fading typhoon's gusts. Freestone's boots splashed on the embassy rooftop as she held her rifle at the ready, even though the sensors had given an all-clear. Above the squad, the tiltrotor rocked for a moment as if some giant had grabbed its tail before letting it surge higher into the sky.

Arranged in a rough perimeter around her small force, Freestone's menagerie of diminutive bots began to power up and flip themselves over. All except one, creating a gap in the perimeter sensor display on her view screen.

"Pincer's down!" yelled Trim. The unit's bot handler meant it, literally. In the map-like 2-D view she saw, the unit's close-protection UGV was roughly where it should be, taking position roughly 50 meters from the unit. But in the 3-D dimensions of the real world, the canister mount on the tiltrotor's belly had apparently shot one bot over the edge of the embassy roof.

Trim tore open a strip of Starling drones from his combat rig and the tiny drones began to take flight, swirling around first the bot handler and then the unit as they mapped out their surroundings.²⁹ In seconds, the drones pushed their stitched-together 360-degree video to Trim and Freestone's feed. It highlighted the status of what was to be their ground partner. The unit's multifunction quadruped bot was churning in the waters of what had been the embassy's courtyard, now flooded from the storm surge.³⁰

²⁹ Offensive Swarm Enabled Tactics (OFFSET) program, Defense Advanced Research Projects Agency. <https://www.darpa.mil/work-with-us/offensive-swarm-enabled-tactics>

³⁰ Seth J. Frantzman, "Rafael Combines Technologies to Give Combat Robots a 'Brain' to Map Threats Indoors," Defense News. January 6, 2021. <https://www.defensenews.com/home/2021/01/06/rafael-combines-technologies-to-give-combat-robots-a-brain-to-map-threats-indoors/>

“Which dumbass engineer designed a dog bot that doesn’t even know how to doggie paddle?” Trim asked as the robot slowly began to be pushed down the street. “You want me to go down and try to rescue it?”

“Not unless you brought your boardies,” Freestone replied. “Tell Iggy to log it as lost and self-destruct before it becomes the pet of some kid downstream.”

“Supply should have sent us with UUVs instead,” Trim muttered.

A gust of wind sprayed rain sideways through the embassy’s shattered windows and the visual from the tiny drones blinked out.

“Wind over 30 knots is too much for them,” Trim said, reading her mind. “But maybe we can use them static, perch ’em somewhere to keep an eye on things ... What do you think, Belly? That rooftop across the street about the distance a good bowler could handle?”

The medic in the unit, Belly, had gone to Geelong Grammar before he’d joined the ADF infantry, and Trim would use any moment to pick at his elite pedigree.

In a comically slow gesture, Belly sternly held up his finger as if gauging the wind. He paused, a smile then overtaking his face.

“Actually, as good as my arm is, we can rig up some surgical tubing from the medkit for a slingshot,” he said. “Or, if you’re launching a drone, is it more technically a catapult?”

Freestone marveled at both their ingenuity and the delight they took in the blend of old and new tech.

“I don’t care what you call it. Just get it sorted and then join us on the inside,” Freestone said as she motioned her small group of soldiers toward the rooftop stairwell door. As they descended the steps to the offices below, a lone embassy guard waited for them

behind a makeshift barricade of an overturned desk; Iggy had already verified his bonafides.

Behind him, Freestone heard raised voices. The building layout and personnel tracking indicated it came from the cluster of people in the embassy's main conference room. The staff assembled there was having some kind of argument that drifted in and out with the wind.

It seemed they also had gotten the same notification of her new mission orders.

"Tinker, what's the status of the embassy's data cores?" she asked.

There was a pause as he looked quizzically back at her before responding. "They seem good. There's no evident ice, so water hasn't flooded the vault. Yet. It shorted out the external door, though."

"Okay, I'm going to need you to figure out how to get it open."

"Yes, ma'am." But she could tell by the tone of his voice he didn't think it a priority in the midst of a rescue mission during a typhoon.

Suddenly, shooting rang out from the south, at least a few hundred meters away. Small arms. Careful shots interspersed with long, uncontrolled bursts. Then a series of faint explosions, almost like fireworks.

Trim pushed a feed from one of the microdrones they'd placed on the neighboring building's roof. It showed a four-story building at an intersection down the street. Set on a small rise, water flowed down one side of the building creating a kind of moat, but the other side of the building was still traversable. A collection of four SUVs had gathered there, with armed men and women behind them in firing positions.

As the view built, labels began to appear over the objects, the most important being the building marked as the “Consulate of the People’s Republic of China.”

“Looks like someone is getting into it with the PLA embassy guard unit ... Uh oh! ... Shit,” Trim said.

She also noticed the urgent problem: Iggy had put a target lock on one of the SUVs from which gunfire had emanated.

A buzzing warning then cued in Freestone’s helmet audio, indicating the Cobber drone’s automatic target recognition system was beginning its weapons release countdown. Someone back on the *Adelaide* had loosened the rules of engagement for the autonomous platforms and the near-miss with the surface-to-air missiles fired at their tiltrotor must have shifted the combat system’s risk algorithms. Typical. Closest to the fire and last to know.

Was the SUV an attacking vehicle or the PLA’s evac plan? It didn’t matter.

She mashed her forearm screen repeatedly to abort the strike, choosing “invalid target” among the four icon options to explain why.

All in all, it was an easy call. She didn’t need a refresher from the pol-mil courses she had taken to know that a drone striking an automobile in front of the PRC embassy was only going to create a diplomatic nightmare.

Nothing like the problem to come, however, as she now had to deal with Australian embassy staff that had just found out their would-be rescuers weren’t there for them.

Freestone’s new orders had altered the package escort priority. Evacuating the memory cores came first.

AUSTRALIAN EMBASSY

3 MAY 2038 / 0652 HOURS

While the Australian ambassador berated her for abandoning his staff, Freestone simultaneously studied the video feed of Tinker out of the corner of her eye. He triumphantly waved his pry bar above his head. Every bot handler carried the low-tech tool as a point of pride, and after failing to succeed through digital means, he'd apparently cracked open the data room door's control access panel like some pre-Bitcoin bank robber.

Then the screen went white. As Tinker opened the door, he didn't step back quickly enough, and the blast of cold air inside hit him instantly. The superconducting Cryogenic Compute Complexity (C3) systems delivered about 20 PFLOPs of computing performance better than the old complementary metal-oxide-semiconductor (CMOS) based data centers, but the niobium wires inside had to be cooled 4 Kelvin.³¹ A sheath of insulation allowed the liquid helium coolant to keep the data core to that cryogenic level inside, but it still threw off enough cold to keep the room around it as cold as the Arctic used to be.

As the icy fog cleared, Tinker looked like a character out of that old Disney movie she had loved as a kid.³² The water that had been dripping from his beard had hardened into icicles and his eyebrows were crusted with frost. It would all melt in seconds in the tropical heat, but she knew that the snap shot of that moment in the video feed would likely go viral across the entire force.

She held her stone-faced expression though, careful to show no mirth at his predicament as that would only prompt the ambassador

³¹ IAPRA, "Cryogenic Computing Complexity (C3)" <https://www.iarpa.gov/index.php/research-programs/c3> accessed Feb. 20, 2021; Quentin P. Herr, et al, "Ultra-Low-Power Superconductor Logic Northrop Grumman Systems Corp. report, March 23, 2011, <https://arxiv.org/pdf/1103.4269.pdf>

³² <https://movies.disney.com/frozen>

to scream at her more. The self-restraint was easy enough; he was an amateur compared to the Duntroon instructors who taught her to show no emotion when being chewed out.

All his histrionics and curses were to no avail, and the diplomat knew it. He'd already livestream-cabled his protest back to Canberra, but the Foreign Minister herself had confirmed it.

Those cores contained a treasure trove of not just confidential diplomatic analysis for the entire region, but also locally stored data and models too sensitive to be in the cloud, waiting for a hand-carry to ASIS. If somebody got their hands on the cores, they could work backward, potentially pulling everything from which locals had passed on classified intel, to maybe even being able to unravel the encryption algorithms themselves. No machine had made the call, but it was the same kind of raw calculation. More lives would be lost by losing the cores than the embassy's skeleton staff.

On Freestone's view screen, an icon appeared to let her know that her request for an added tiltrotor for the embassy staff had been denied. There were only so many and *Adelaide* was swamped with competing missions.

Another blast of gunfire came from the direction of the Chinese embassy, then silence. In that moment, Freestone noticed that the wind had also died down. Rain continued to lash at the window of the conference room, but at least the windows weren't rattling from the wind any more.

Without ordering it, Trim left the room to relaunch the microdrones. As Freestone began to let herself feel that pause between relief and a new breath, her helmet vibrated, a metallic buzzing against her skull. At the signal of an imminent threat, she pushed the ambassador to the ground with one hand and swept her bullpup-style carbine to cover the entrance to the room.

Just as one part of her brain processed that there was no one entering the door, another part processed that the pip on the warning tactical grid was 45 degrees to her right. Still in a firing stance, she swept her weapon across the room. Just over the gun's front sight, she saw a small drone flying toward the exterior window of the conference room. The form of a butterfly, it had crude purple-colored fabric wings. Iggy hadn't identified the type, but to Freestone's human eye it looked like part of those holiday celebration swarm kits.

The drone flew closer, and then slowed slightly, tiny legs reaching out to stick to the exterior panes.

The room then went white, even as Freestone's mind wondered whether it was a putty or nanofibers that had held the explosive drone to the slick glass.

AUSTRALIAN DEFENCE COLLEGE VIRTUAL CAMPUS 8 SEPTEMBER 2035 / 2231 HOURS

The pill looked like an unpolished gem, roughly faceted and milky colored. The funny thing about bioceuticals was the more cutting-edge they were, the cruder they appeared. Freestone had printed this batch in her unit's fab lab the day before. It was a new combination of nootropics that she had modeled to her own physiology and needs. Small doses would allow her to increase her reaction time while simultaneously letting her step back from the intense focus the old formula offered. A couple of years ago this would have been against regulations, but the rise in civilian bioceutical use meant the Army now permitted the use of tailored formulas.

She picked it up and couldn't help herself, taking a sniff.

It smelled like soured yogurt and spoiled fish, as mandated by the regs for legal biofabs. You wanted someone to have one last think before they took a stim. Make them evergreen or bubble-gum flavored, and it was all too easy.

She put the pill quickly in her mouth, gulped, and washed it down as quickly as she could with a glass of water. It tasted like it smelled. She almost missed the bad coffee.

As Freestone put on her VR gaming rig, she saw that most of her classmates in her ADC short course had already logged in to their private data cores. The online class on Learning Systems Models for Littoral Operations was over, so each of them could have gone their own way, relaxing, hanging out with family, or just getting the sleep that they all knew they needed. But playing the mixed strategy and first-person shooter game together was one of the unspoken expectations of such remote learning pods.³³ Even if they weren't all

³³ Scott Kuhn, "Soldiers maintain readiness playing video games," *Army.mil*, April 29, 2020

on the ADC physical campus, camaraderie existed by design in the virtual environments. The late evening log-on was akin to an extra lap on the obstacle course with her team or a pub night out.

As the final members of the class pod assembled in the VR site, the gaming system then searched for who else was on the net. They may have been physically located across six different states and provinces and three other nations, but they all shared that same emotional moment of anticipation at who it would select as their opponent, and even a bit of fear that it would be the kids from Duntroon.

“Team Carlisle”

She instantly regretted taking the wake-up pill. Teaching the officers at the American war college how it was done would be stimulating enough.

AUSTRALIAN EMBASSY

3 MAY 2038 / 0654 HOURS

Freestone blinked her eyes, trying to get out the sun-like spots so that she could focus on her forearm tac-screen. The viz glass was photochromatic, so the full force of the incendiary wouldn't blind her, but already she had a screaming headache

"Check-in," Freestone said, eyes closed as she tore open a small black pouch filled with gel. The combination of stim, cogniceutical, and pain relief medicines would take just moments to hit.

Belly gave her a report. "We're all good. You're the only galah that looked at the explosion," he clucked.

"Just wanted to make sure DFAT had gotten its money's worth from the builders."

Designed to withstand the force of a car bomb, the thick glass of the embassy conference room was now spiderwebbed with cracks. It had held, but a second drone strike would break it, likely not even needing the explosives to do so. They just had to hope that whoever had launched it had used up their stock.

"Any intel on whose drone it was?" she asked Tinker.

"We don't have any telemetry on its launch site, but odds are it's linked to the group going after the Chinese embassy. Looks like they're going to take it."

As he spoke, Freestone queued up the data collected and processed by the recently launched micro-drones. It showed the final phase of the battle: the PLA embassy guards were outnumbered by at least twenty-five identified military-aged males, armed with the usual mix of light weapons and cheap bots. Everything they threw at the PLA was relatively low-tech, though,

taking out any option for calling in a nullifying cyber counter-strike to lock down their systems.

With no uniforms to firmly identify and link the attackers to an official or informal organization, Iggy had marked them with a hazy green color. But a pop-up did provide face IDs pinged to multiple national police warrants. Likely a pick-up crew of local gang members, she concluded.

“There something else of note,” Trim added, pausing to let her process it. “JOC’s pushed an alert that they got from the Comm Bank liaison with ASIS. They’re seeing a surge of micropayments in this area of operation... Distributed ledger, so they don’t know who, but someone has put the word out they’ll pay for what’s in the embassies, including ours. The group that hit the Chinese embassy won’t be the only one in on the hunt.”

As he spoke, Freestone’s personalized meds began to work. The spots in her vision receded and the throbbing at the base of her neck disappeared. More importantly, the meds brought back that familiar sense of focus honed during the last few years.

Just as she’d been trained everywhere from the seminar room to the sim center, Freestone assessed the critical issues and tried to think them through. The cores had priority, but even if they put them in a sling under the tiltrotor, their weight meant they wouldn’t be able to bring back both her team and the full embassy staff. Even if they dropped all their body armor and weapons, the numbers just didn’t work. It was too heavy a load. But by the time the tiltrotor assigned to her team made its way back for the second pickup, the embassy would likely be overrun. They’d get one run for the staff, the cores, and her team.

She looked from the feed of the water outside, a calm pool where the Pincer bot had splashed about earlier, to the cracked window of the conference room, to the blank wall-sized whiteboard that faced it. The emptiness of it taunted her.

It was what her old *Star Trek*-obsessed former commander would have called a “Kobayashi Maru,” an unsolvable problem.³⁴ And it was now on her to find the right answer to it.

³⁴ *To Boldly Go*, upcoming book by Steve Leonard et al, 2021.

ADFA DESIGN + DEFENSE MIDNIGHT SPRINT / 2 MAY 2033 / 2329 HOURS

The hundreds of small, brightly colored paper stickies were arranged in rainbow-like mosaics along the conference room's windows and walls. If you pulled back, it was almost like one of the modern takes on Aboriginal dot art at the Australian Museum, maybe something by Emily Kame Kngwarreye... if she had worked in the bureaucracy of the Russell Offices.³⁵

The assignment for the eight-student team was to work up a new operational management system concept. Yet the 12-hour design sprint exercise was really meant to get the students used to generating ideas, to throw something against the wall and see if it sticks, in both meanings of the term.

One of Freestone's cohort yelled out an idea of how they might mimic the way that car loan companies were using three-dimensional visual representations to tame the complexity of multiple-source, unstructured data. Freestone wrote it down on a purple 7.6-cm-by-7.6 cm square of paper and stuck it to the whiteboard.

It also felt mentally freeing in a way, Freestone thought, to be going old-school like this, rather than using a screen or sim. Something about watching the blank space fill with hand-written insights seemed to spark the group's energy. Perhaps it was the realization that somewhere in the art was the answer to what seemed unsolvable when they started. They just needed to look at it from the right angle.

³⁵ <https://www.artgallery.nsw.gov.au/collection/artists/kngwarreye-emily-kame/?tab=works>

AUSTRALIAN EMBASSY

3 MAY 2038 / 0819 HOURS

The Cobber drone flew so close to the cracked window that its thundering pass might shatter it. But hopefully the high-speed turn-and-burn down the street sent an unmistakable message.

The aggressive low-level maneuver was a warning for anybody considering firing on a lumbering old twin-rotor Chinook helicopter that its robotic wingman was on station watching protectively.

“Ambassador, staff to the roof stairs now,” Freestone said to the senior diplomat.

The embassy walls and remaining windows began to shake as the Chinook, retasked from *Adelaide*, approached. It moved slower than even its usual lumbering flight, the weight of its sling load straining its engines.

That had been Freestone’s realization from coming at the problem from another angle. Instead of trying to figure out what could they carry out, a new world of options was opened up by asking what could they carry in?

Hovering over the murky rotor-whipped waters in the courtyard, the Chinook released its cargo. This was the critical moment: they thought the water was now deep enough, but there was no data on it for Iggy to process. No one had ever heli-dropped a four-meter autonomous UUV into a city before.

With a splash, the shark-gray robotic submarine dipped under the water and then bobbed to the surface. Removing the sonar module of the open-architecture UUV had made it much lighter than normal.”³⁶

³⁶John Keller, “Boeing to Develop New Payloads, Capabilities, and Missions for Orca Large Long-Range Unmanned Submersibles,” *Military & Aerospace Electronics*, October 15, 2020.

She tapped on her arm screen, sending Trim and Dodgy a curt message: “Time to get wet.”

The crew of the Chinook pushed out an emergency raft that self-inflated the second it hit the water, and the two soldiers swam out to pull the raft back into the embassy. A few minutes later, they reappeared, dragging the frost covered raft with its precious cargo of the data cores toward the UUV.

It wasn't in the design specs or certainly any RAN doctrine manual, but Freestone knew it would work. The hard numbers backed the human creativity. Iggy couldn't ever have come up with this plan, but it could instantly run the calculations on everything from whether the cores would fit inside the makeshift cargo hold of the UUV to the temperature decay timelines as the cores made their underwater out to sea.

That was the real beauty of this multi-domain op redefined.³⁷ It was the blend of the known and unexpected, the long-studied and the newly improvised coming together. That, and Freestone had offered up to her commanders a way to accomplish her mission without compromising the human values they all held dear.

A few minutes later, Freestone knelt on the embassy's rooftop, the Chinook's powerful rotor wash blowing past her. She mentally counted off the embassy staff one more time, just to be sure. As she ordered Trim and Dodgy, and the accompanying train of bots watching over them, to hustle up the stairs to the waiting helicopter, she checked the UUV's progress out of the flooded city. It was now past the point of most concern, the local gang surrounding the Chinese embassy. There had been the risk of them

<https://www.militaryaerospace.com/unmanned/article/14185349/unmanned-payloads-submarines> Accessed January 29, 2021.

³⁷ Mark Mankowski, “Does the Australian Army Need Multi-Domain Operations?”, *The Cove*, September 24, 2019. <https://cove.army.gov.au/article/does-the-australian-army-need-multi-domain-operations> Accessed January 31, 2021.

blocking the street and fishing it out. But that would have required them first to have noticed and then made sense of the slight chill in the water as a robotic sub traveled by out of sight. The ETA clock ticking down showed that the UUV would arrive at the designated rendezvous point 127 minutes before the core temperature degraded past the point of memory recovery.

That part was now the responsibility of the *Attack-class* sub that had accompanied the task force. For her, the only responsibility now was to get the humans in her care out of the storm.

Trim was the first through the door, stopping at the ramp as he too scanned for threats.

“When we get back, you’re gonna need to go straight to the *Adelaide’s* quartermaster.”

She kept her eyes scanning for threats, but asked him, “Why’s that?”

“Gotta change that Captain’s insignia to the RAN one if you’re going to be commanding submarines now.”

A soft ping in Freestone’s headset and she motioned him up the ramp. Then something small flew by her, buffeted by the rotor wash before folding in its wings and dropping to the ground, just before the ramp. The last of the unit’s Starling drones was snatched up in midair by Dodgy, who jogged past without breaking stride.

Freestone took a final look around the rooftop and a last scan of her arm-screen. No bots and no humans left behind. Just like she’d been taught from her first day at the School of Infantry.

She flashed a thumbs up to the crew chief manning the Chinook’s Gatling gun and climbed up the ramp.

After Reading – Key Lessons of the Visualization:

- The new technology of future battle requires new approaches to education to best employ it while recognizing its limitations. *For example, how might we evolve our education and training to include AI-supported planning and decision making, and how might we transform training to include human-machine teaming at every level?*
- Professional military education might use very different tools, forms, locales of the classroom. *How do we ensure all our people have access to the right learning, about the right topic at the right time and place?*
- Future military units might have different organizational forms and requirements, requiring new modes and skills of leadership. *How do we incentivise and develop the creative new ideas and organisations that might be required in the military of 2035, and what is the role of military learning institutions in this process?*
- Information provides potential, but the use of it determines actual capability. *How can software help decide what information is most critical and when we access it?*
- Lifelong learning provides an intellectual and cognitive operational edge during military service. *How do we use technology, and provide time, for more continuous learning for military personnel?*
- The future operating environment will be inherently complex, blend the virtual and physical, and be multi-domain – requiring learning new skills to master it. *How do we evolve our curriculum in military training and education institutions (and in personal learning) to keep up with these changes, and ensure their implications are included in military learning?*

