CHIEF OF AIR FORCE

SYMPOSIUM 2023

AIR AND SPACE POWER CENTRE

Air Commodore Michael Durant, Master of Ceremonies

Distinguished guests, ladies and gentlemen, good morning and a very warm welcome to the 2023 Chief of Air Force Symposium. I am Air Commodore Mick Durant, Director General Strategic Planning Air Force, and I will be your Master of Ceremonies for today. We are delighted to welcome you here to the Melbourne Convention and Exhibition Centre, and to see so many new and familiar faces here and present. I would also like to say welcome to all of those who are out there online. You are many.

We are also looking forward to a week showcasing air and space power at the Avalon International Air Show. As is the custom in Australia I would like to acknowledge that traditional custodians on the land on which we meet, the Wurundjeri and Boonrwrung peoples of the Eastern Kulin Nation, and I pay my respects to the Elders past, present and emerging.

The theme of the symposium is Ready to Launch: Boosting Capability Delivery. This recognises that the accelerated rate of change in the strategic environment, requires us, as an air and space power community, to rapidly assess and deliver material solutions. To meet capability needs, both now and in the short term. Boosting our capability is essential, if we are to effectively engage across the spectrum of competition from cooperation to conflict. We have a rich day ahead of us, over the course of the Chief of Air Force Symposium, you will hear from experts from Australia, our region, and from around the world, from military, industry and academia.

As we explore the capability and resilience in the realm of air and space power. Air Marshal Chipman, Chief of Air Force will set the scene expanding on the symposium theme Ready to Launch: Boosting Capability Delivery. We are delighted to advise that the Honourable Richard Marles, MP, Deputy Prime Minister and Minister for Defence, will be joining us this morning to deliver the opening address and to open the symposium. Our keynote address will be delivered by Air Marshal Retired, Edward Stringer, Air Marshal Stringer will provide his perspective on adapting our thinking on forced development to deliver the capability we need. This will be informed by his observations of the Ukraine. We have three panel discussions today. Comprising experts from defence, academia and industry to explore first at how to boost capability development and delivery. Followed by discussion on boosting sovereign sustainable aviation fuel capacity. And finally our final panel will then explore what the competitive edge in the space innovation looks like.

But first, we need to cover off on some housekeeping points. This slide details the emergency arrangements for the Melbourne Convention and Exhibition Centre. The centre has a two tone alarm system, if there is an issue the first tone will sound, there is no need to react to this tone, the convention staff will investigate and they'll let us know what it means over the loud speaker. A second tone however, will sound if an evacuation is required. In this case please follow the directions of the conference staff to the emergency exits and proceed to assembly points.

Today we will be using the EventsAir app to support your attendance at the conference, this is where you'll find details on the program, the presenters and any timing changes that we may need to introduce. If you haven't already done so, please ensure you download the app. The instructions are on the slide, I'll just give you a moment to absorb those if you need to. If you need any help with the app, please see our friendly conference staff and they will be pleased to assist you.

The app is the preferred means for you to ask questions during the symposium. As per the slide, just click on the relevant session to locate the Q&A area, and submit your question. We will also have microphones available if you would prefer to use that method. I should also highlight though today, Q&A will only be conducted during the three panel sessions.

And finally, ladies and gentlemen, please turn off your mobile phones or put them to silent.

It is my privilege now, to welcome Air Marshal Robert Chipman, Chief of Air Force, to deliver his opening address.

Sir, I invite you to address the symposium.

Chief of the Royal Australian Air Force, Air Marshal Robert Chipman

I acknowledge the Traditional Custodians of Narrm, the Wurundjeri and Bunurong peoples of the eastern Kulin nation. We pay our respects to their Elders past, present, and emerging; and to Elders of all First Nations communities that join us today. I extend that respect to Aunty Deb, our Air Force Elder, Aboriginal and Torres Strait Islander peoples who serve with pride and distinction in the Australian Defence Force.

I am very pleased to welcome many of our friends from around the world for this symposium, it's been four years since we have been able to gather for the Australian International Airshow, and it is wonderful to be reunited.

I especially acknowledge the attendance of:
The Honourable Richard Marles MP, Deputy Prime Minister and Minister for Defence.
The Air and Space Chiefs from, Bahrain, Belgium, Brunei, Cambodia, Canada, Germany, Iraq, Ireland, Japan, Jordan, Malaysia, Mongolia, New Zealand, Norway, Pakistan, Papua New Guinea, Philippines, Portugal, Republic of Korea, Singapore, Sri Lanka, Sweden, Timor Leste, United Kingdom. The United States is represented by senior leaders from all five Services, and the OSD. Delegations representing Air and Space Chiefs from: France, India, Indonesia, Italy, Spain, Thailand, Turkey, United Arab Emirates, and Vietnam. As well as NATO and the UN.

Senior Enlisted leaders from Canada, New Zealand, United Kingdom and the United States joining our Warrant Officer – Air Force Ralph Clifton.

Chief of Army, LTGEN Simon Stuart and Commander Fleet Air Arm, Commodore David Frost. Industry, Academia, and Government leaders, and the many aviation leaders in the audience and online, joining us today. Welcome.

We understand in Australia that our security in prosperity will be delivered in partnership with our friends, our allies and partners. Those partnerships rely on shared understanding, mutual interest and trust, buttressed by strong people-to-people links. I thank you all for your efforts to join with us here today. You strengthen our collective security simply by being here to share your insights and perspectives, and deepen our friendships around the globe.

To bring our collective focus to where we are meeting, here in the Indo-Pacific, I'd like to start today with a brief historical account from the Guadalcanal campaign in WW2. With only three weeks' notice, Admiral Nimitz knew that he would not have at his disposal the resources needed to prosecute all of his objectives. Nimitz's mantra to his theatre commanders was to "do the best we can with what we have". This mantra was repeated on a number of occasions in the immediate aftermath of Pearl Harbour.

Nimitz faced precarious times and until America's industrial capacity mobilised to deliver the carriers; capital and support ships and combat aircraft that he needed to enable the central Pacific strategy, many of the earlier battles; including the battle of the Coral Sea just off Australia's coast were fairly close run things. Balancing political and strategic objectives to provide the American public with a decisive victory, these battles demanded Nimitz and his commanders take calculated risk; when to engage to seize the initiative and when to disengage to preserve their forces. Of course, when the might of America's industrial capacity did kick in, Nimitz enjoyed overwhelming numerical superiority.

Underpinning Nimitz calculations was a deep appreciation for the strategic geography of the Indo-Pacific Region. The Indo-Pacific is both a dynamic and a physically vast and diverse region and is an arena of increased competition among powers, great and growing. I subscribe to the view that strategic geography will always shape our approach to Defence and National Security. Like Nimitz, we must contend with the vastness of the Indo-Pacific and back-in combat power with force projection infrastructure, communications and logistics.

I think it is safe to say that we have caught up with our future. Technology has advanced so rapidly that many of the future concepts we aspired to are now within our reach. Our strategic warning time has shrunk, evidenced by the indicators and warnings that might have cued us to prepare for crisis or conflict in our region, are now behind us. What was once our future, is now upon us. We are no longer delivering a force structure that can be strengthened over a 10-year period to deter conflict, we need a force structure that will deter conflict today.

This presents significant challenges for middle powers, like Australia, to protect and advance our Defence and Security interests. Or more to the point, it's an impossible challenge were we to take it on alone! Forging trusted and purposeful partnerships based on shared values and interests is absolutely at the core of peace and stability of the Indo-pacific region. In my mind, there is no better exemplar than last year's Exercise Pitch Black. Over 100 aircraft and 2500 personnel, from 17 nations gathered to take part in this Exercise. This was a powerful demonstration of how allies, partners and friends can integrate and work together in the interests of collective peace and stability. And it came at a time when Europe was once again plunged into crisis.

It is important we learn from the Ukraine war, and understand how the lessons might apply to the Indo-Pacific region. Putin has experienced something in Ukraine that military theorists have long known: War is the realm of chance. Nations who pursue their interest through aggression forfeit control to chance.

It is obvious, despite technical and numerical superiority, that Russia has failed to achieve air control over Ukraine and that air power has been poorly integrated with their scheme of manoeuvre. We recognise part of the story, through its absence, is the importance of air control; something we have taken for granted in our recent combat experience.

Ukraine has made excellent use of highly mobile ground-based air defence to deny Russia use of their airspace. There is much to learn from Ukraine's tactics: agility, layered defence and deception, as we consider how we might manoeuvre to project air power across our northern infrastructure. We have seen the value of interdiction and joint fires, though conversely, how quickly precision stores are consumed in high intensity conflict. And how challenging they are to replenish. Magazine depth is an essential consideration to force readiness.

And we have seen intelligence, surveillance reconnaissance and targeting systems play a critical role in exploiting battlefield opportunities. Ukraine appears to enjoy a home ground advantage; with sufficient resilience to maintain situational awareness, even fleetingly, and capacity to deny their enemy's ISR and targeting effort.

We have seen a proliferation of low cost drones and loitering munitions delivering ISR and fires to great effect. They don't replace the roles of contemporary combat aircraft, but they might serve as a useful complement. Drones certainly present a challenging threat to our forces on the ground. We are considering the potential of low cost drones that bring mass to our air combat system and we are considering what new measures are necessary to defend against them.
The war in Ukraine has also demonstrated the roles of the space and cyber domains in modern conflict. Use of civilian capabilities in conflict is not new, but the resourcefulness to use commercial companies, such as Starlink, to provide situational awareness sets a new precedent. Cyber-attacks, including through Visat, show the multi-domain threats that must be countered to compete on the battlefield. And information operations have clearly been a priority for both nations.

It remains unclear whether Russia's experience in Ukraine is the result of short-comings in equipment, readiness or doctrine. Ukraine has been masterful in mobilising their national resources, international allies and partners, and industry, which has surely contributed to Russia's strategic miscalculation. Certainly the extraordinary courage and audacity of Ukraine's people has played a role. An important lesson in its own right. Ukraine has demonstrated that war is not just the realm of chance, but also the realm of innovation and initiative.

To frame our upcoming panel discussions; we might consider how Nimitz might have Boosted Combat Capability in the context of the Ukraine War. We are no longer in a position where major capital ships and sophisticated aircraft like the F35 can be wheeled off the production lines at the same rate as Corsairs or Wildcats in WWII. The modern day version of the Nimitz mantra to do the best we can with what we have may be to inject and integrate low cost, high volume capabilities to augment and force multiply existing force structures - this would include capabilities designed to deliver kinetic; disruptive and deception effects on mass as well as those designed to increase the survivability of key nodes and critical infrastructure.

We might apply a similar logic to our operational design. To manoeuvre as a force across our infrastructure delivering air power when and where it's needed. To manoeuvre for asymmetric advantage, this is how a small to medium size Air Force might generate lethal and survivable combat power – both in competition and in conflict!

When I came into this role as Chief of Air Force, I made clear my priorities to be ready, resilient and resourceful; I will explain what I mean by these terms and how they are relevant in our discussions today. Readiness requires us to focus on delivering capability today while simultaneously investing in our capability for the future force – one cannot be at the expense of the other - we must manage strategic risk over time.

Readiness demands tactical excellence in high-end warfighting, integrated with the joint force, across Government and with our allies and partners in pursuit of our national interests. And it means having the capacity to sustain a high intensity campaign, as we see today in Ukraine.
Ensuring resilience requires a deep understanding of our vulnerabilities and preparing to operate with degraded systems in contested environments.
Fundamental to the Royal Australian Air Force's resilience is protecting our Air Bases and critical supply lines, and where necessary generating alternate pathways to sustain air and space power that are less vulnerable to disruption.

The Royal Australian Air Force licenses all aviators to be innovative and resourceful in delivering air and space power. In some cases, we will pursue options that expedite planned upgrades to our capability or exploit alternate innovative technical solutions. At other times, our resourcefulness will require interim, risk-informed operational and tactical workarounds. The common imperative is to boost our current capabilities and rapidly introduce emerging technology for best advantage. To do the best we can with what we have.

The theme for today's Symposium, Boosting Capability Delivery, has been chosen because we recognise that while significant advances have been made in the acquisition and sustainment of military capabilities, the rate of change in both our strategic environment and technology requires us to rapidly assess and deliver emerging capabilities in order to gain meaningful advantage.

I have no doubt our discussions today will enrich our collective understanding of both the challenges and opportunities we face as a community of likeminded actors striving to enhance the security and sustainability of our world. Today, we will explore the evolving strategic and operational context in which we all operate; challenges and opportunities in enhancing capability delivery processes; the potential for Sustainable Aviation Fuel to enhance supply chain resilience and mitigate our impact on the environment; and the collective challenge of delivering and sustaining Space Capabilities, where the importance of effective partnerships across multiple sectors is so vital.

It is easy to become seduced by technology; to do so would be to forget that national security is a human endeavour. The impediments to boosting capability delivery are often policy related, procedural or cultural. While advanced platforms teamed with cutting edge and disruptive technologies can be game-changers, we won't realise their advantage without evolving our thinking.

As Air and Space power professionals from around the world, we must identify, unlock and leverage these opportunities. 5th Generation technologies alone will not be enough. We must enable these technologies through a creative, innovative and collaborative mindset within a Joint and Integrated framework, that encompasses Defence industry, academia and of course, our allies and partners.

So in closing I would challenge you to place a contemporary frame around the Nimitz mantra of doing the best we can with what we have. This mantra places technical and organisational challenges before us, to ensure we generate ready, resilient and resourceful air and space power, but it also presents a world of opportunity.

I am very grateful for the time and effort all of our panellists have committed to be with us here today to share their perspectives – it promises to be a valuable discussion.

It is also my pleasure now to welcome The Honourable Richard Marles, Deputy Prime Minister and invite him to the stage to officially open the symposium.

Deputy Prime Minister, Minister for Defence, The Hon. Richard Marles, MP
Chief of Air Force Symposium 2023 - Minister's Address

Well, Thank you. Can I start by acknowledging the Wurundjeri people of the Kulin Nation, the Traditional Owners on the land of which we meet today. And can I also acknowledge the people on which the land on which the airshow is held at Avalon.

Can I acknowledge Rob Chipman, Chief of the Royal Australian Air Force, Can I also acknowledge Lieutenant General Simon Stuart, the Chief of the Australian Army; to my predecessor and mentor Kim Beazley. Can I acknowledge the 22 Chiefs of Air Services who are here today, along with the 56 international delegations which are joining us, welcome, welcome to Australia, welcome to Melbourne; and welcome, as we are in the lead up to the Avalon airshow. Which of the three big defence exhibitions that are held in Australia, this is the oldest and it's the largest. And let me also acknowledge Justin Giddings, the Chief Executive Officer of the AMDA Foundation that holds the air show. The air show is not only the oldest and the biggest, it is obviously the best of the three exhibitions, because everyone knows that Air Forces are the coolest part of any military. And since we last met, of course, Top Gun Maverick has graced cinemas around the world. This important documentary bears out exactly this point.

In a months time, the Royal Australian Air Force will be celebrating it's 102nd birthday. The Royal Air Force of the United Kingdom will be celebrating it's 105th birthday, I think the Finnish Air Force is of a similar age. And next year, we will be commemorating the 110th anniversary of the beginning of World War I, the first war in which air power played a significant role. And so, it is fair to say that there is a maturity in Air Forces around the world, with the advent of Cyber Forces and Space Forces, Air Forces are no longer the new kid on the block. With more than a century of learning around tactics and procedures. In a service which is as a dependent upon and impacted by technology as any, all of this puts into sharp relief the significance of a gathering such as today where we can share that experience and share that knowledge. But today's symposium is also occurring at a moment in time where the global rules based order is under as much pressure and stress as it has been, really, at any point at the end of the Second World War.

We see that in Eastern Europe with the war in Ukraine but we're seeing it here in the Indo-Pacific as well. Where we are watching one of the biggest military buildups that has occurred anywhere in the world since the end of the Second World War. And this military buildup has not been done in a transparent way, it is opaque and unclear.

And it brings to bear the importance of the role that air power can play in contributing to the potency of defence forces, in order to provide balance, which can underpin stability and continue to provide for peace in the world. From an Australian perspective, we understand that the defence of Australia doesn't mean much unless we can make a contribution to the collective security of our region and make a contribution to underpinning the global rules based order around the world. And that is very much our focus. But as we look to develop our own defence force, the air power and the development of that will play a critical component in the buildup of our defence force. We do so from the perspective of wanting to ensure that there is transparency around what we're doing. That there is an understanding amongst our neighbours and the other nations of the world, as to why we are engaging in an increase in our defence spending, a buildup of our defence forces and exactly how that will occur.

Which again, is why today's symposium is so important. Because this symposium, amongst all that will be occurring to in the day, is fundamentally an act of transparency, it's an act of confidence building. As all of us share our experience, and our knowledge and our plans for the future. And that is very much the spirit which underpins the event today.

As we look forward to the air show later in the week, this is a moment in my professional life, where in a sense my worlds collide because when you all come down to Avalon later in the week, you will be in my constituency and my electorate. And I was at Avalon on Saturday, I drove past it this morning, it is looking fantastic. All the aircraft are there. The weather forecast looks good, which has not always been the case for air shows in the past. So, we can gather today with a sense of excitement about what the air show will have to offer later in the week and we really look forward to that.

And with that, can I really wish you all the best for a productive day ahead with the symposium.

And with that, declare the symposium open.

Thank you.

Air Marshal Edward Stringer, Royal Air Force, Retired

One year and three days ago today a P5, nuclear armed, military superpower, with a population of 140Mn people and an 80 Billion dollar defence budget, invaded its poorer neighbour of only 40Mn people and a defence budget of 5 Billion dollars.

Most analysts and advisors coincidentally agreed with Putin's assessment of the likely course of this one-sided confrontation - one year ago today it would have been over. President Zelensky's now famous reply to Biden's offer of evacuation "I need ammo, not a ride" is one for the ages. Imagine the world today if he had accepted the estimations of others and capitulated.

Many have agreed with a former UK National Security Advisor that Ukraine changes everything. 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 in just the last two years.

The post-vaccine, tail-end of the pandemic did not reflect as well on Chinese competence as its onset. Global supply chains were tested and found wanting. The US-led Western withdrawal from Afghanistan became a humiliating rout. As already mentioned, Russia confounded all but 5-Eyes intelligence assessments and invaded Europe's second largest country with the stated aim of subjugating its people - it then failed militarily to do so. Chinese sensitivity over recognition of Taiwan resulted in four days of intense military exercises that removed any lingering doubt over intent. Xi Jinping manoeuvred himself into an unprecedented third term and moved China further towards autocracy. Japan overturned its previously inviolable constitutional limits on defence expenditure. And, almost lost in the background, evidence of climate change continued to mount. After all that, the recent invasion of US sovereign airspace by a Chinese balloon looks pretty small beer...

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 Afghan Govt and the balloon - 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.

So, in the first third of this address let me state what within that strategic backdrop I think has been clarified before I move into a more detailed assessment of the evidence of Ukraine. 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.

- First 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 it 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. Xi's lurch towards one-man rule looks threatening, and China is a 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 don't look good, and there was no amount of authoritarianism that could defeat 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, the two 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.

- 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 final piece of the jigsaw is the continued move from an analogue to a digital age - the Fourth Industrial Revolution. And these last two areas of 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.

There are two macro points to recognise in Ukraine, 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 SAMs 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 AAM launched from within Russian controlled airspace, and the density of its Ground Based Air Defences, or 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, and Russia appears 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 its 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, or EW. Ever a secretive area, this has been vital ground in the drone campaign, built on a bedrock of E-LINT 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 28yr old tech entrepreneur as minister for government digitisation across all departments, including the 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 televisually 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. Zelensky has listed the importance of international partners, in order, as the US Govt, then Microsoft and AWS, and then the UK...

In rapidly combining satellite comms such as Musk's Starlink, with commercially sourced and adapted drones, space-derived geo-int, all manner of Open Source Intelligence, and data-crunching software to make sense of it, all dispensed via the cloud to everyday laptops, Ukraine is redefining both networked kill-chain warfare and pragmatic adaptability.

In a lesson not new to airmen, precision strike at range has proved a crucial advantage to Ukraine - HIMARS GPS-guided missiles being the poster-boy of this campaign. The shift in importance from the close battle to the deep battle has been reinforced. But this is no huge technological leap - GW1 demonstrated 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 shouldn't 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'. 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 opening section on the immediate lessons, a thought on acknowledging what we haven't 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 commentating on what could become a subject reserved for Land Warfare specialists drawing skewed deductions from necessarily limited lessons.

So in my second section I will look at what that wider analysis might be. And I will put us in the place of Ukraine, fighting a peer competitor.

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 CAOC campus? Or conventional airfields, even with hardened aircraft shelters?

Might the practice of those new members of NATO, 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 USMC is looking at dispersed operations for its F-35 force, and the USAF looked at how to shrink a functioning CAOC into the back of a C17. Both these programmes look prescient now.

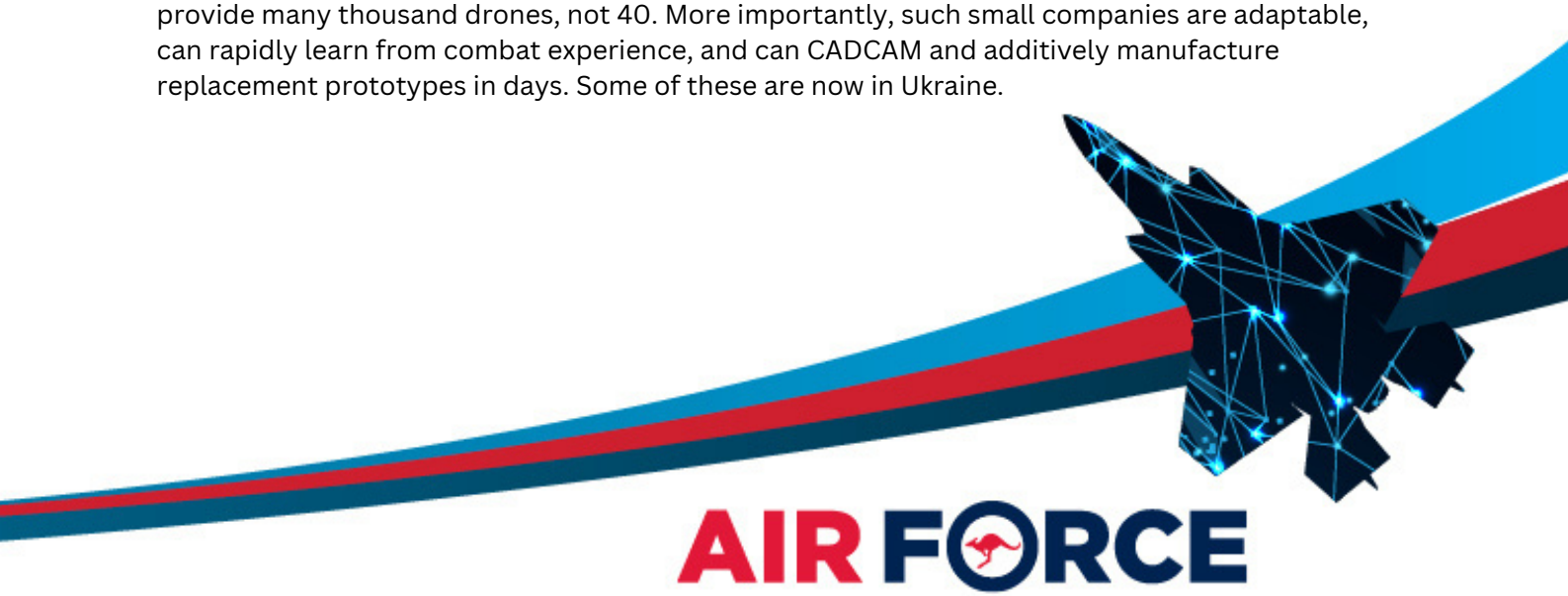
Allied to the above is the need to look at how we manage signatures in an age where persistent surveillance is making hiding anywhere on the globe increasingly difficult. Low signature, dispersed units are going to want low emissions and low power consumption, and so will incidentally benefit from a 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 in the van. But those early generation unmanned systems were developed for low-intensity, CO-IN campaigns. We didn't 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 £1.2Bn, while providing only about 40 relatively unsophisticated, low and slow ISR platforms. And we have no production line to pump out replacements.

Ukraine has demonstrated what we admitted but could ignore: in contested air space drones might not last longer than several days. But would that matter if they are not that expensive and could be replaced? There are, for example, companies in the UK who can turn out drones with approximately similar capabilities to WATCHKEEPER at a micro-fraction of the cost. £1.2Bn could provide many thousand drones, not 40. More importantly, such small companies are adaptable, can rapidly learn from combat experience, and can CADCAM and additively manufacture replacement prototypes in days. Some of these are now in Ukraine.



In short, it is possible to imagine a world where we don't go through extensive requirement setting and programmatics. 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 T&E. And not just for drones... I shall return to this later.

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 Ukraine 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, or LO, aircraft such as the F-35. In the contested SAM environment around the Donbas 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 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 loyal wingmen, 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 - 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.

This also calls into question how we operate and defend our assets in space. I fear that is a whole new key note address, 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 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 NW 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 NW 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 wouldn't lead with 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 what is behind Zelensky's call for F16s. 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 where 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.

The theme of this conference is Ready to Launch: Boosting Capability Delivery. I am going to make the leap and state that that 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 RAAF and my own Service being products of the great allied air expansion and development from 1939 to 45, when the allied airforces had approx 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 Combined Air Operations Centre, the CAOC, that has run all our successful air campaigns since 1991.

For example…

The Western Desert Air Force fighting Rommel to a standstill almost unaided in 1942

The Israeli use of air power in 1967

And in 1982 air power was key to the Falklands War

In Kosovo in 1999 a 2* USAF commander complained that "we were not allowed to use the air campaign we had been taught at Maxwell!" 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 - the use of fleeting power in the third dimension, 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 can't 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 neighbourhood 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, as, for example, have the Finns?

Have we exercised with commercial providers to rapidly integrate and adapt a blend of civ-mil 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 at you through the Nikolai Tesla's ether. Missiles of various hues, hypersonics, directed-energy, drones, electronic warfare, cyber and network connectivity, space-based capabilities. These are all long-standing features of the air domain.

As is fighting in the deep and at range. Air forces should be staking a claim in this ever more important corner of the battle-space.

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 B21 Raider, and sense other air forces are going to look at such platforms, or similar ways of deploying air effects at extended range. In this part of the World, credibly delivering combat effect from beyond the First Island Chain will be a bedrock of deterrence.

There is a concomitant to the conceptual point on adaptability made earlier and exemplified by that idea of a civ-mil '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.

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 on South Island that should shorty move to Woomera for phase two testing. Allied to rapid cube-sat development, such capacities could provide real resilience and adaptability in space. And space capabilities launched in, say 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 aero-space, EW and cyber capabilities as the lessons of the war dictate. And able to scale the necessary production across the alliance or coalition to meet wartime consumption rates.

AUKUS is centred on submarines but explicitly includes many technologies with uses well beyond the maritime domain; AI, space, cyber, etc. There is the UK-Australia Space Bridge initiative. Could not the air forces use these vehicles to make sure such useful military/industry/academia collaboration extends across all of our domain?

For if we are to win that technological arms race with China then air forces should be in the van 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 here 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 air 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 bought 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.

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!"

So I will conclude not in a brief rehearsal of the last half hour, but in 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 socieconomy, 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. There are tensions, Taiwan foremost. 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 through this keynote address 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 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.