THEATRE AIR CONTROL SYSTEM 2025

Squadron Leader Robert Vine

Introduction

In 1940 two air forces fought for control of the air over south eastern Britain and although outnumbered, the Royal Air Force triumphed over the Luftwaffe. One reason for the British success in the Battle of Britain was the superior organisation of their air defence system, by leveraging this system the RAF was able to gain an advantage even though their aircrew were relatively inexperienced and the Hurricanes which made up the majority of their fighter force did not exceed the performance of the Luftwaffe fighters.

The acceptance into service of the F-35, EA-18G, Air Warfare Destroyer and LHD will represent the culmination of a 20 year process to modernise ADF platforms and focus on an expeditionary strategy. Although our platforms will be cutting-edge, there will be other countries in our region that will match us technologically and success will once again rest on how our platforms are organised into an air control system. This paper will assess the challenges that all components of the ADF Theatre Air Control System (TACS) will face in the 2025 timeframe and the opportunities that must be exploited to hold a competitive advantage in the region.

To determine what capabilities the 2025 TACS requires I will assess the ADF capability to execute the Find, Fix, Target, Track, Engage, Assess (F2T2EA) targeting cycle in the most dangerous environment that it may operate in. Should the TACS embrace the systems and concepts it requires for the 2025 operating environment then how does the ADF build and sustain this capability? I will explore the changes in personnel, organisation and training that are required to exploit these systems.

2025 Operating Environment

In assessing the challenges that the TACS will face we must consider the environment that it may need to operate in. While there is much discussion of the future operating environment, the author believes that the following factors will influence the ADF TACS in this time period:

- Large numbers of 4th generation aircraft will be operated by air forces in the near and far region.
- Small numbers of 5th generation aircraft will be operated by select air forces.
- Control of the electro magnetic and cyber domains will be contested.

While unlikely, the most dangerous scenario that Australian and US military forces may confront in 2025 is a conflict with a peer adversary. This conflict will be characterised by the Australian and US forces operating small numbers of 5th generation fighters alongside dwindling numbers of 4th generation fighters against a large number of 4th generation fighters that fight alongside small numbers of 5th generations fighters.

Allied aircraft will battle for control of the air against other fighters but they must also confront a large number of extremely capable surface-air missile systems based on land and at sea. This battle will be conducted in an environment where detection of all targets is not ensured, nor is evading detection by the enemy assured. Crews will find systems that rely on the electromagnetic and cyber domains will be highly degraded. The battle will not be confined to the air, land bases will come under attack from ballistic missiles in large numbers and this will hamper efforts to generate air sorties. Control of the sea will also be contested, battlistic missiles, surface and sub-surface platforms will effect how allied naval units operate in support of the air battle.

While there will be differences in the make up of the opposing forces, they will confront each other as qualitative and quantitative peers. To gain an advantage, the ADF and allies must gain and maintain the organisational advantage required to maximise the lethality of its capabilities.

The 2025 TACS Capability

Find / Fix

The targeting cycle starts with finding the target and fixing its location. Current 5th vs 4th generation fighter tactics assume that we will detect the opponent before he can detect us, but how do we counter a low observable opponent and the possibility that we will not detect him first?

Low observable platforms achieve not only a low radar cross section but low electro-optical, infra-red and electromagnetic signatures as well. When combined, these features make it difficult, but not impossible to detect the aircraft. The pilot of a 5th generation aircraft must fly the aircraft and operate its systems in a way that minimises its signature so that he does not reveal his position to enemy sensors. We can counter a low observable opponent by utilising a broad range of sensors to detect him. By doing so, we make it harder for the pilot to operate his aircraft in a way that evades detection.

5th generation aircraft utilise low probability of intercept radar and communications systems to prevent an opponent from sensing their presence, identity and intentions by listening for signals transmitted by the aircraft. There are many methods that can be used to hide radar and communications signals but these techniques can only minimise the likelihood of the signal being intercepted and in turn prevent a system receiving enough signals to identify the source.

To increase the probability of detecting radar and communication signals, electronic support systems need higher gain antennas and faster digital processors so that they can detect the very weak and very agile signals of 5th generation aircraft. A distributed network of antennas to feed an electronic support system can help detect low probability of intercept emissions. Such a system could include detectors spread across all platforms that are operating in the battlespace. From ground based detectors to those on fighter platforms and UAVs, the greater the number of detectors that an opponent must evade, the greater the probability of intercepting their signals.

5th generation aircraft achieve a low infra-red signature through engine designs that reduce the temperature of jet engine exhausts. While this can dramatically reduce the infra-red signature of the exhaust plume it is very difficult to achieve this reduction simultaneously with high engine power. This requires the pilot to balance engine use with infra red signature reduction and results in a trade off between being fast and being stealthy.

The heating effect that air friction has on aircraft surfaces will also create a signature in the infra-red spectrum. It is very difficult to reduce this signature but it can be managed by the pilot. The pilot has to position his aircraft so that the minimum infra-red signature is exposed to the opposing detector. By employing a number of infra-red detectors that are geographically dispersed, the possibility of detecting a 5th generation opponent in the infra-red spectrum is increased.

Current radar cross section reduction techniques optimise an aircraft's radar cross section for specific radar frequency band and look angle. They are not 'invisible' and signatures must be carefully managed by the pilot positioning his aircraft appropriately in reference to threat radars.

One counter-stealth opportunity is to use multiple sensors operating in a different frequency bands and on different look angles to what the opponents radar cross section is optimised for. With current and planned capabilities, the 2025 TACS will possess a broad band of active sensors: over the horizon radar (HF); TPS-77 land based radar (L-band); E-7A airborne radar (L-band); Air Warfare Destroyer sea based radar (S-band); and F-35 (X-band). These diverse and mobile platforms can be placed across a wide area so that an opponent can optimally position his aircraft against one sensor but not all.

Passive coherent detection systems could also be employed to further complicate this scenario. By passively absorbing TV, cellular, satellite and other such signals that are incidentally reflected by an aircraft we can further diversify the position and frequency band of our sensors and make counter detection impossible.

The broader the range of sensors that an opponent must deny, the less likely it will be that they can defeat detection and identification by the whole system. The 2025 TACS will operate a sensor suite that includes passive radar detection, infra-red and radar sensors but more of these sensors will be required so that they can be geographically dispersed and give us the maximum probability of detection. The 2025 TACS must also fuse these sensors so that they can provide information to all those who require it. The TACS currently relies on tactical data links such as Link-16 to perform this function, data fusion systems will be essential to the targeting cycle in 2025.

Track / Target

Essential to the Track/Target portion of the targeting cycle is the identification of targets. Once detected the TACS must be capable of determining the target platform type and allegiance to ensure only enemy contacts are engaged with deadly force. Identification Friend or Foe (IFF) systems mitigate the risk of fratricide by providing an active response from the aircraft but lack of a positive IFF response is insufficient evidence to declare a target hostile. Therefore, identification must be achieved through a variety of active or passive means.

Active radar means of identifying an aircraft include Jet Engine Modulation and Inverse Synthetic Aperture Radar techniques that analyse the radar return signal to determine aircraft type. These techniques rely on a strong return radar signal and can be denied through low radar cross section aircraft design. They can also be ambiguous, a return signal from one type of aircraft may be similar to another type making it impossible to positively identify an aircraft.

Passive means of identifying an aircraft include systems that analyse the electromagnetic signals of aircraft radar and communications systems. The ADF operates a number of systems capable of detecting and identifying radar signals but this can be denied through the design of radar and communication systems to have a low probability of detection. These signals can also be ambiguous, if one type of radar is operated by many different aircraft types it can be difficult to make a positive identification.

To improve the probability of positively identifying a 5th generation fighter aircraft, all active and passive detection systems operated by the TACS must have identification features. This will allow the frequency and positional diversity of its sensors to be applicable to identification as well as detection.

Systems to identify aircraft are not sufficiently diversified, and current ground based sensors have a limited ability to identify their contacts or contribute to the identification of targets detected by other sensors. The ideal TACS will allow cooperative detection and identification across multiple sensors, for example a 5th generation aircraft may be tracked using the fused data of the Air Warfare Destroyer, TPS-77, E-7A and F-35. The target could then be identified by any one of these platforms prior to engagement.

Engage / Assess

Once the opposing aircraft have been found and positively identified they can be engaged. Although a diverse system of sensors will exist in the 2025 TACS to find, fix, target and track, engagement will still rely on the F-35 sensor detecting the target in order to engage it. While the weapons of the F-35 could be launched without cueing from its radar, the highest probability of intercept occurs when the weapon is cued prior to launch. The Air Warfare Destroyer and E-7A will posses Co-operative Engagement Capability that will allow the Air Warfare Destroyer to engage a target cued off E-7A sensor data but unless this system is expanded to all sensor and engagement platforms there exists the possibility that the TACS could detect an opponent but not engage him.

Even if cooperative engagement is implemented for queing, the seeker systems of the weapons we employ are not diversified. Missiles such as the AIM-120 AMRAAM employed by the F-35 and Standard Missiles employed by the Air Warfare Destroyer utilise an active radar seeker in the missile for guidance during the final phase of flight. If the missile radar is unable to find a low radar cross section target it will not guide towards it in the final stage of flight. Jamming will also reduce the probability that the missile successfully engages the target. Although advanced Infra Red guided missiles have counter measure rejection features, their ability to find the target is reduced when the target has a reduced IR signature and advanced IR flares to counter it.

To achieve the highest probability of intercept, the weapons used by the TACS must be able to be cued off multiple sensors and the missiles must feature multi-mode seekers with the ability to guide off active radar, passive radar, infra-red and off-board sensors through to the final phase of flight.

It is still difficult to assess if a weapon has had the desired effect on the target. Pilots may know that the missile was able to guide to the target but did it impact close enough to destroy it? Targeting a low observable aircraft will add confusion to the engagement assessment process, if sensor contact is lost after an engagement can we be confident the target was destroyed or did we just lose sensor contact?

Electro optical systems and the eyeball are still the best method of determining weapon results. By watching the weapon impact and assessing its results the need for further weapons can be determined. This part of the targeting cycle needs to be considered in the development of future systems – if we are not able to assess the effectiveness of our weapons it can add confusion to the battle space.

Communications

It is clear that the 2025 TACS will need to fuse a number of diverse sensors and weapons in order to win. Therefore, good communication between the TACS platforms is critical to operational success. This centre of gravity will be understood by potential adversaries so it is critical we examine how communication systems will survive in the 2025 battlespace.

Sensor systems are always connected to a host platform to process and disseminate the sensor data. In some platforms, the sensor is directly connected to the host platform i.e. the MESA radar connection to the E-7 Mission Computer. In other systems the sensors are remotely located from the host platform and must transfer their information over long distances. An example of this type of connection is a deployed TPS-77 sending its data back to a Control and Reporting Centre.

Even though the sensor detects the target, if the communications between the sensor and the host platform are disrupted, the sensor data cannot be used for the targeting cycle. The 2025 operating environment will feature a large number of threats to Radio, Space and Cyber communications systems, as the 2025 TACS will rely on communication between a number of sensor and platforms this is an ideal way for an adversary to break the targeting cycle. CRCs are the most vulnerable to disruption of sensor-host communications links.

The sensor fusion that is required to defeat low observable threats is implemented by connecting the sensor host platforms to each other. As many of our host platforms are air and sea based, the method of connecting the platforms will be by space and EM systems. This is currently achieved by ‘Link-16’ a radio system that coordinates data exchange across platforms but it does not fuse the data in the method required by the 2025 TACS. There are systems now available that advertise an ability to jam Link-16. The F-35 features an Multifunction Advanced Data Link that allows sensor fusion between F-35s, this system is hardened against jamming making it more survivable than Link-16. However the F-35 data link is unique and still relies on Link-16 to communicate with other platform types, if fusion of data from many different types of sensors is required, the Multi function Advanced Data Link and Link-16 will not be sufficient to tie the 2025 TACS together. A new, common data link is required to fuse sensor data across different sensor types and support cooperative engagement. This system must be survivable in contested electromagnetic, space and cyber spectrums.

Coordination

Although an advanced data link system will be able to fuse data collected by sensors, it will still be necessary for system operators to coordinate. This coordination will be required to optimise the use of all sensors to ensure that detection occurs and to then ensure that the data is passed efficiently. Once all sensors have been fused and full battle space awareness achieved, the TACS must be able to coordinate a response to the tactical situation.

Current TACS coordination systems include Voice radios operating in HF, VHF and UHF bands as well as Satellite Communications (SATCOM). Text messaging systems for coordination include Internet Relay Chat over terrestrial and satellite bearers as well as Link-16 Free Text Messages. Although Link-16 has allowed a foray into ‘Digital Control’ of fighters, this system has not been effective because of the restraints that a formatted messaging system places on clear, concise communication of unique circumstances.

Coordination systems are also vulnerable to denial in the 2025 operating environment, there are systems advertised as being able to deny the ‘Have Quick 2’ anti-jam radio system as well as space and cyber systems. Should the ability to coordinate be removed from the 2025 TACS, engagement systems may still be able to attack autonomously but this will only suffice for small scale threats. Against a peer adversary, a coordinated response is required to win.

To maintain the ability to coordinate, the 2025 TACS must have a number of diverse and hardened coordination systems. Coordination systems that operate on the EM or space spectrum must be agile in frequency band, allowing the system to hop to an available piece of the spectrum. Systems using the cyber spectrum for coordination must have a number of diverse network paths available and the agility to switch between them as they are degraded. Each platform must have a number of diverse coordination systems available to use so there is redundancy in other systems once one or more have been degraded.

The greater number of systems, frequency bands and network paths that an enemy must deny, the less likely they are to deny the whole system. Lastly, the network design and associated protocols must be protected at the highest of security classifications so that they cannot be easily analysed to find vulnerabilities.

Command and Control

With a sensor fusion system that ensures detection of threats, a cooperative engagement capability that allows 5th generation targets to be engaged and a robust coordination system to bring these components together, the 2025 TACS must be an organisation that leverages these strengths.

‘Centralised control and decentralised execution’ is the primary tenet of air power with air operations controlled from the Air and space Operations Centre and executed by tactical level Command and Control platforms such as AEW&C and CRC. While there are many historical lessons that confirm the validity of this structure, we must consider whether this structure is survivable in the 2025 operating environment.

The central ‘hub’ naturally presents a critical node that can have a substantial impact on operations if it becomes ineffective. The Air Operations Centre seems to be such a node – if it can be isolated by blocking its communication systems then it can be rendered ineffective. Hardening communications systems and placing the Air Operations Centre in a remote area can reduce the likelihood of this occurring but the

Air Operations Centre may still be vulnerable to a kinetic attack be it from asymmetric attack or ballistic missiles.

The Air Operations Centre undertakes many functions but these can be distilled down into two main tasks; planning for and management of the execution of air operations. The loss, or isolation of an Air Operations Centre must be considered against these tasks.

The planning functions of an Air Operations Centre are conducted over a 48 hour cycle, this starts with the commander determining how he will apportion his air assets to tasks and then his planning team generate an Air Task Order that determines when and where aircraft will fly and what role they will conduct or the targets they will attack. The planning functions of the Air Operations Centre will not be significantly impacted by communications isolation unless there is a long term outage that effects the ability to distribute the Air Task Order.

The execution management function of the AOC requires solid communications links between the air and other component headquarters, intelligence agencies and tactical level Command and Control (C2). The AOC identifies the need to re-task assets, coordinates the required response and then tasks the change to airborne aircraft through tactical C2. In the absence of the AOC, tactical C2 can undertake some of these functions – our platforms are capable of re-tasking assets but to do so they need to be made aware of the need to do so and have the authority to do it.

Should the Air Operations Centre be isolated during execution then intelligence agencies and other component commands must have the ability to inform tactical C2 of their need to re-task aircraft. If this communication path is provided then tactical C2 must have the authority to re-task aircraft when the Air Operations Centre is in a degraded state. This will require a set of pre-defined parameters that C2 agencies can use to execute the air war in the way that the commander desires even though they are not able to contact him.

The 2025 TACS Capability

The air command and control system employed by the ADF will need to adhere to its basic tenant but evolve to enable it to operate in a contested environment. Tactical C2 agencies must be given the communications systems and authority to dynamically re-task aircraft in the event of a loss of the Air Operations Centre.

By 2025, the ADF will have the major platforms that will be required to battle for air control in the most dangerous operating environment. However, the ADF will lack the systems that these platforms need to fuse data, communicate, coordinate identify and engage low observable opponents in a contested air, electromagnetic, space and cyber environment.

Building & Sustaining the Capability

Fighter Pilots

The F-35 has been touted as a revolutionary platform that will fundamentally alter how the air war is fought. While it is difficult to quantify this while the aircraft is still under development it is safe to assume that the F-35 will be employed differently to the F/A-18A and will place different demands on the pilots who fly it.

In order to determine how the F-35 will be employed it is important to look at the difference between it and the platform it replaces. The F/A-18A is fundamentally limited by its sensors, it has a short range mechanically scanned radar with poor accuracy and limited update rate. The F/A-18A has a targeting pod with a limited field of view and a helmet mounted visual cueing system that is also limited in field of view. By contrast, the F-35 has an electronically scanned radar with long range, high accuracy and high update rate, it features a Distributed Aperture System that allows images from all around the aircraft to be projected into the pilots vision.

The F-35 also features an advanced data link so that the information from other F-35s and other platforms are available to the pilot. This information is fused by a highly capable on-board computer and displayed to the pilot on a large display. The limitations of aircraft sensors will no longer dominate how the aircraft is employed. The best example of this difference is in the tactics that have been used against F/A-18As. In training an adversary aircraft would try to evade detection by the F/A-18As sensors allowing them to shoot without the F/A-18A knowing there was an adversary in a position to do so. Such a tactic would be nearly impossible for a 4th generation opponent to achieve against the F-35.

So where is the F-35 limited? Given that the 2025 operating environment will feature large numbers of 4th generation adversaries the risk is now that the F-35 may be overwhelmed. The F-35s sensors may detect all of the targets, but the weak link in the chain may be the pilots' ability to understand the information gained from his sensors then develop this into a course of action. In a sense, the F-35 will be limited by the cognitive ability of the pilot.

The training regime for F-35 pilots must take this limitation into account and give them experience operating under conditions of information overload. The 2v4 and 4v4 intercepts that are typical of F/A-18A training will not produce such conditions and won't challenge an F-35 pilot. More of the training regime will need to be devoted to employing the F-35 against large numbers of adversaries to produce information overload conditions.

Producing such conditions with the same number of aircraft will require live flying to be integrated with virtual and constructive targets. Systems will need to be procured that synthetically generate targets for the F-35 pilot to deal with alongside live targets.

Air Battle Managers

If the F/A-18A is a sensor limited platform, it is the Air Battle Managers (ABMs) who help to overcome this problem by providing information from ground or airborne surveillance systems to the fighter pilot. If the F-35 is no longer sensor limited, then how does ABM evolve to support the F-35?

In a different sense, the F-35 may become sensor limited when it must counter a low observable adversary. As discussed in the capability section, countering a low observable adversary will require a network of diverse sensors. The ABM of 2025 will need to understand how to fuse all of those sensors to ensure that the targeting cycle can be executed. ABMs will need to achieve this despite the adversary's attempts to contest the space, cyber and electromagnetic domains that such systems rely on.

Against a large number of 4th generation opponents, the ABM can help to overcome the limitations of 5th generation fighter platforms by ensuring the TACS maintains the cognitive edge. Without the requirement to fly the aircraft and unhindered by the human machine interface limitations of a fighter, the ABM is able to devote more cognitive force to the air battle.

Even if the F-35 pilot is able to comprehend a very complex battlespace, his ability to coordinate a response will still be limited. With a small number of radios available to him it will be difficult to coordinate support from other fighters, Air-Air Refuelling and Intelligence, Surveillance and Reconnaissance platforms to respond to the threat. ABMs can coordinate the activities of the TACS to solve the following problems:

- Positioning of sensors to optimise detection
- Fusion of data from those sensors
- Determining the identity of contacts
- Dissemination of information
- Scramble of aircraft
- Posturing fighters to meet the threat
- Allocation of targets to fighters and SAMs
- Allocation of refuelling to receivers
- Re-assigning tasks

This list will be familiar to an ABM of today but the ABM of 2025 will need to undertake these roles with more and more diverse sensors, with degraded communications and against a peer adversary. The role of the ABM will shift from ‘fighter control’ to sensor fusion and the environment under which they must operate will become far more complex.

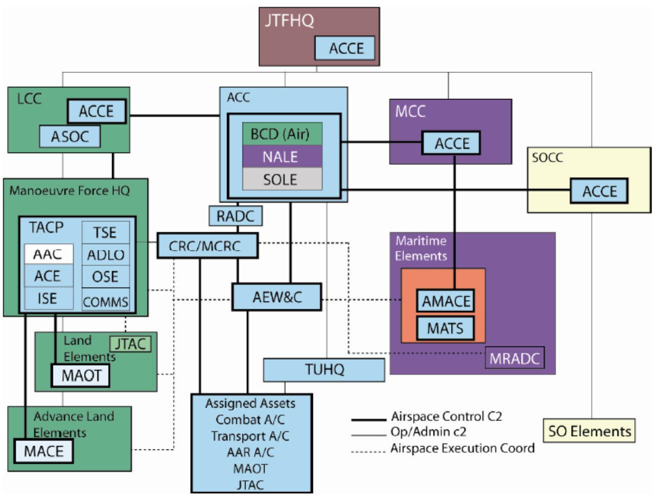
Training ABMs will become vastly more difficult as the ABM must understand how all of the ADF and coalition sensor systems operate and how they can be integrated. A training environment will be required that allows ABMs to position and configure sensor systems in a complex battlespace and then respond to enemy action to deny those systems.

If the F-35 pilot is not challenged by a 4v4 intercept then neither will the ABMs. It is only in much more complex scenarios will the ABM see situations of cognitive overload in F-35 pilots and develop the skills to assist them in dealing with an overwhelming number of targets. Any system that integrates live and synthetic training for pilots must also stimulate ABM systems and accurately model sensor performance.

Air and space Operations Centre

The need for air power to be centrally controlled has been both positively and negatively demonstrated in the Gulf wars and Vietnam respectively. This tenant contradicts the fact that for a system to be survivable there must be no critical nodes to it – the challenge for the Air Operations Centre of 2025 is to balance both of these conflicting requirements. While equipment can be purchased to allow this, command and control is fundamentally a procedures problem, how do we structure the TACS so that there are no critical nodes?

This challenge requires the TACS to be structured so that operations can continue without the direct involvement of the Air Operations Centre. While the ‘decentralised execution’ matra of the Air Operations Centre support this, there are still many ways in which the Air Operations Centre is the central node for intelligence information that forces a change to the friendly plan for execution. The best example is the prosecution of Dynamic Targets, if an intelligence platform gains an indication of a high priority target that information is passed to the Air Operations Centre. The Air Operations Centre then indentifies the aircraft best suited to striking that target and provides the target information along with authority to strike to the assigned aircraft.



If the Air Operations Centre is not able to receive this information, or disseminate it to the tasked aircraft then the targeting cycle breaks down and a high priority target that can change the course of the war may not be hit. To solve this dependency on the Air Operations Centre operational procedures must allow intelligence information from tactical to national technical level assets be passed directly to tactical C2 agencies. On receipt of this information, the tactical C2 agencies need the authority to act on that information.

To do so requires a cultural shift in how Air Operations Centres plan for operations and how they are executed at the tactical level. The Air Operations Centre must generate operational level guidance that tactical units can operate to in the absence of specific orders. In this sense tactical level units must become more aware of the operational and strategic considerations of the air commander. If the intelligence cueing for the above dynamic target is passed to an AEW&C because the Air Operations Centre cannot be contacted, the AEW&C crew must have a contingency plan that can be enacted when the AOC cannot be contacted. This plan must tell the AEW&C that this target is a higher priority than certain others that are currently being struck and that in this situation they have the ability to change the aircraft's mission in the absence of the AOC.

Team Training and Exercises

If the whole of the TACS is required to win the air war of 2025 then the whole system must train together to ensure that it is a complete and fully functioning system. Too often, Defence exercises feature only some components of the TACS and it is common for the operational level command and control agencies to be exercised separately to the tactical level units they command. This results in elements of the force developing Tactics, Techniques and Procedures that may not be valid when the whole of the TACS is brought to bear.

The TACS must undergo a cyclical training regime that uses a building block approach to developing personnel skills as well as Tactics, Techniques and Procedures. Training can start with unit level events and gradually incorporate integration of all components of the TACS. This regime should culminate in a certification for the whole ADF TACS to gain confidence that the ADF is ready for operations.

As well as being difficult to generate a live flying environment that will test the F-35, it will be difficult to generate an environment that tests the whole TACS. Live flying must be integrated with virtual and constructive elements across the whole system. As well as simulated targets, a training system that includes simulated friendly aircraft alongside live flying is required to generate problems that mirror the complexity of the most dangerous operational environment.

All elements of the TACS must be forced to operate in degraded cyber, space and electromagnetic domains. To do so requires cyber, space and electromagnetic 'ranges' where effects can be introduced against friendly systems that operate in these domains so that Tactics, Techniques and Procedures to counter these effects can be validated in a representative environment.

At the conclusion of training events it is necessary to analyse the outcome so that lessons can be identified and fixes applied. To do so requires the participation of all elements of the TACS, this will need systems to connect disparate elements and provide a fused playback of the event so that mission failures can be analysed.

As well as training systems, personnel dedicated to producing training scenarios and facilitating team learning are required to ensure that the training scenarios accurately replicate the operational environment. These scenarios must not be developed to validate current tactics but to accurately mimic the course of action of an adversary so that tactics are developed to deal with a likely scenario.

The Power of Enablers

In a fiscally constrained environment where major acquisition projects are at risk it is often hard to find the value that enabling systems provide to national power. As the ADF can only confront the most dangerous operational scenario of 2025 with our allies and coalition partners and it is in this context that enabling systems will have the greatest impact.

The ADF has prided itself on making contributions to coalition forces which provide an impact that is proportionally greater than the size of the contingent. Doing so gives Australia greater leverage in the conduct of those operations and increases our national power beyond what we could achieve on our own. Niche enabling systems can provide a disproportionate impact to coalition operations as their effect reaches across the whole coalition system.

For example, the RAAF Mobile Control and Reporting Centre controlled all aspects of military air operations in Afghanistan from 2007-2009. Every aircraft in that country spoke to an Australian ABM and dramatically increased the visibility of the Australian contribution. This was achieved with a footprint of 75 personnel operating a system costing tens of millions of dollars rather than hundreds of millions.

The contribution of Australian personnel to coalition operations should not be discounted. People who can develop a whole of system approach to air operations are in short supply across western air forces but in high demand for operational planning staffs. An ADF TACS that trains as a whole system will develop many such people, providing them to coalition planning staffs further increases the visibility of the Australian contribution and also sculpts the operation towards Australian objectives.

As was demonstrated during the Battle of Britain, success or failure against an adversary that outnumbers you and is your technological equal depends on how your own platforms are coordinated into a system and how you use the entire system as leverage against your opponent. With billions of dollars already invested in platforms, success or failure will hinge on the foresight to spend a comparatively small amount of money and effort to create a hardened and capable system with these platforms. Without this investment, the billions spent on platforms will be irrelevant to the final outcome.

Conclusion

In 2025 the ADF will operate a number of high-end platforms that can contest control of the air in the most dangerous operational environment. However, there are significant gaps in the capabilities that are required to integrate these platforms into the system of sensors and shooters required to execute the targeting cycle and win against LO adversaries in a contested cyber, space and EM environment.

To maintain control of the air in 2025, the ADF must invest in diverse sensors, hardened communication systems and the personnel who operate them. The ADF must exercise as a complete air control system with live and synthetic components so that tactics, techniques and procedures can be tested against the most dangerous operational environment. Without investment in the capabilities that tie platforms together into a system, the ADF air control system may not be able to control the air in 2025.

Biography

SQNLDR Vine joined the RAAF in 2002 and qualified as an ABM in December of that year. He completed an initial posting at 3 Control and Reporting Unit, qualifying in all RAAF Control and Reporting Centre (CRC) roles and deployed to OP SUMATRA ASSIST to coordinate humanitarian and disaster relief efforts. In 2007 and 2008 he deployed to OP SLIPPER where he served as a Mission Commander with the USAF and RAAF Mobile CRCs. From 2008-2010 he was posted to project AIR5333 as Operations Manager where he oversaw the introduction of the Vigilare system into service as the replacement for the RAAF CRC systems. Following this posting he completed number 9 Fighter Combat Controller (FCC) course and was posted on promotion to SO 2 Tactics Development at HQ41WG.