

DCAF SPEECH TO INDUSTRY CONFERENCE – 30 MINS

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Introduction – slide 1

Four years ago, the air force launched plan Jericho at this event. Jericho was a catalyst for the air force's transformation into a fifth-generation force. We have achieved a great deal since then, through bottom-up initiatives like the networking of our air mobility fleet to top-down direction such as the formation of the air warfare centre and its focus on integration.

In 2017 at Avalon, we launched the air force strategy 2017-27 to strengthen the guidance for the air force to become a truly fifth-generation force. Importantly, the strategy document was simply one visible component of a range of improvements the air force made to its business processes that complemented broader defence reforms.

We ran the first air warfare instructor course in 2017, two years ahead of schedule. This first course epitomised our vision for a fifth-generation force in many ways. While the 2017 course built upon proud foundations stretching back to the 1950s, it represented a fundamental shift. Instead of producing a small number of superb air combat specialists, the 2017 course graduated more than 20 airmen from multiple capabilities who are expert integrators. Similarly, the air force's new approach to professional development and our reforms to personnel systems will give us a more flexible workforce with the skills we need for the future. You will see a plethora of technologies this week, but our people efforts are how we will truly harness the combat potential of a fifth-generation force.

Partnering and innovation have been essential to this progress and, perhaps more importantly, much of the work that we have done so far has made air force a better partner and a more innovative organisation. At the edge is an air force perspective, but part of that perspective is that everything we do is as part of a joint and integrated team. You will see some of the fruits of this progress on display this week.

You could be forgiven, then, for thinking that Jericho's work is done and we can move on. The chief and I have been asked that question many times. Well I'm here to tell you today that – to borrow from Churchill – for Jericho this is not the end, it is not even the beginning of the end, but it is perhaps the end of the beginning.

It is the end of the beginning because Jericho has put the air force on a path to becoming a fifth-generation force. That vision — now guided by the strategy — must, and will be, realised because it is the foundation of our future successes.

But is not even the beginning of the end because becoming a fifth-generation force is necessary but not sufficient. The world is changing, as today's proceedings have made clear, and the character of competition is changing with it. We recognise that for our force to prevail in future competition we need to explore its edges and exploit the opportunities that lay beyond.

So, I am pleased to once again use this event to mark a transition in the air force's evolution by launching 'at the edge.' 'at the edge' presents the air force's vision of how we will operationalise our force's potential to prevail in future competition and how we will leverage Jericho's flexibility and agility lead the exploration of our edges and accelerate our exploitation of the potential that we find there. We recognise that partnerships are essential to realising potential beyond our limits and I invite you to consider how we might realise this vision together.

The challenge – slide 2

Firstly, I'll take a moment to explain why we are launching at the edge. Peter Layton's primer and the discussions we've heard here today have done a great job laying out the many and varied aspects of our world that are changing, so I won't labour the point that we face a dynamic and challenging world.

Instead, I'd like to focus on the four aspects of our future that have been particularly pertinent in our thinking about how the royal Australian air force responds to the changing character of competition. These four aspects have been critical pillars in allowing us to develop a coherent response to complex and dynamic challenges. They are why our response is 'at the edge.'

First and foremost, it is our view that war – and other forms of competition – will remain, by nature, clashes of human wills. Human direction and control will remain essential to our business, as for the moment, only humans can attribute value and meaning to actions and events. For the air force, this means that our response must be human-centric, even though we are responding to changes largely driven by technology.

Secondly, the rising tide of information and the power generated through its processing means the tempo of competition is accelerating to speeds, and reaching into domains, that are beyond human comprehension. So whilst we believe competition will remain human by nature, it is fair to say that competition is becoming superhuman in character. Humans alone will be unable to cope with the machine-driven aspects of competition. Whilst our response must be human-centred, we must find a way to overcome human limitations so that our force can survive and thrive. Knowledge in this sense, is power.

Thirdly, the margins of difference between competitors are eroding. Advanced technology and sophisticated military equipment are available to more state and non-state actors. For our air force, this brings many welcome benefits as regional partners develop greater capacity and capability. But it also challenges our long-held tactical and technological advantages and forces us to contend with some unwelcome realities. We may be forced to operate in circumstances in which we cannot assume an operational advantage and may indeed be forced to operate at a disadvantage. This is particularly pertinent to our ability to control the air domain, which has become such a central pillar of western force projection.

Fourthly, the lines between domains and states of competition are blurring. Future competition is very likely to defy efforts to put it in a box and organisations whose first step in responding to a challenge is figuring out which box it goes in are starting in lag and will only get further behind. Ideas like multi-domain operations and integrated force concepts address part of this challenge but another aspect is recognising that we are in constant competition. The chief of air force is a capability manager who provides forces to the chief of joint operations to conduct operations but an era of constant competition short of conflict blurs that distinction.

As I said, these four characteristics are why air force's response to our challenging future is 'at the edge.' that phrase, 'at the edge' has two distinct meanings that together address the challenges we face operationalising our fifth-generation force so that we have a human edge in information age competition, and by bridging the gap between risk and reliability such that air force is simultaneously stable and agile.

At the edge: augmented intelligence – slide 3

We must operate ‘at the edge’ by shifting our force from one in which humans operate machines and cooperate with other humans, to one in which humans and machines operate together. Humans alone cannot cope with the volume, velocity, and variety of information we will encounter or respond to events at superhuman speeds and in domains beyond our comprehension. But machines, so far, appear unable to define intent and purpose, imagine alternative futures, or be held legally and morally accountable. We must therefore combine the two.

Our approach plays to our comparative strengths. We are a small force but our people and our equipment are of the highest quality. Our free-thinking people have grown up in a society that values their expertise, creativity, and freedom of thought. They are accustomed to making their own decisions in ambiguous circumstances. While this can give supervisors headaches from time to time, this freedom of thought and creativity is our biggest strength as it allows us to seek a human edge in the information age.

In many respects, this is an evolution for air forces. Humans alone cannot fly, so the earliest aviators combined the physical power of machines with human cognition to forge a human-machine team that allowed them operate in a domain and at speeds previously beyond human grasp. Over time, machines have taken on more and more of the human’s cognitive load and we now see, in capabilities like the F-35, machines that have been specifically designed to combine the cognitive strengths of machines and humans in ways that truly make them more than the sum of their parts.

Our challenge, then, is to scale the human-machine teaming that we see in at the platform level up to the force level. You might think that this is a matter of integration and networking such that we can do the things we do already better and faster. This is indeed a key part of it — reflected in the priority we have given to improved integration and connectivity since launching Jericho. But as well doing things better, we must do better things.

Augmented intelligence is how we will to shift the air force to operate at the edge. It is how we will combine the creativity and flexibility of our people with the tempo, precision, and mass of machines to do better things. This is how we will operationalise our systems in a manner that best leverages our comparative strengths to prevail in future competitions in which we may be outnumbered and outgunned.

The outcome of augmented intelligence will be a force with the creativity and agility to cognitively overwhelm our competitors. Our systems will enable us to operate in and through multiple domains and at all levels simultaneously. Augmented intelligence will give this force the creativity and agility to impose **human-inspired dilemmas at machine tempo** to disrupt competitors’ cohesion, while enhancing our own.

Becoming a fifth-generation force will enable us to do things better, augmented intelligence will allow that force to do better things. We need both to prevail.

Augmented intelligence lines of effort - slide 4

We will develop augmented intelligence through four lines of effort.

Autonomous processing will examine where and how we can exploit machine processing, such as artificial intelligence and machine learning, to gain the greatest value from the volume, velocity, and variety of information available. We are looking to find the ways in which we can use machines to offset human cognitive weaknesses and enhance human cognitive strengths, much as the F-35 does for pilots today. A priority is exploring how we can infuse autonomous processing throughout the force to enhance decision tempo, flexibility, and resilience. This is not about centralising or de-centralising decision-making but rather about building a force with the flexibility to distribute decision-making according to need, rather than proximity to processing power.

The *advanced sensors* line of effort is aimed at finding new ways to detect and track challenging targets in difficult conditions. Increasing sensor diversity by itself will enhance situational awareness quality and resilience. But increased sensor diversity coupled with machine processing's capacity to generate and manage fused multi-sensor tracks presents new opportunities, particularly in the difficult environments of Australia's region and in space.

The *combat cloud* is our effort to pursue integration that allows the resources of our force to be applied as a unified whole. Our vision of the combat cloud is about far more than sharing information and distributed situational awareness. We must also determine how we can manage and apply weapons, sensors, and processors. Peter Layton aptly described this notion as a 'combat thunderstorm, hurling destructive lightning bolts from any part of the cumulonimbus.'

Technical integration, particularly machine-to-machine integration that allows resources to be applied at machine speed, is essential but we must also consider the way that we think and operate our force. Technically, enabling integrated fire control between an F-35 and a *Hobart*-class destroyer will count for little if we are using operational procedures designed for an era of voice communications.

Finally, and perhaps, most importantly we will explore *human-machine augmentation*. I say most importantly for two reasons. Firstly, this is where we have an opportunity to truly exploit our greatest strength — our creative and flexible people — to do better things by imagining new ways of operating. But secondly, and more profoundly, the rise of machine cognition has the potential to fundamentally reshape human society so we must tread thoughtfully along this path. While we will seek ways to optimise the cognitive performance of humans, machines, and human-machine teams as part of this effort, we will do so with a proactively developed ethical and moral framework, and within the law.

These four lines of effort will guide our development of augmented intelligence and highlight that operating at the edge requires far more than improved connectivity or a sprinkling of artificial intelligence. We must reconsider every aspect of how we operate to find ways to do better things.

At the edge: exploring the edges – slide 5

How, then, are we going to realise augmented intelligence?

The answer to that is the second meaning of 'at the edge.' we will explore the edges of our capabilities to find and exploit the opportunities to be found there.

Leading this edge exploration effort, and accelerating our realisation of the opportunities we find there, is Jericho's new focus. Jericho will lead by building partnering and innovation infrastructure over the course of 2019. These efforts will allow the air force and its partners to rapidly explore, test, prototype, and induct new thinking.

We are reorienting Jericho for two reasons. Firstly, we need most of the air force organisation to continue the difficult task of building and operating current and near-future force. As I have said several times today, a fifth-generation force is the foundation that allows us to explore and operate at the edge. Secondly, we recognise that developments in our augmented intelligence lines of effort are moving quickly and are being led by others, often through rapid and small adjustments across multiple organisations. In short, we need different organisational approaches to meet different requirements, so that our people can work in structures optimised for their specific requirements.

These two factors highlight the dichotomy that the air force must contend with over the coming years. On the one hand, we must build on our proud tradition of reliability and stability to deliver and operate our capabilities. On the other hand, we must be more prepared

to engage with risk as an element of opportunity to build the creativity, agility, and resilience necessary to prevail in future competitions. For a long time, our air force has been able to control the risks that it has faced on operations so we have been able to focus on stability and reliability. We are far less likely to have this degree of control in future competitions so we must ensure we are postured to adapt to shocks and can function after failure.

We believe partnerships, inside and outside the air force, are how we will bridge this gap to find and exploit the potential that lays beyond the edges of our force. Our reorientation of Jericho is therefore focused on making it easier for our people to build partnerships between risk and agility on the one hand, and reliability and stability on the other.

Jericho's reorientation is focused on facilitating ideas or problems through a triage system to progress them far enough to hand off to other areas, such as the defence innovation hub, to become operational solutions.

Partnerships have been essential in getting us this far. Our thinking about future challenges and how we can respond has been a collaboration with organisations like defence science and technology, the Australian signals directorate, universities across the country and, of course, our industry partners from the largest primes to the smallest start-ups.

I also want to emphasise that we view partnering as a two-way street. The air force is launching at the edge and pursuing these efforts as part of an integrated joint force. Articulating our vision of how we can respond to future challenges is a contribution to the contest of ideas helping the Australian defence force and our allies prepare for the future. For example, the Australian army's *accelerated warfare* thinking shaped our own.

The air force's fifth-generation systems are here now, so we must respond to the challenges and opportunities that they present. But we do so on behalf of, and in partnership with, the entire defence organisation.

Jericho will remain a small agile team leading the innovation through the Jericho edge. The edge will be the primary hub for building communities that link our ideas and problems with others to find solutions and ways to turn ideas into realities. The Jericho edge is where we will test and demonstrate the potential of new thinking with demanding air force audiences and build the pathways into the air force's running system that allow ideas to be inducted and implemented.

These will be supported by Jericho labs at universities around the country. These physical spaces will be our outposts into the world of advanced research and development. These labs are places where our partnerships will have the freedom and flexibility to tinker and develop their ideas. I am pleased that we are already prototyping a labs arrangement with the University of Sydney and I look forward to an expansion of these opportunities elsewhere.

Conclusion – slide 6

Let me reiterate that 'at the edge' marks the end of the beginning for the air force's fifth-generation transformation. We have achieved a great deal in a short amount of time and must continue the work that Jericho sparked in 2015. Guided by the air force strategy, we will become a fifth-generation air force over the next decade.

But the world has also changed since 2015, and the future competitions that the air force confronts are intensifying and accelerating. We are building a foundation for success in these future competitions. But we must complement this effort with a deliberate focus on exploring the edges of our force and exploiting the opportunities that lay beyond. 'at the edge' guides how we will do this and what we can achieve in so doing.

We will operate at the edge by combining the human creativity and flexibility with the

power of machines to cognitively overwhelm our competitors. Augmented intelligence is how we transform from being a force that uses humans to operate machines, to one in which humans and machines operate together.

We will reorient Jericho to facilitate partnering that allows us to bridge the gap between risk and agility on one hand, and reliability and stability on the other. We will leverage Jericho's flexibility and agility to lead this edge exploration to complement and accelerate the air force's larger fifth-generation transformation.

Partnering is crucial to all aspects of at the edge and I invite you to consider how we can work together to realise this vision. Our greatest strength is the creativity and flexibility of our people and partnering at the edge is how we can unlock potential beyond our own limits. This is how we gain a human edge in the information age.

Slide 7