(*Check with delivery*)

Ladies and gentlemen

Unmanned Air Systems will play a pivotal role in the Royal Australian Air Force's ability to deliver air power effects in the support of our national security interests. We identified the need for UAS in the short term to support our forces in Afghanistan and filled that need through the introduction into service of the Heron. We appreciate the importance of UAS in our long-term maritime surveillance capability and intend to acquire a High Altitude Long Endurance UAS for maritime patrol and other surveillance under Air 7000 Phase 1B by the end of the decade.

But the true value of these systems is not to provide a direct human replacement, but rather to extend and complement human capability to deliver these effects. These systems extend air power's endurance by providing potentially unlimited persistent capabilities without degradation due to human fatigue or inattention.

These effects range from electronic warfare to ISR and potentially into strike. None of the effects are new to Australia, but the means of delivering them is evolving, just as the means to deliver most military effects have evolved over the years.

We only have to cast our minds across the last thousand years to the see the evolution of artillery bombardment as an example of changes in the delivery of a military effect. Propelling an explosive projectile across a battlefield has been the focus of nearly every army since the Chinese first documented their use in 1132. As the means of propelling the projectile has changed with technological advances, so too has the character of the effect. Greater ranges, accuracy and increased explosive power all combined to generate more effective artillery bombardment. Importantly though, the effect, to propel an explosive projectile across a battlefield field, has not.

I use artillery as an example of an evolution in a military capability to demonstrate that the focus of military forces is on effect. The method of delivery is important as we strive to gain military advantages but effect is where our focus remains.

So if military's focus is on effect why is the unmanned debate centred on morals and ethics?

What I will do today is provide a fresh perspective on both the ethical and moral issues surrounding the use of unmanned air systems. But also, what I consider more important is to provide a view on where these systems currently fit within our Air Force and where I see the use of unmanned air systems in the future delivery of Australian air power.

But, when it comes to the public debate on unmanned air systems, it seems the focus has narrowed on the platform rather than the effect, and here the pejorative term 'drone' is frequently used. Some pundits will argue that the use of these systems is immoral. They will argue, as one writer put recently, that 'drone' operations mean there is no chance of losing your own troops, thus war can be waged on a whim.

Many media articles use phrases like, 'drones have killed', or 'a drone targeted a civil population', or as we have heard recently 'drones invade the privacy of private citizens'. It is as if the platform has become an entity and responsibility is being placed on this inanimate object. You do not read in any article that an F-16 killed an insurgent leader. The same can not be said of 'drones'. This is because decisions involving lethal or destructive force are made by humans in accordance with the Laws of Armed Conflict and the principles of warfare. This is the way it has been in the history of Australian military operations and it is the way it will continue into the future.

We live in a world with unheralded access to mainstream and social media, and such access has enabled the realm of fiction to merge with the realm of fact. We are continually exposed to a Hollywood's representation of modern and future warfare which readily confuses fiction from fact. Clearly here I refer to the myth that unmanned air systems act outside the control of the human decision maker.

We read almost daily that a new technology is emerging, one that will revolutionise a particular way of doing business. There is inevitably a large amount of hype, but in reality only few products reach the market. Many capabilities do not ultimately reach their hyped-up potential or are deemed too expensive to mass produce. Thus, we need to bind our debate to a realistic timeframe and given the rate of technological advances I believe 30 years is a far enough horizon. Therefore, I will constrain today's address to UAS capabilities I expect will be both technically and economically feasible out to 2040.

On top of cost and feasibility, we should be mindful that Australia does not embrace every promised technology. We need to bear this in mind as we wade through the unmanned air system debate. Seeing a UAS on a glossy brochure or under an internet headline does not mean the capability will be integrated into our force structure.

Mentioning glossy brochures and internet headlines leads me to an important element of the debate; that of terminology. Before I enter into the debate too deeply I want to be crystal clear on terminology from

the Air Force perspective. The use of different terms has left the debate on the use of unmanned air systems fundamentally unbalanced.

I appreciate that the use of the term 'drone' is common place in the wider media but it is not a term used in Air Force to describe our use of unmanned air systems.

Clarity and precise language is important because language is not jargon; words matter.

We have heard the word 'drone' used countless times to describe everything from a sterile worker bee to a 'terminator'. In nearly every case, when we are referring to unmanned air vehicles, the term evokes an image of a platform flying around making its own decisions. Apparently a 'drone can decide what to look at and who to target. It would seem that some want the public to believe the platforms are directly responsible for the effects they deliver. This could not be further from the truth.

The term 'drone' was used in the past to describe simple unmanned aircraft used as airborne targets. UAS are not drones because they are far more complex and subject to ground-based human control.

So if not 'drones' what then?

We collectively call the capability an Unmanned Air System or UAS. It is a weapon system in its own right. It delivers a multitude of effects and is complex mix of sub-systems that include the platform, payloads, ground control elements, a command network, and launch and recovery teams. Alongside these are data processing elements, a workforce of intelligence analysts, as well as supporting sub-systems involving training, and maintenance.

Unmanned Air Systems are far more than the platform and definitely are not self-determining nor self-sufficient. They are designed by humans, controlled by humans, with operational decisions made by humans.

But as much as it is the system that delivers the effect, the platform remains the focus of most of the debate. In Air Force, we refer to the airborne platform as a Remotely Piloted Aircraft or RPA. This term more correctly represents the fact that we have human involvement in every step in the system. From the launch, to the tracking and monitoring of the sensors, humans are involved.

The other common term is Unmanned Aerial Vehicle or UAV. Again, this term refers to the platform rather than the capability. While it is technically correct, it does not accurately reflect the character of the platforms we operate. However, while RPA is the preferred term I understand why UAV is used.

Terminology aside, the other major influence in the UAS debate is the degree of autonomy or automation that these systems employ. Again, this is an area where more fiction than fact is threaded into the discussion.

As the US Defense Science Board noted in a 2012 report, unmanned systems enable the option to work at speeds and on scales beyond human capability.

Autonomous capabilities reduce the high cognitive load currently placed on operators. But within a defined set of bounds.

Note the key word here is bounded.

Why – because the terms autonomy and automation conjure up images of UAVs making independent decisions and taking uncontrolled actions. The reality of course is much different. But it is fiction that UAVs operate free from the bounds of human decision-making. This style of thinking distorts the UAS debate. And the term 'drone' perpetuates this fiction.

It should be made clear that all autonomous unmanned systems are supervised by human operators at some level. The degree of human interaction is dependent on the platform and the character of the operation.

Autonomous systems' software is designed to limit the actions and decisions delegated to the computer. Instead of viewing autonomy as an intrinsic property of an RPA in isolation, the autonomous operation of systems needs to be considered in terms of advancing human-system interactions.

System software is designed to constrain the actions and decisions delegated to the computer. Like the US Science Board, I see automation and autonomy as a continuum. This continuum ranges from complete human control of all decisions within the RPA, to situations where many functions are delegated to the systems. At the high-end only minimal high-level human supervision occurs. The UAS the Air Force use today, and those we will use in the immediate future, will operate in the central band of this continuum.

Modern aviation relies heavily on automation to deliver the level of performance and safety expected by the travelling public. Right now there are passengers all over the world blissfully ignorant that their aircraft is being operated with some high level of automation. Commercial fights operate with most passengers unaware that for the majority of the trip the crew rarely touch the controls. Many operations are performed by the mission systems programmed well before the aircraft even leaves the ground. Notwithstanding, there is still a human monitoring and managing the systems. But could this monitoring and managing be conducted remotely?

Autonomy is well entrenched into our travelling way of life. With UAS, the button to couple the platform's mission system is pushed remotely rather than in the aircraft. However, in the end it comes down to an electronic signal, whether the button is on-board or off-board.

I will not further expand on the academic arguments on what specific levels of autonomy or automation mean. The language is important but not as significant as what autonomy means to the operation of UAS. And what it means is a greater ability to exploit the characteristics of air power.

So if we have established RPAs are aircraft are under the control of human decision makers, where is the debate? I appreciate that the most of the debate is centred on the use of UAS as a strike platform, so I see the debate as both moral and ethical. I acknowledge that the line between morals and ethics is grey. However in this forum I refer to morals in relation to Government responsibilities and ethics in relation to the actions by our forces. Firstly, it has to be ascertained whether it is morally acceptable to engage in a conflict? Secondly we should question whether it is ethical to use UAS in conflict?

Airmen are not responsible for the justness of the war, only for carrying out actions in accordance with the Law of Armed Conflict (LOAC). It is the responsibility of the Government and society to argue whether the nation has the right to engage in war. The military carries out violence sanctioned by the state in accordance with a strict set of rules of engagement. These rules are laid out by the Government not the military.

So, the moral argument is whether it is justified to use violence in the name of national security. Not whether the use of RPAs are right or wrong. The focus should not be on the delivery mechanism. This argument is a moral one which societies within each state must rationalise. As an enlightened society we have to debate the question - what is the relation between justice and necessity? But as a Defence Force, under our constitution, it is not our place to decide whether to go to war.

But as a Defence Force, under our constitution, it is not our place to decide whether to go to war. If it is determined a war is just, then the question of the justness of using RPAs is one of ethics. Is it ethical to use RPAs in war?

In every conflict, we operate in accordance with a very strict set of rules of engagement or ROE. The rules are based around the fundamental Laws of Armed Conflict. These rules dictate the boundaries of necessity and proportionality for military actions.

Operations with UAS are conducted within the ROE, as are all our combat capabilities. Whether the activity is an ISR task or a strike task, ROE applies. The targeting process is exactly the same whether a strike is performed by a UAV or manned platform. The requirement for weaponeering, target

identification, and collateral damage assessment are all the same. Decision-making is no less stringent if the mission is conducted by an RPA or by an F/A-18. Collateral damage considerations are the same.

The debate around the use of UAVs is firmly based around current operations in and around Afghanistan. Those that argue UAVs should not be used because they cause collateral damage are missing the point. The decision-making process is the same regardless of the platform. If we can't operate within the ROE we don't take the action at all.

What is not obvious to the general public is the nature of the supporting systems behind the RPA conducting the strike mission. These systems provide a multiplying effect to the military effectiveness of the RPA. But just as important they provide the safeguards as well. Literally dozens of sets of eyes are on a strike target acquired through the sensors of a UAV. And those sets of eyes are supported by multiple data and intelligence sources, as well as legal input. They all contribute in real time. They are all supporting decision-making throughout the targeting process. And a weapon release only occurs following final ROE authorisation.

So if RPAs will be part of our future, how will UAS change the way we deliver our family business? The nature of air power has not changed with the introduction of unmanned air systems. The same cannot be said about the character of air power.

Of all the enduring characteristics of air power, it is increased persistence that we gain through the use of UAS. Unmanned platforms can stay airborne far in excess of most current manned platforms because they are unencumbered by an airborne crew. Instead of having to return to a base and swap the crews, we can cycle ground-based crews for the duration of the mission. This duration can be measured in days, limited only by the amount of fuel the RPA carries.

The Air Force has always delivered air power for the security of national interests through four fundamental roles; airlift, ISR, strike and control of the air.

When it comes to Australian airlift I do not see much UAS activity in the foreseeable future. We will continue to be served by the C-17A and the KC-30A as our strategic lifters, alongside the C-130J and C-27J for operational and tactical airlift; and of course the Chinook and MRH-90 for tactical mobility.

Technology may enable these platforms to be operated remotely, but I do not envisage the cost of modifying the platforms will be feasible. I also think a major cultural evolution will required by passengers before they accept a crewless aircraft. This may occur in the future but unlikely in the timeframe we are looking at.

However, I would highlight that unmanned airlift is being conducted in the MEAO at one end of the airlift continuum. In 2011, an unmanned variant of the K-MAX helicopter moved up to 3,500 pounds of

supplies to support US Marines operations. The mission was conducted over about an hour and a half and was the first unmanned aerial system cargo delivery in a combat zone. The unmanned K-MAX can fly to four locations, drop supplies at each within a 10-meter circle and return to base using GPS coordinates. The airlift continuum is evolving and there are opportunities available to exploit by elements of the ADF.

But perhaps the air power role most influenced through the use of UAS is ISR. This is where the Air Force has started to exploit the benefits of unmanned operations and the growth area into our future. The introduction of the Heron was a huge step forward for Air Force ISR. It heralded a transformation in the delivery of Australia air power and has been a catalyst for a cultural shift in our approach to the delivery of ISR.

ISR is an enduring role of Australian air power and has been since our inception. But, the thirst for information has long been tempered by the endurance of our manned platforms. The UAS overcome some of the traditional limitations to provide persistent ISR. This has changed our approach to ISR. Pattern of life surveillance is now available through greater persistence. This has been the key to tracking and targeting high-value combatants, while contributing to the reduction of collateral damage.

Persistence has contributed to the counter IED mission by allowing more sensors on threat areas for longer. The UAS is used to detect changes in roads and tracks, reducing the exposure of our ground forces to IED threats.

UAS allow for the persistent overwatch of patrols and convoys. It can provide alerts against any detected threats and reduce the response time for support elements. With an increasing awareness of this ever present eye-in-the-sky, requests from ground forces for UAS have increased almost exponentially.

However, sensing through optics and radar is only one aspect of the UAS ISR capability. Increased persistence allows more time to monitor communication and electronic transmissions. The longer the time available to monitor transmissions, the greater the fidelity of our intelligence.

Greater persistence can also reduce some of the traditional limitations in communications. UAS can operate as communications relay platforms, minimising the impacts of geography, thereby extending the range of most communication networks.

However, perhaps one of the most prolific changes we will see in Air Force ISR will be in the maritime environment. The introduction of the Triton maritime UAS, or an equivalent, will change the way we do our maritime surveillance business. Used in concert with the new P-8 Poseidon, our AP-3C replacement, the Broad Area Maritime Surveillance UAS will revolutionise maritime surveillance. With an endurance of up to 40 hours, we will be able to surveil more of the maritime environment than ever before. Its

sensor suite and performance characteristics will allow the detection and identification of a vast number of surface contacts. We will be able to provide surveillance overwatch of maritime task forces for periods far longer than previously able. And in concert with the P-8 it will provide a maritime response capability exceeding what we are capable of today.

But the most contentious role for UAS, one I highlight that Australia does not possess, is that of strike. Much has been written and discussed on the use of armed RPAs, with the Reaper claiming the greatest notoriety. As I previously stated, I see little difference between the use of an armed RPA and a manned platform. The targeting and decision-making process for manned and unmanned platforms is robust and in accordance with the ROE and LOAC. To the combatant the effect is the same; it is the media and the spin the adversary use that creates the illusion of difference. If it is considered immoral or unethical to conduct a strike or cause collateral damage then it the action that needs to be questioned. The type of delivery platform is inconsequential.

Unlike airlift, I do envisage Australia will acquire a UAS with strike capability. Our ground forces deserve the best level of protection. We have a duty to the population to safeguard as best we can the men and women we commit to conflict. If that means obtaining a capability that increases the protection of our soldiers, sailors and airmen then it would be negligent not to consider UAS. This means we must have a balanced and informed discussion on the use of unmanned systems; a debate that appreciates the reality of technology. One that understands the limits the Government places on the application of force. And one that recognises where responsibility lies in the execution of any force.

The most fundamental role Air Force undertakes to support our national security is control of the air. Currently we deliver this role through our classic Hornets and Super Hornets, and in the future the Joint Strike Fighter.

Technology in the field of unmanned air combat vehicles or UCAVs, is advancing rapidly. Many would have seen the recent imagery of the X-47B undertaking trials from an aircraft carrier. There is a long way to go before this experimental platform translates into an operational capability. And even if experimentation is successful, it is still a point of conjecture the amount of benefit to be gained from a UCAV.

Taking out the life support systems and human-machine interface resident in a fighter will save space and weight. But the platform will still need a comprehensive sensor suite, weapons capacity, and at least 5th generation characteristics to be competitive against modern fighter aircraft.

Yes, UCAVs will be able to turn tighter because they are free from the physiological constraints of humans. But, in the age of stealth, shooting first before an adversary can react is the real goal.

Now if human physiology is the Achilles Heel of manned fighters then communications are the weak link in the UCAV. Unmanned platforms must be able to communicate between each other, to a controlling aircraft or to a ground station. Their vulnerability is communications. A jammed signal could significantly degrade a UCAVs combat performance. So while we can strip away the human element of a fighter aircraft, we will need to enhance other areas; and this comes at a cost.

We know from experience that leading-edge technology is not cheap. It is likely to be well beyond the timeframe of this discussion before UCAVs are both affordable and capable as leading edge fighters.

Remember my warning about glossy brochures and internet headlines. I think the warning is equally relevant to the UCAV debate. And don't be drawn into the argument that a UCAV, or UAS for that matter, is considered a throw-away item. Yes they have the potential to remove the human from harm's way; and they may eventually be less expensive than a manned platform. But they will not be cheap. I don't know any commander that is happy when they loss a capability, even if it is an unmanned one. It means one less tool to support your forces and no platform is easily replaceable.

We must never forget that in the Australia way of war, the decision to execute a strike is a responsibility of humans, regardless of the platform. As an enlightened society it is our right, in fact it is our obligation, to question the veracity of taking life or creating destruction in the name of national security. But there is nothing immoral or unethical about the use of RPAs. You can argue that the ROE are wrong or question the legitimacy of the reasons for undertaking conflict, but don't shoot the messenger. The UAS is another military tool in our belt. The real moral costs come not because they exist, but because we have decided to commit them.

To those that object to the use of UAS because they are 'too cowardly, too remote, and too removed from scrutiny', I offer no apologies. I ask those who argue the use of UAVs is cowardly to consider the safety of the sons and daughters, or brothers and sisters we commit to combat. War is not a sporting contest where the fairness of a level playing field is sought. Advances in military technology have always sought to maximise operational and tactical advantages. This is why we have acquired precision weapons such as JDAM and JASSM. It is why we are looking to acquire a long endurance UAS. And it is why we have acquired the Super Hornet, and in the future the JSF. We will always strive to maximise the desired effect while minimising the risk to our forces. This is the nature of military operations.

The debate over unmanned air systems needs to focus on the social, political, and bureaucratic environment that allows for conflict in the first place. It is only at that level that we can begin to frame the moral and ethical questions of carrying out such missions.

One thing in this debate is clear. The character of air power is changing. For the foreseeable future Australian pilots will still drop bombs and fire off missiles; some from the cockpit of an aircraft and

perhaps in the future, some from the confines of a ground station. However, strike missions will be relatively few compared to the number of ISR tasks. ISR is the growth area for Air Force unmanned operations. A cultural shift within the organisation is already taking place. We must be ready to exploit all the opportunities UAS will provide. Through this new way of business we will continue to meet Air Force's prime responsibility to the people of Australia; the delivery of air power in support of our national security interests.

Thank you.