



The SIR RICHARD  
**WILLIAMS**  
**FOUNDATION**

# Air Combat Operations 2025 and Beyond

*SEMINAR EXECUTIVE SUMMARY*

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# Air Combat Operations – 2025 and Beyond

On Tuesday 11 March 2014, The Sir Richard Williams Foundation conducted its biannual seminar on ‘Air Combat Operations – 2025 and Beyond.’

The seminar explored the challenges and opportunities afforded by the introduction of 5th generation air combat capabilities. Themes explored included:

- The future Asia/Pacific security environment
- Future technology advances and challenges
- How the US Marines are approaching the challenge of integration of 5th generation capabilities with the legacy force
- Consideration on how the RAAF will approach the transition to, and integration of, 5th generation airpower capabilities

Held on the sidelines of the RAAF 2014 Airpower Conference in Canberra, the seminar sought to identify the many opportunities and complex issues that ‘5<sup>th</sup> generation’ air combat capabilities will bring to the Royal Australian Air Force and to those of Australia’s allies and regional partners.



## INTENT

The seminar brought together a high calibre mix of current and recent past Defence leaders, industry, projects managers, academia, defence scientists, and current and future capability operators to discuss the emerging trends in air combat operations and geopolitical influences, and how these may inform future force structures and postures in our region and further afield, and the way a 5<sup>th</sup> generation platform will be operated.

Before introducing the speakers, seminar master of ceremonies AVM (ret) John Blackburn prefaced the day's proceedings by outlining the Williams Foundation's intent in hosting the event – these being to discuss future air combat operations concepts and CONOPS; joint effects; legacy 4<sup>th</sup> generation systems; enabling systems; capability upgrades; people & training; and our collective mindset and thinking.

In his opening statement, Williams Foundation Chairman AIRMSHL (ret) Errol McCormack challenged the speakers and the audience to consider two tasks – the seemingly impossible task to “predict the future”, and the slightly simpler but no less challenging task to “examine how to accommodate the step change in capability” a 5<sup>th</sup> generation air combat capability will bring.

AIRMSHL McCormack spoke of the historical context where the RAAF introduced successive generations of combat aircraft “from Mustang to Meteor to Sabre, to Mirage to Hornet,” but “graduated the old methods” on to the new aircraft, “and not very well.” He asked the audience to consider whether the “current education, training and logistics systems will be able to accommodate the introduction of a 5<sup>th</sup> generation capability.”

To this end, a rollcall of distinguished speakers was assembled, and all of them ably articulated their views and understandings of the current and near future status of the RAAF and global air forces; of the threats starting to enter service in the region; of their professional experiences in operating 5<sup>th</sup> generation combat aircraft; and the comparisons of the capabilities offered by 5<sup>th</sup> gen platforms and systems compared to legacy systems. They also spoke about the current and near-future geopolitical situation in the Asia-Pacific region; about the rise of China and where its current and future ambitions may lie; and of the current status of the multi-national F-35 Lightning II Joint Strike Fighter program.

Keynote speaker, Chief of Air Force AIRMSHL Geoff Brown praised the Williams Foundation for being “forward looking” and for its efforts to “raise the level of the [air combat capability] debate” in Australia.





# GENERATIONS

Before delving into these insights and the questions they raised, it is first important to baseline the conversation by categorising or defining what is meant by a '5<sup>th</sup> generation' air combat capability.

The origin of the generational categorisation of jet combat aircraft is debatable – long-time *Aviation Week* correspondent Bill Sweetman claims it originated from within Lockheed Martin's business development machine shortly after the X-35 was declared the successful JSF solution in 2001. But others point to documentation used by Russian and Swedish marketeers from the 1990s when referring to the improvements in capability the US Air Force's Advanced Tactical Fighter (ATF) program and the resulting Lockheed Martin F-22A Raptor would bring to the fight when compared to in-service 'legacy' fighters.

Even earlier than that, a USAF *Airpower Journal* article published in 'Winter 1990' defines six generations of jet fighters up to the US teen-series, but presumably leaves room for a seventh generation as it does not include the then-developmental Lockheed YF-22/Northrop YF-23 ATF and the McDonnell Douglas/General Dynamics A-12 Avenger II in its listing. Russian and Chinese observers also categorise aircraft into generations, albeit with differing and broader definitions across fewer generations that relate more towards their own platforms and capabilities.

Regardless of their origins, the following generational categorisations have been widely adopted by most operators and informed Western observers, and were reinforced in their seminar presentations by AIRMSHL Brown and by ADF analyst, Mr Peter Hunter.

**1<sup>st</sup> Generation** – The first generation of jet fighters were those of the immediate post-WW2 and Korean War period. Despite introducing advances such as the turbojet engine and swept wings, these aircraft essentially retained the same or similar cannon or machine gun armament and gun sights of their piston-engined forebears. Examples of first generation fighters included the NA F-86 Sabre, and the Soviet MiG-15 and MiG-17.



**2<sup>nd</sup> Generation** – In the heady days of the 1950s as the cold war gained momentum, the second generation of fighters evolved with the introduction of sustained transonic or supersonic dash capabilities, rudimentary fire control radars, and infra-red guided air-to-air missiles. Examples include the MiG-19, Hawker Hunter, North American F-100, and Dassault Mystere II.

**3<sup>rd</sup> Generation** – As technology rapidly improved and defence budgets exponentially increased, the late 1950s and 1960s saw the introduction of the third generation of fighters. These aircraft were capable of sustained supersonic flight, carried improved fire control radars and semi-active air-to-air missiles, the first generation of tactical electronic warfare systems, and introduced multi-role capabilities. Aircraft such as the McDonnell F-4, Vought F-8, Dassault Mirage III, the MiG-21 and MiG-23 are all examples of third generation fighters.





**4<sup>th</sup> Generation** – The lessons learned from the Vietnam conflict generally informed the fourth generation of fighters. These aircraft introduced more efficient and powerful turbofan jet engines, ‘look-down’ doppler fire-control radars, fly-by-wire flight control systems providing high agility, integral and podded EO/IR targeting sensors, laser and GPS-guided precision weapons, active air-to-air missiles, heads-up displays, and improved electronic warfare systems. This generation is the longest lived of the five generations so far, and includes all the US ‘teen-series’ fighters, the Mirage 2000,

Saab Gripen, the MiG-29 and Sukhoi Su-27/30, China’s Chengdu J-10A, and the Dassault Rafale and Eurofighter Typhoon.

**5<sup>th</sup> generation** – The general criteria for being categorised a fifth generation aircraft includes those systems advanced by later fourth generation aircraft, but adds the all-important designed-in low observable shaping and materials, internal weapons bays, and high degrees of situational awareness through integrated sensors and networking. So far, the only operational fifth generation aircraft is the F-22A Raptor, although the F-35 Lightning II also meets these criteria, and based on initial reports, the Sukhoi T-50 PAK-FA and Chengdu J-20 are expected to follow suit. Some commentators

claim the ability to supercruise and the possession of all-aspect VLO stealth should also be used to categorise fifth generation aircraft, in which case only the F-22A need apply at this time.



But there are also some notable aircraft currently in production or development that have evolved to the point where some of their capabilities span the gap between the 4<sup>th</sup> and 5<sup>th</sup> generation categories. Aircraft such as the Block II Super Hornet, Boeing’s Advanced Super Hornet and Advanced Eagle concepts, the Sukhoi Su-35 development of the Flanker, the Chengdu J-10B, and planned developments of the Typhoon, Rafale and Gripen all offer various features including advanced AESA radars and optical sensors with higher levels of integration, some built-in or added-on low observable features,

conformal auxiliary tanks or shaped weapons pods, and advanced electronic warfare systems. These aircraft are generally referred to as **4.5 generation** or **4+ generation** fighters.

Mr Hunter also pointed towards a potential **6<sup>th</sup> generation** of air combat platforms when referring to the coming unmanned combat aircraft systems such as the joint French-Swedish nEUROn, the UK’s BAE Taranis, Northrop Grumman’s X-47B and the US Navy’s follow-on UCLASS program, and similar unmanned combat aircraft projects underway in Russia and China. But it is generally accepted that few if any of these will be available in operationally significant numbers before 2030.





## EVOLVING CAPABILITY

The seminar's keynote address was delivered by AIRMSHL Geoff Brown who opened with a reminder that, while 2025 may sound like science fiction to many of us, it is only a decade away. He said because of the long lead times in developing complex systems such as modern air combat systems, decisions on what we will field in 2025 will have already been made or will soon need to be made.

Echoing AIRMSHL McCormack's opening remarks, CAF cautioned the audience to continue to re-evaluate the way they think they will operate a 5<sup>th</sup> generation air combat capability. As an example, he related the experience of the mid-to-late 1930s when the first four-engined bombers were in development, and how the "way these platforms were deployed [during the war] bore little resemblance to concepts developed during their development process." The moral is, he said, that while "strategic thought and planning in peacetime are necessary and productive processes, the realisation is ever present that peacetime plans for the employment of new weapons in war will not work out with expectations."

That same lesson could be applied to many 3<sup>rd</sup> and 4<sup>th</sup> generation combat aircraft that grew into missions that were way beyond their original design remit – with notable examples such as the F-4, F-111, and F-16 coming to mind.

CAF also predicted that the way the F-35 will be employed will likely "evolve over time and will change with experience," and cautioned the audience to not be complacent in thinking that simply acquiring the F-35 will "deliver an airpower advantage." The F-35 must be employed not as a stand-alone capability but as an element in an integrated system-of-systems, a point that was echoed by several other speakers on the day.

US Marine Corps pilot LtCol 'Chip' Berke described 5<sup>th</sup> generation fighters like the F-22 and F-35 as an "ecosystem" which has been provided by Lockheed Martin and the Air Force, but one which offers little innovation without the operators. He said the best thing you can do with the ecosystem is to integrate it, "because the more people who can get inside that ecosystem, the more intelligent the communications become, the better everyone is."

He said that, "what makes the airplane special is not just that it can fly fast and is invisible, but that it makes everyone else in the ecosystem more capable. A good analogy for a small force with limited funding such as the RAAF was the fact that the USAF only received some 180 F-22s out of a planned force of up to 750, and thus had to "come to grips" with integrating the F-22 into its force to make its legacy aircraft better "out of necessity."

And Mr Peter Hunter said the key thing in the success of the F-35 "will depend as much on how innovative we are in integrating and operating our 5<sup>th</sup> generation platforms and their enabling systems as on the technology itself."





## NOT A REPLACEMENT AIRCRAFT

LtCol Berke cautioned the audience to not treat the F-35 just as a replacement aircraft. “The F-35 doesn’t replace anything,” he said. “Previous generations are merely chronology, time associated with airplanes. But if you look at the F-35 as a replacement to the Hornet or Super Hornet, you will undermine from Day One the real capability of the airplane. It does not replace anything, it is unique, it is revolutionary, and it is in a world never before defined by what tactical platforms can do.”



This is a message that has failed to gain traction in the public arena where the debate has consistently been reduced to the lowest common denominator whenever the acquisition of a new combat aircraft is announced. The Super Hornet was erroneously touted as a replacement for the F-111, and more recently the potentially game-changing P-8 Poseidon and MQ-4C Triton UAS have merely been sold to the public as P-3 Orion replacements. While all of these aircraft will take over the missions performed by their predecessors, they will also bring many new capabilities to the entire ADF.

During its early development, the JSF was a marketeers dream. It was touted as a replacement for nine different aircraft types currently operated by the partner nations, with all the associated operating cost efficiencies and commonality benefits that would bring. But when viewed in hindsight, a massive opportunity was missed to also explain the new capabilities the JSF would bring, not just in an air combat context but if exploited fully, to a nation’s entire force structure.

Most recently we have seen the F-35 chosen as a “replacement” for the RAAF’s ageing classic Hornets. In a climate of fiscal restraint and in the absence of any context about the long-term strategic capabilities it will bring, it was perhaps inevitable that the media would latch on to the high acquisition cost of the new aircraft.

So while the numbers of F-35s planned roughly equate to a one-for-one swap-out of legacy platforms, the 5<sup>th</sup> generation paradigm and the capabilities it will bring to the ADF is so much more than just having ‘X’ number of airframes in the ‘carports’ at Williamtown or Tindal or Amberley, or listed on an order of battle somewhere. It should be incumbent upon the ADF with support from think tanks and the specialist media to better articulate this argument.

LtCol Berke summarised the potential of the F-35 best when he said, “Legacy airplanes are tactical platforms that make tactical decisions and fly tactical missions that impact the overall strategic objective. I believe there is a requirement to view the F-35 as a platform that can operate across the spectrum from tactical to strategic or anywhere in between as required.”



## STEP CHANGE

The step change in capability the F-35 will bring was a recurring theme throughout the seminar presentations. Speakers consistently pointed to the aircraft's advanced sensors, LPI communications, low observability, improved situational awareness, and other advanced systems as the key attributes that differentiate the F-35 from its predecessors.



To emphasise the advances in sensors and other systems, AIRMSHL Brown explained how the classic Hornet which was developed in the 1970s is a very different aircraft today to the one the RAAF initially acquired. In the last decade the Hornet has undergone a massive mid-life upgrade program which has seen it equipped with a more capable APG-73 radar, Link 16 and ARC-210 comms suite, enhanced cockpit displays, an advanced electronic warfare suite, a helmet mounted cueing system with new high PK active and high off-bore sight air-to-air missiles, and precision-guided and stand-off air-to-surface weapons.

He related a recent experience he had when flying an upgraded Hornet in a training mission. Despite being in a dominant position against a relatively new Hornet pilot, he was 'killed' by an over the shoulder ASRAAM missile shot which had been 'spiked' and uncaged by the pilot's helmet mounted cueing system. He remembers that event as a "technological development that had fundamentally changed my mind as to what was offensive and what was defensive."

SQNLDR Matthew Harper offered a clear insight by comparing his experiences in flying the 4<sup>th</sup> generation classic Hornet and the 4.5 generation Super Hornet in the RAAF, and the 5<sup>th</sup> generation F-22 Raptor while on exchange with the USAF.

He told the audience that, despite the advances which have made the classic Hornet "one of the best 4<sup>th</sup> generation aircraft out there", the aircraft is still very limited. He spoke of the mechanically scanned radar which needs to be "driven by the pilot" and which is restricted in the number of targets it can see and track, and of the limitations of the Link 16 network and the compromises that need to be made when "everyone wants to use it".

He also explained that the Hornet is "not low-observable in any way", that its mission computers are at 100 per cent capacity, and that sensor performance is very sensitive to the operator's skill levels. Sensor fusion for a Hornet pilot essentially means looking at multiple displays, each one displaying a different sensor picture which may not be up-to-date due to Link 16 limitations, and often means having to make a best-guess decision based on poor situational awareness. He said with the Hornet, in the decade ahead "it's increasingly obvious we don't have the systems capability to offer a meaningful contribution to the fight."

With the Super Hornet, SQNLDR Harper said the improvements brought by the AESA radar, integrated electronic warfare features, some low observable enhancements, the advanced mission computer, and better sensor fusion which provides greater ability to manage complex EW & targeting, have made a "fantastic jet" even better. He said the improvements were "designed to a sensible point which made financial sense", and would mean the Super Hornet is survivable and upgradeable into the 2020s.

But he said the Super Hornet was still limited by being confined to a Link 16 network which isn't LPI, and despite the better sensors the lack of real sensor fusion "adds a layer of complexity" which can result in task saturation. "It's still very challenging to determine what the best way is to track an adversary and maintain SA against advanced threats," he said

By comparison, SQNLDR Harper said the 5<sup>th</sup> generation F-22 was built from the ground up to optimise its capabilities, and that there is a real impression that the platform was "built in collaboration with engineers, scientists, fighter pilots, and warriors."

He said the most important feature of 5<sup>th</sup> generation is its integrated avionics, and that "all the sensors are built into the jet" and are all controlled by a central core processor, which means the pilot doesn't need to manipulate them. He explained that the cockpit displays promote an "evolved level of pilot interaction with the platform," and that the HMI is "incredibly intuitive - It wasn't long at all to go from the previous mindset, to looking at the displays and working with the picture to set up a work flow."

SQNLDR Harper said the fusion is the "key enabler" for 5<sup>th</sup> gen. He said because the sensors require little or no manipulation means it "frees up huge amount of brain space for the pilot." He said all the relevant information is presented in sync "not just your own aircraft, but with the entire formation."

LtCol Berke described the fusion offered by 5<sup>th</sup> gen platforms as "an overwhelming advancement in breadth and depth in terms of the spectrum in which it operates." He said it's unlikely we fully understand what that breadth and depth will allow pilots to do yet due to the vast differences to the capabilities offered by legacy platforms. "It's not just a matter of being able to function in a wide array of information - if we can't fight in a particular spectrum, whether it's RF, IR, laser, EO, the F-35 has the ability with the agility on the platform to live in whatever spectrum it thinks it needs to be in."



## STEALTH

The definition of stealth was described by the speakers as so much more than just the traditional view of using radical shaping and exotic materials to give a low radar cross-section. AIRMSHL Brown described “true LO” as being designed in from the ground up in every signature of the platform, including IR, RF and the visual spectrums. He said LO technology meant “minimising electronic emissions,” and that an equally important factor in stealth was networking and the superior situational awareness to give a pilot “decision superiority”.

LtCol Berke described stealth as “not about detection, it’s about access,” meaning true stealth is the pilot being able to choose how best to avoid threats, when to engage or disengage, or when to be seen or not be seen. SQNLDR Harper said stealth means “reducing your adversary’s situational awareness to almost zero,” and that if you “do a good job in managing” a 5<sup>th</sup> generation platform’s LPI comms, stealth will “provide increased survivability and improves mission success.”

Mr Hunter said stealth is preserved by having secure comms, and that its overall effect is greater than the sum of its parts. He explained that developing a full suite of stealth features is not straightforward and requires incredibly complex systems engineering, multiple disciplines, and “significant attention to detail.” Apart from shaping and materials, key design features also include propulsion, internal fuel and stores, and embedded or flush sensor apertures.

In discussions during a break at the seminar, Mr Hunter agreed that while it is one thing to construct a number of essentially hand-built prototypes or technology demonstrators, the real test comes in the ability to industrialise and mass produce low observable platforms with consistent quality and tolerances required to maintain signature management. To date, only one nation has demonstrated it has the industrial and technology base to mass produce, field and employ stealth combat aircraft.



## INTEROPERABILITY

A key message that was repeated by several speakers was the need to integrate the F-35 fully into the ADF's force structure, and to not field it as a stand-alone 5<sup>th</sup> generation capability.

Mr Hunter articulated this when he said “our success will depend as much on how innovative we are in integrating and operating our 5<sup>th</sup> gen platforms and their enabling systems as on the technology itself. It doesn't take a classified brief for us all to think about how we may need to adapt our CONOPS to maintain the capability edge we enjoy today into the future.”

The message that the F-35 and its 5<sup>th</sup> gen capabilities will make many of the ADF's other capabilities better is a compelling one. In this context, we are reminded of LtCol Berke's 'ecosystem' meme. “The only thing better than four Raptors, is four Raptors and four Hornets,” he said. “It's better for the Raptors, and it's better for the Hornets and for everyone else involved.”

The situational awareness the F-22 provides to its pilot, and that an operational F-35 will bring to the fight can be shared not only with other air combat aircraft, but with AEW&C, with Growler, with Aegis and LHD surface ships, with ground forces, and with the C2 network via Vigilare, and will help to provide a more complete and timely 'big picture' of the battlespace.



Mr Hunter says, “Battlespace awareness suggests a need to build a wide range of joint capabilities.” Fortunately for the ADF, many of those above-mentioned capabilities are already in place or on the way, but are yet to achieve the 'joint' part of the equation. He said “the achievement of battlespace awareness and information superiority is no straightforward undertaking. It depends heavily on substantial capabilities in information management and processing.” There are substantial advancements needed in the way the ADF manages its people, its training, its doctrine and its governance.

USMC Col Mike Orr echoed Mr Hunter's views. He said it's “not just about bringing 5<sup>th</sup> gen to the rest of the force, it's about raising the level of everybody up to that level” through sharing information and situational awareness. “One plus one doesn't just equal two; one plus one plus one plus one equals a whole lot – it's truly revolutionary!” he said.

Col Orr related the USMC experience which in many ways mirrors that of the ADF. “We need to sell the F-35’s capabilities to maritime, to SF, and to other joint forces,” he said, adding that we need to be thinking now about how we are going to push information down from the F-35 to elements such as special forces or the maritime force to allow “smart decision making at the tactical level.” He said “It’s not just about the pilot in the cockpit; it’s about what he brings to the joint and combined fight.”

But Col Orr warned that integrating the 5<sup>th</sup> gen platform seamlessly into a force won’t be easy, and that a degree of “backwards compatibility” may need to be put in place. To this end, the US is now using airborne ‘gateways’ such as BACN-equipped platforms in order to interface between disparate types of links and communications. He said while this allows mission commanders to take advantage of some of these 5<sup>th</sup> gen sensors, space may be denied in a future conflict so terrestrial systems will need to be established as well. “If you build a robust self-healing network with multiple points of failure, not single, that’s your best defence.”



## TRAINING

LtCol Berke debunked an age-old fighter pilot 'truism' when he said the mantra 'Speed is life, more is better' no longer applies, and instead proclaimed that 'Information is life, more is better.'

"Information is the commodity that is far more valuable than speed," he said, adding "Show me the fastest airplane in the world, I'll show you the guy who's going to die the quickest." He says information is now the most precious commodity a combat aircraft can provide, adding that it's still important to "wrap that information up in a tactical platform."



What this means for future generations of fighter pilots and how to train the new mantra is one of the biggest challenges facing the ADF. LtCol Berke said "the burden on the aviator as a result of the platform is going to change dramatically. What you expect them to do inside the F-35 cockpit is going to change dramatically."

He said the expectation of a 200 hour wingman in a 5<sup>th</sup> gen fighter will be "exponentially greater" than that of a 200 hour wingman in a legacy fighter, and that the training system will need to recognise this and adapt in order to "get pilots up to speed quicker."

SQNLDR Harper said the fundamentals of the ADF's current and planned training systems were sound, but that low-hour wingmen will need to be trained as tacticians from an earlier point in the training process than is currently done. "The legacy aircraft pilot-driven systems mean it takes time and practice to manage information and to upgrade from wingmen to flight leader, to flight commander, to instructor pilot due to system management and task saturation," he said.

But with much of the system management already taken care of in 5<sup>th</sup> gen aircraft, the new aircraft's systems are significantly less sensitive to the experience or lack thereof of the aircrew. "People grow up with a legacy wingman mindset as to how fighter operations are to be executed, and it can take 500 to 1,000 hours to be good at it," SQNLDR Harper said. "In 5<sup>th</sup> gen, when you remove those shackles and have the situational awareness, you can be trained from day one to be a flight lead."

In a post seminar follow-up, SQNLDR Harper said he believes the transition to the 5<sup>th</sup> gen aircraft will be no more difficult than the current transition aircrew make to the Hornet and Super Hornet. "The jet is electronically more complicated," he said, "but the information is assimilated and fused for the aircrew such that they can concentrate on fighting the enemy rather than controlling the systems and sensors in the aircraft to build situational awareness and make decisions." He said it was an "amazing feeling" for a pilot to be able to free himself from having to battle with the management of the sensors, and to be able to concentrate on the tactics and fight at hand.

"I expect that we will continue to train people in our own way, but observe and adjust as we learn more from our first aircrew to participate in JSF F-35 in the US," he added. I have no doubt that even now, any of our fast jet-identified aircrew would have no problems transitioning to JSF. I will say, however, that I do expect the RAAF will find ways to optimise the way we train our ab initio students for their JSF conversion."

## SECURITY

While the F-35 brings new and advanced capabilities to the ADF, it is understandably also encumbered with a greater burden of security and information assurance.

To this end, the ADF will need to re-think how it manages information in the future. Col Orr related the USMC experience, explaining that, “advanced sensors come with some caveats on how or where we got the information, so we have to create the right security environment.” He said if we’re going to share high fidelity situational awareness, there will need to be greater emphasis on making sure all the people who need access to that information have the right security clearances to share it. “You need to spend money on secure facilities, and in vetting and clearing people so they can have ‘intelligent conversations’ about some of these advanced capabilities,” he said.

The RAAF has already taken its first tentative steps down this path when it acquired the Super Hornets in 2007. New compartmentalised headquarters facilities were required in order to deal with the security requirements associated with operating aircraft with the Super Hornet’s LO materials, advanced sensors, and other capabilities. In a sense, the Super Hornet has provided an insight into what the ADF will need to do in order to accommodate the security aspects of the F-35, albeit on a much larger scale.

Similar considerations have been applied to high-end capabilities such as JORN, Vigilare, and the E-7 Wedgetail AEW&C, and will no doubt be applied to the P-8 and MQ-4C Triton when they enter service. Similarly, the capabilities provided by Navy’s new Aegis radar-equipped destroyers will require a greater emphasis on security and information assurance.



## THREATS

Mr Hunter gave the audience a good overview of possible threats that are likely to influence the way 5<sup>th</sup> gen combat aircraft are employed in the future.

He said the rapid progression in 4<sup>th</sup> generation capabilities globally has “led a 5<sup>th</sup> gen push” in recent years, but added that, despite several nations declaring a desire to join the 5<sup>th</sup> gen club, only China and Russia appear to have made any significant progress. He added that, despite these advances, it “should be remembered that these capabilities take time to develop and are difficult to achieve.”



Mr Hunter said that, while it was important to be aware of higher-end competitors, in the context of the wider operating environment, the introduction of complex integrated air defence systems (IADS) with advanced multi-band radars and highly accurate long-range SAMs should also be considered. These systems have “increasingly effective search, acquisition, fire control and engagement radars, they operate in numerous bands and low frequencies to reduce the advantages of stealth, and they are widely dispersed and networked.”

He explained that stealth by itself will not always be able to counter high-end IADS threats, so it will need to be complemented by building on information superiority and electronic warfare to ensure future air campaigns can be conducted. He added that the “emphasis by competitors on stealth capability development drives home the point that stealth will remain an important component of air warfare.” He added that the stealth features that have been designed into 5<sup>th</sup> gen platforms will “enable them to respond to the threat of proliferating IADS and all enable them to get closer so they can use sensor fusion to track and kill threats.”

LtCol Berke explained that 5<sup>th</sup> gen capability goes way beyond the capability of the platform. “We learned very early on in the Hornet that we weren’t superior in every metric by which you measure an airplane,” he said. “I’m less concerned about the individual characteristics of the airplane, or whether PAK-FA is more manoeuvrable than an F-35. That on its own doesn’t strike me as something that I should be concerned about at the expense of other things.”

He said that everything from the training, to how the ‘ecosystem’ is integrated, to how they make the airplane functional “outside of traditional metrics” is what will give us a significant advantage. “When you incorporate all the elements into a 5<sup>th</sup> gen conflict, that’s much more profound than whether his airplane is faster than mine.”

Speakers Professor Michael L’Estrange and Dr John Lee gave informative presentations outlining the regional geo-political climate. Dr L’Estrange’s assessment gave a global overview of the elements of strategic continuity and the dimensions of strategic change currently underway or forecast to occur in the medium term. In particular he focussed on the changing strategic outlook in South-East Asia and the Pacific, and on current and future trends in shaping the security environment in the region.

Dr Lee’s presentation focussed in on China, and in particular how the Chinese viewed the region strategically. He looked at what China’s strategy may be in the region going forwards, on what its economic and political strengths and vulnerabilities were, and surmised what its political and strategic objectives may be in the future and how it might achieve these.



## KEY MESSAGES

The key messages from the seminar were that 5<sup>th</sup> gen is here to stay, that it will mean a whole new way of doing business for the RAAF, that the F-35 will require a number of key enabler capabilities in order to maximise its potential, and that it has the potential to make not just the RAAF but key elements of the whole ADF better.

LtCol Berke rhetorically asked “what can I do in 5<sup>th</sup> gen that is different?” He then reversed the question by asking “what do you want it to do?” He said if you want to limit the F-35 to a tactical role then that will be very easy to do. But if you want to “expand this ecosystem and encroach onto other mission sets that nobody ever thought it had the potential to do, the capacity is there to do it.”

RAAF Air Commander AVM Mel Hupfeld, representing CAF in the closing Q&A session, wondered whether enough thought had gone into the key enablers. He said the RAAF was currently “trying to ask the right questions and then find the means of answering them.”

Attending as a delegate, the RAAF’s Director Air Combat Transition Office (DACTO), GPCAPT Phill Gordon offered that he thought the ADF’s “capability development process is particularly stove-piped along platform lines, so we’re trying to break down those barriers.” To this end, he said the Chief of Air Force was currently writing an air combat capability intent “that will talk about how he wants the air combat force to work with everything else, and that will be a guiding document.”

In a program update to the seminar, the JSF Program Executive Officer, LtGen Christopher Bogdan explained that, while the F-35 program was now moving in the right direction after two “significant emotional events”, he still saw many risks ahead. LtGen Bogdan highlighted program cost as a continuing issue and said affordability was his number one priority, not just the aircraft acquisition cost, but the ongoing operation and support (O&S) costs of the aircraft. “It doesn’t matter how good the F-35 will be, and it will be marvellous in the end game,” he said, “But if people can’t afford it, it won’t be much good to us.”

He also echoed other speakers’ comments in that he thought many of the enabler capabilities would not be ready to maximise the F-35’s capabilities. “Relative to some of the basic systems that will interact and operate with the F-35, we’re starting to get a clearer picture of what has to happen,” but he added “we’ve got a lot of work still to do.”

One of the enablers he identified was the intelligence community. “This airplane sucks up a lot of information to precisely operate,” he said, adding that he doesn’t think “we’ve quite got a handle on that yet,” and that there was the potential to “outstrip” the intelligence community’s ability to gather sufficient information to “make the airplane what it can be.” LtGen Bogdan’s takeaway message was to “don’t just make the airplane fit current systems, change some of the systems to fit the airplane.”

