

## Military Strategy

# Agile Capability Delivery as an Aspect of National Power

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Here, I summarise major points in the Ukraine war and analyse how the war is being fought and what we might learn. The war has taught us to use a blend of civilian and military capacities as well as integrating and continuously evolving technologies: cyber, electronic warfare, space, manned and un-manned systems and smart weapons to keep our theory of winning ahead of that of the opposition. De-feating a peer adversary needs mobilisation across all our socio-economy and do so as a coalition with allies, academia and industry.

## Introduction

On 24 February 2022, one of the five permanent members (P5) of the United Nations Security Council with nuclear capability, a military superpower with US\$80-billion defence budget, and a country with a population of 140 million people, invaded its poorer neighbour of only 40 million people and a Defence budget of US\$5 billion. Most analysts and advisors coincidentally agreed with Russia's President Putin's assessment of the likely course of this one-sided confrontation that the invasion would have been over soon. Ukraine President Zelensky's now famous reply to United States (US) President Biden's offer of evacuation 'I need ammo, not a ride' is one for the ages (Kessler, 2022). Imagine the world today if Zelensky accepted the estimations of others and capitulated.

Many have agreed with a former National Security Advisor of the United Kingdom (UK) that 'Ukraine changes everything' (Ricketts, 2023). I am not necessarily among them—though had Putin succeeded, it might be true. Because there have, after all, been many possible 'changes of everything' across the globe in just the last two years. For example:

- the post-vaccine, tail-end of the COVID-19 pandemic did not reflect as well on Chinese competence as its onset (Goh & Zhang, 2022);
- global supply chains were tested and found wanting (Panwar et al., 2022);
- the US-led Western withdrawal from Afghanistan became a humiliating rout (Nevett, 2022);
- Chinese sensitivity over recognition of Taiwan resulted in four days of intense military exercises that removed any lingering doubt over intent (Chang & McCarthy, 2022);
- Peoples Republic of China (PRC) President Xi Jinping manoeuvred himself into an unprecedented third term (McDonnell & Guinto, 2023) and moved China further towards autocracy;

- Japan overturned its previously inviolable constitutional limits on defence expenditure (Johnson & Dominguez, 2022);
- almost lost in the background is the evidence of climate change continued to mount;
- and as already mentioned, Russia confounded all but Five-Eyes intelligence assessments and invaded Europe's second largest country with the stated aim of subjugating its people. Russia failed militarily to do so.

After all that, the recent invasion of US sovereign airspace by a Chinese balloon (Palumbo et al., 2023) looks trivial.

But if we review the security strategies, published by many allied countries in recent years, then none of these challenges was unexpected individually—except the collapse of the Afghanistan Government and the Chinese balloon incident—though such a coincidence of events was not imagined by many. We can, therefore, see what has actually been revealed and now calibrate those challenges or threats accordingly. Within that strategic backdrop, let me clarify some background issues before I move into a more detailed assessment of the lessons from the Ukraine war. I will go on to analyse that evidence for applicable lessons for air power, and then, finally, apply them to air power thinking with some suggestions.

## Background issues

The first issue is the relative ranking of Russia and China. Russia has definitively proved itself to be the acute military threat in North-Western Europe. But it has also revealed in its military's relatively poor performance and its failure to use energy supply as a strategic lever that Russia is not the superpower that many imagined. If the international sanctions regime is maintained as long as a defiant Putin is in power, then it is hard to see how Russia recuperates within a decade.

China can now be seen more clearly too. President Xi's lurch towards one-man rule looks threatening, and China is

a major competitor that the democracies never faced during the Cold War: a peer economy; an efficient administration; and a technological and military superpower. But it has also revealed that its economy is not immune to the laws of physics, its demographics do not look good, and there was no amount of authoritarianism that could defeat COVID 19: *Omicron*. So yes, China has proven to be much more of a competitor than Russia, but nowhere near as 'ten feet tall' as previously feared, and not unstoppably destined for hegemonic supremacy. In short, Russia and China inhabit very different parts of the competitor to threat spectrum, require different policy responses, but both can be handled at affordable cost if we are sensible.

The second issue is that climate change remains the challenge of the age. But Ukraine reveals what many had been saying: that Net Zero cannot be pursued to the exclusion of all other concerns. The challenge might be expressed as getting to carbon neutral as soon as practicable, but without being economically or geopolitically reckless. This will require investment in sustainable technologies - and that can help Defence.

And the third and final piece of the jigsaw is the continued move from an analogue to a digital age—the Fourth Industrial Revolution. These last two issues involving science and technology are, combined, the foremost arena in which the competition with China will be played out. There is ever a link between economic supremacy, military power and political power. As, ineluctably, military technology advances alongside industrial revolutions, then how we transform our militaries will have a bearing on whether we win the strategic competition. Pulling the right lessons from Ukraine is, therefore, vitally important.

### Evidence from Ukraine

There are two macro points to recognise in the Ukraine war, as they frame the analysis of how the war is being fought and what we might learn. The first is that for all its dreadful carnage, the war is being fought in a somewhat limited way. Ukraine can only conduct military operations in its own territory, the comprehensive deep battle is only being attempted by Russia, and partially. And second, this is the first significant conflict between two large, post-Soviet countries, with armaments essentially from the same arsenal, and a Land-centric way in war as befits continental powers. The difference between the two is, therefore, essentially the difference in the moral and conceptual components.

Beyond the purely military, there is much to reflect on when it comes to national resilience. But mastering the conceptual component has been the defining difference to date between the two militaries in this David and Goliath contest. Ukraine, knowing well the doctrines and mindset of Russia, has managed to anticipate, out manoeuvre, adapt and construct a 'theory of winning' that negated Russia's superiority in the physical component.

In the air, Ukraine has essentially adopted a disruptive strategy in two ways. First, it has used traditional means in novel ways to craft a defence that has essentially prevented the Russian air force from operating over Ukrainian

occupied territory. Realising Russia does not run effective Combined Air Operations of mutually supporting packages Ukraine has dispersed its surface-to-air missiles (SAM) and fighters to protect them and thence to run ambushes; effectively it challenges Russian crews to play Russian roulette on their singleton missions.

This has not been easy for Ukraine, given both the range of the more advanced Russian air-to-air missiles (AAM) launched from within Russian controlled airspace, and the density of its Ground Based Air Defences (GBAD). Nevertheless, in maintaining their defence the Ukrainian Air Force has successfully fought the larger and better equipped Russian air force to a stalemate. Neither side tries to operate over the others territory, nor does Russia appear largely to have given up on even trying to gain air superiority. This is a big win for Ukraine.

The adaptability of the Ukrainian defence has been seen most recently in the rapid integration of diverse systems to detect, track, and defeat the Russian missile campaign against critical national infrastructure. This has been a strategic campaign in that Russian success could have had a material bearing on Ukraine's ability to prosecute the war. In successfully downing up to 80% of incoming missiles, Ukraine has neutered Russia's strategy.

The second branch off Ukraine's air strategy is to seek a form of poor man's air superiority through imaginative use of drones. Drone units have been used systemically as a key part in the intelligence battle and the kill chain, effectively negating Russia's conventional advantage in offensive platforms. Allied to that, is the vital importance of Electronic Warfare (EW). Ever a secretive area, this has been vital ground in the drone campaign, built on a bedrock of electronic intelligence (ELINT) and an understanding of how the electro-magnetic spectrum is being used. Undoubtedly Ukraine has been helped by discreet Western advice, but it has shown real savvy in becoming an intelligent customer here and is far from a passive recipient. And what has been revealed to us is that our assessment of Russian EW capability was at the pessimistic end of the range. Russian EW is eminently beatable.

In this highly contested environment drone life is understandably short. Again, rapid adaptability, not least in the design of replacement systems, is the winning military virtue. We have long discussed making best use of militarised civilian technology, especially in the space and cyber domains. But Ukraine has actually done it, and quickly. Appointing a 32-year-old tech-entrepreneur as Minister for Digital Transformation across all departments, including the Ministry of Defence (MOD), has paid great dividends. The resourcefulness of the Ukrainian farmer has been allied to the flair of the tech entrepreneur and sponsored by a government with little to lose and a nation behind it. This is a powerful combination.

One of the least heralded aspects of this war has been in the cyber contest. Never as tele-visually or emotionally compelling as scenes from the battlefield, it has gone under-reported and so has been dismissed by some who claim conventional kinetic power is the only hard power. The reality is that this has been a keenly fought and vital contest,

where civilian capacities and allies have played a significant part in defending Ukraine's state. The new capabilities of the information age are redefining how hard power is orchestrated and focussed. And those belittling information ops in general, while marvelling at clever Ukrainian use of social media, need only to take a good look at themselves.

Grey Zone warfare is real, and its arenas get more intense as the fighting gets more kinetic, they do not get supplanted. President Zelensky has listed the importance of international partners: (in order of priority) the US Government; Microsoft and Amazon Web Services (AWS); and the UK Government. Ukraine is redefining both networked kill-chain warfare and pragmatic adaptability by rapidly combining terrestrial capabilities with satellite communications, such as Elon Musk's Starlink with commercially-sourced and adapted drones as well as space-derived geo-intelligence with open source intelligence data. And most importantly, the drones' Command and Control (C2) as well as data-crunching software are all dispensed via the cloud to everyday laptops.

In a lesson not new to airmen, precision strike at range has proved a crucial advantage to Ukraine such as the use of High Mobility Artillery Rocket Systems (HIMARS) Global Positioning Systems (GPS)-guided missiles. The shift in importance from the close battle to the deep battle has been reinforced. But this is no huge technological leap —Gulf War One demonstrated in 1991 how precision-attack at range could decimate a land force to the point it became combat-incapable. What is being illustrated in Ukraine is that land forces are extending their horizons and their effective range.

There are also some lessons that should not need stating but experience tells us that they do. Weapons stockpiles matter. And not just stockpiles but the ability to quickly ramp up industrial capacity to replace them, and all manner of war-fighting materiel and personnel. The benefits of logistic simplicity and standardisation are being rehearsed. This is as true for coalitions as individual nations. Add Ukraine to the long list of wars where governments faced a 'shell crisis'.<sup>1</sup> Well mobilised, resilient nations win wars. Our forces, including our air forces, must think on how we expand our professional peacetime corps rapidly in wartime.

To end this section on the immediate lessons, a thought on acknowledging what we have not seen, and where false lessons may be drawn. I have already heard one well known commentator in a London salon declare that Ukraine demonstrates that air power would quickly be negated by GBAD and is in any case not required. Air forces must not be cowed into not commenting on what could become a subject reserved for Land Warfare specialists drawing skewed deductions from necessarily limited lessons.

In the next section, I will look at that wider analysis of what air power might be as I put us in the place of Ukraine fighting a peer competitor.

### Air power thinking

My first observation is on 'dispersal to survive and operate'. If the enemy has long range precision missiles then how survivable is a large and fixed Combined Air Operations Centre (CAOC) campus? Or conventional airfields, even with hardened aircraft shelters? Might the practice of those new members of the North Atlantic Treaty Organization (NATO), ie Sweden and Finland, have something to tell us? Long driven by the need to fight off Russia alone, they have both developed national plans for effective dispersal—to highway strips for example. But they also deliberately design equipment with maintenance requirements that can be met by a few regulars at the head of small teams of trained reservists. Resilience is designed in.

I am aware that the US Marine Corps is looking at dispersed operations for its F-35 fighter aircraft force, and the US Air Force looked at how to shrink a functioning CAOC into the back of a C-17.<sup>2</sup> Both these programmes look prescient now. Allied to these efforts is the need to look at how we manage signatures in an age where persistent surveillance is making hiding anywhere on the globe increasingly difficult. Low signature, dispersed units are going to want low emissions and low power consumption, and so will incidentally benefit from a leaner logistic tail. Advances in sustainable technology help us here. Nor should we see that battle of hiding and finding in purely passive terms of dispersal and camouflage. Integrating cyber and electronic warfare, perhaps algorithmic warfare, to actively and passively disrupt enemy target acquisition will become the bedrock activity of survive to operate in the air domain.

Turning to drones, an area where our high-tech air forces have been at the forefront. But those early generation unmanned systems were developed for low-intensity, counter-insurgency (COIN) campaigns. We did not lose many and so didn't notice their cost, or really notice if some of that expense was because we designed and procured uninhabited aircraft as we built inhabited ones. For example, the UK's *Watchkeeper* programme has grown over the 17 years of its life to cost £1.2 billion, while providing only about 40 relatively unsophisticated, low and slow Intelligence, Surveillance and Reconnaissance (ISR) platforms (British Army, 2020). And we have no production line to pump out replacements.

Ukraine has demonstrated what we knew all along but ignored that in a contested air space, drones might not last longer than several days. But would that matter if they are not that expensive and could easily be replaced? There are, for example, companies in the UK who can turn out drones

1 In 1915, a shortage of artillery shells on the front lines of the First World War led to a political crisis in the United Kingdom.

2 The C-17 Globemaster is a transport aircraft able to airlift cargo close to the battle area.

with approximately similar capabilities to the *Watchkeeper* at a micro-fraction of the cost. *Watchkeeper*'s cost of £1.2 billion could provide many thousand low-cost alternative drones, not just 40. More importantly, such small companies are adaptable who can rapidly learn from combat experience and use Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) to additively manufacture replacement prototypes in days. Some of these are now in Ukraine.

In short, it is possible to imagine a world where we do not go through extensive requirement setting and *program-matics*. Instead we invest in an evolving drone farm, a collaboration across industry, that sees drones as relatively expendable systems sitting somewhere between manned aircraft and smart weapons. Bought in batches and rapidly updated in the light of operational experience, where the battlefield does the expensive test and evaluation (T&E). Such an adaptive method is not just for drones, but I shall return to this in the succeeding section.

From drones, one steps immediately to electronic warfare. Vital as an enabler not just for remotely controlled systems, but for almost all aerospace capabilities. The evidence from the Ukraine war is that NATO need not fear Russian electronic warfare as long as it takes it seriously—and that means a regain after years spent prioritising COIN. This has implications when we look to China, which has a capacity grown originally from Russian roots.

And that analysis also validates the move to low-observable (LO) aircraft such as the F-35 Fighter aircraft. In the contested SAM environment around the Donbas (a region in eastern Ukraine) it would be stealth aircraft that we would have to look to in the first instance to operate there and gain air superiority. Appropriately supported by EW and suppression of enemy air defences (SEAD) assets, that looks like an achievable mission.

Indeed one extended lesson from Ukraine is that NATO air power looks more than capable of overmatching Russia's air defences. Now imagine that LO and EW mix augmented by a suite of relatively expendable drones and smart weapons, some optimised for SEAD, some being Australia's Loyal Wingman (Royal Australian Air Force, n.d.), and the development path to maintain that superiority looks clear.

Having looked at the survive-to-fight side of the ledger, there are just as many important lessons on how to aggressively win that fight. How do we find the enemy first and finish him at range? The first function to look at is Find, which is to take the explosion in data availability, from careless social-media to commercial satellite, and harness it. Previously that would have swamped analysts, and so we 'Directed' our intelligence gathering and processing.

Now, we can train artificial intelligence (AI) algorithms to process huge amounts of data. And that may provide surprising, counter-intuitive conclusions. So the relationship between data, information, intelligence, and decision-making is changing fast. And that has significant implications into how we educate and train future commanders. Charismatic and instinctive leadership has their moments, but when measured, informed and risk calculating leadership is likely to win out.

Our leaders need the best data available. Our own, high-end, Five-Eyes intelligence has proved its worth time and again, but it should be directed to where we cannot find the information more cheaply via commercial means. So air forces should not stick to managing only that which they organically control, but become brokers of aerospace power across the coalition's civil-military spectrum. That does mean our working out in peacetime what those war-time dependencies might mean, as Elon Musk is now illustrating in Ukraine (Skove, 2023). But if the National Aeronautics and Space Administration (NASA) is now building its strategies around commercial providers operating where previously only superpowers could, then perhaps Defence ought to be thinking the same way.

This also calls into question how we operate and defend our assets in space. I fear that is a whole new topic in itself, but it should be an area where the broader experience of the democratic powers tells; working together to manage risk and promote deterrence. Nevertheless, we still need to make deliberate efforts to deal with the threats now materialising in the space domain.

And when we have cross-referenced myriad data sources to find and fix the enemy's order of battle, then how do we finish it? HIMARS in Ukraine has provided one answer, but a GPS guided missile still has some limitations: the target needs to be fixed to a grid reference, and range is still limited. But let us accept that land forces can now strike land targets in what was previously the deep battle.

Wars, however, are won in the deep and air forces retain great utility here, especially in complicated targeting. So we are going to need more range. And, therefore, perhaps we are returning to the specialist bomber from a brief sojourn into the multi-role fighter-bomber era. Which was largely a product of NATO's assumed twenty day war in north-west Europe, one where air-land battle doctrine predominated. Ukraine is reminding us every day that what was previously considered the deep battle is becoming ever more decisive. And the geography of this part of the world is not that of north-west Europe.

To conclude this second section, let us take a step back. One only has to posit the technical question of how NATO would intervene at an operational level to see how quickly Russia's operation in Ukraine would be rolled-up. And NATO would not lead with battle tanks (eg Leopard 2s), it would launch a significant EW and SEAD campaign, generate air superiority, and then target the deep enablers of Russia's national fighting power. Perhaps this is behind President Zelensky's call for F-16 Fighter aircraft. Not a literal plea for a single aircraft type, but a demand that reminds us in the West that we are asking Ukraine to fight in a way which we would not, and to take casualties we would not. This is what we as airman should be stating every time we here a confident statement that Ukraine proves we simply need more tanks and artillery.

In my third and final section, I will suggest some other things that airmen might be thinking and saying.

## What do we do?

Going back to the theme: Ready to Launch: Boosting Capability Delivery, I am now going to make the leap and state that we should be premised not on capabilities to deliver our standing operational commitments, or air support to the limited operations of recent years, but on our ability to launch into a war against a peer that requires a level of national mobilisation as seen in Ukraine. And as we ourselves have done before; the Royal Australian Air Force (RAAF) and my own Service (Royal Air Force) being products of the great allied air expansion and development from 1939 to 45, when the allied air forces had approximately 3.8 million personnel under command.

Staying with that historical theme for a moment, it might be of value to just remind ourselves of air power successes before recent wars cemented our concepts of air power employment under an omniscient CAOC that has run all our successful air campaigns since 1991. For example:

- The Western Desert Air Force fighting Field Marshal Erwin Rommel to a standstill almost unaided in 1942 (Gilbert, 2022)
- The Israeli use of air power in 1967 (Jones, 1996)
- And in 1982 air power was key to the Falklands War (Shields, 2021)

In 1999, a US Air Force (USAF) commander in Kosovo complained that ‘we were not allowed to use the air campaign we had been taught at Maxwell<sup>3</sup> (Tirpak, 1999).’ Well, sometimes you might not be able to. My point here is not to criticise the current modalities of air power practice—our CAOCs are mightily impressive facilities that have served us well. But it is to remind us that if air power is anything, it is a beautifully elegant idea to use a fleeting power in the third dimension and intelligently applied to work around our enemies.

So the idea must be continually refreshed to keep it intelligent, unpredictable and able to catch our enemies off balance. If it becomes ossified into unyielding structures and processes then it loses the advantages of speed, surprise and flexibility, yet cannot replace those with the irresistible inertia of mass. If what I have just said is true, then the Conceptual Component is the key to air power. And in the introduction, I suggested that Ukraine’s mastery of the Conceptual Component was its major advantage over Russia. Ukraine provides a case where we have had to confront how to fight when you cannot roll out the campaign plan taught at Maxwell. If NATO were directly involved in Ukraine, then it turns out that it probably could do that. But the point remains, and there are other peers in this neigh-

bourhood who could provide a challenge that would remind us that the enemy always gets a vote.

Have we educated and trained a generation of commanders to think around such problems and devise and execute novel air power solutions? Could decades of rolling out the Maxwell Plan successfully have to some extent ossified our capacity to innovate and adapt in Air C2? Are our airmen as dominant in debates on Multi-domain C2 as they should be, given the scale, reach and inherent jointery of air operations?

When did we last exercise and experiment in dispersed operations en masse? Using forces spread wide geographically yet able to concentrate mass of effect at a nominated point when required. And if we did then could we accommodate trained reserves to build the necessary capacity? Are our maintenance schedules designed around reservists?

Have we got plans for the necessary wartime expansion? For example, do we have the Finns? Have we exercised with commercial providers to rapidly integrate and adapt a blend of civil–military capacities in Space, ISR, Cyber and EW? We know we always innovate rapidly in wartime, are we going to do this in an ad hoc way with industry next time? Or are we going to establish the relationships, culture and risk appetite in peacetime and across the air coalition? Finally, when was the last time we planned a genuinely strategic campaign, as opposed to a dominant air–land operation? Could we identify a theory of winning at the strategic level?

Many of the areas that Ukraine has shown to be vital are ethereal in nature, things that come through Nikola Tesla’s ether,<sup>4</sup> such as missiles of various hues, hypersonics, directed-energy, drones, electronic warfare, cyber and network connectivity and space-based capabilities. These are all long-standing features of the air domain necessary for fighting in the deep and at range. Air forces should be staking a claim in this ever more important corner of the battlespace. Which brings me to the physical component, where the attribute required increasingly appears to be the ability to operate at range. I consider there is much wisdom in the USAF’s introduction of the B-21 Raider,<sup>5</sup> and sense other air forces are going to look at such platforms, or similar ways of deploying air effects at extended range. In the Indo-Pacific, credibly delivering combat effect from beyond the *First Island Chain*<sup>6</sup> will be a bedrock of deterrence.

There is a concomitant to the conceptual point on adaptability made earlier and exemplified by the idea of a civil–military drone farm. This needs in depth collaboration with industry and should be developed and exercised in peacetime across the air domain such that it can scale when war comes.

<sup>3</sup> Referring to the Maxwell-Gunter Air Force Base, which is the Air Education and Training Command of the USAF.

<sup>4</sup> Nikola Tesla (1856-1943) was an inventor who pioneered wireless communications and theorised that energy can be transmitted wirelessly using the capacity of ether to hold and transfer energy.

<sup>5</sup> The B-21 Raider is a strategic bomber developed by Northrop Grumman.

<sup>6</sup> Referring to the Pacific archipelago ranging from the north of Japan to the South China Sea.

Similar points can be made about space capacities. And I note a Netherlands/New Zealand company, with US backing, that is developing a very promising, cheap space launch capacity in the South Island of New Zealand, that will shortly move to Woomera (Australia) for phase two testing (Dawn Aerospace, 2022). Allied to rapid cube-sat development, such capacities could provide real resilience and adaptability in space. And space capabilities launched in the UK can be useful over the Indo-Pacific a few hours later.

So our husbandry of the physical component needs to move from a model of long-term programmatics that buy a limited number of expensive organic platforms, to one of integrated industrial cooperation to rapidly evolve a range of aerospace, EW and cyber capabilities as the lessons of the war dictate. And a model that is able to scale the necessary production across the alliance or coalition to meet wartime consumption rates.

The Australia-UK-US (AUKUS) trilateral security pact is centred on submarines but explicitly includes many technologies with uses well beyond the maritime domain; AI, space, cyber, etc (The White House, 2023). There is the UK-Australia Space Bridge initiative (Australian Space Agency, 2021). Could not the air forces use these vehicles to make sure such useful military/industry/academia collaboration that extends across all of our domains?

For if we are to win that technological arms race with China, then air forces should be at the forefront of national scientific and technological discovery, being curious and restless just as they were in the Aerospace era that dominated after 1945. Surely there is an opportunity to expand on the excellent liaison already underway between the Air and Space Warfare Centres.

Finally the moral component. I have always seen in the air domain that this is an extension of the conceptual component. Our people see air power as a vocation, and have confidence in leaders who can paint a compelling theory of winning in the air domain. But the moral component has a large national dimension to it. And all our forces, and their noisy bases, have tended to shrink back into the lesser populated parts of what might be called the Outback. Consequently, and allied to a tendency to concentrate on our own, organic systems, our air forces can become a bit insular. The opportunities laid out above in evolving the conceptual, and restructuring the physical to deliver those concepts, should also allow us not just to connect better with society, but to engage productively across our socio-economies.

I have always brought into the counter-intuitive idea that if you educate and train your people to be effective in the outside world they will stay in. It is when you lock them away that they try and escape. So the ideas put forward here that would see our people regularly based out in industry, in academia, with allies, would prove to be retention positive.

## Conclusion

Reviewing all the foregoing, I see that I have said little that might not be better summed up in Col John Boyd's great aphorism: 'People, ideas, machines; and in that order!' (Boyd, 1991) I will conclude by expanding on Boyd to frame my key points. If we are to expand in wartime to defeat a peer adversary we will need to mobilise across all our socio-economy, and do so as a coalition, and we cannot do that from scratch when the hooter sounds.

Working with allies, academia and industry our well educated **people**, regulars and reserves seamlessly, will work on a range of concepts and experiments to keep air power **ideas** refreshed and vital for the emerging age. That age will see low footprint forces continually dispersed throughout the battle space. Using a blend of civilian and military capacities and **machines** they will integrate and continuously evolve a range of cyber, EW, space, manned and unmanned systems and smart weapons to keep our theory of winning ahead of that of the opposition. This force will deliver effect at ever greater ranges, and do so from a global, not a theatre, laydown.

My very final point is not about Ukraine or Russia. It is about this neighbourhood and deterrence. It is in all our interests to maintain a productive relationship with China despite the current tensions (ie Taiwan). China will have watched Ukraine, and it will have been unpleasantly surprised by western unity and resolve. But it will look at the West's arsenal and will calculate our capacity to sustain a significant peer conflict.

My over-riding aim in thinking has not been to think in abstract terms about modern air combat as some technological sport for air forces. It has been to think on why Russia thought it could get away with invading one of our European neighbours. We need to be able to credibly deter in the future, and so maintain the peace at acceptable cost. To do that we must show that we are, indeed, Ready to Launch.

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